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Analysis of Students' Mathematical Literacy Ability in Solving Mathematical Problems in View of Logical Intelligence

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ABSTRACT (11 pt)

Mathematical literacy skills are really needed by students in everyday life. Apart from that, students' logical intelligence still needs to be developed . Students must be equipped with logical intelligence to improve mathematical literacy skills so they can solve everyday mathematical problems. This research aims to determine students' mathematical literacy abilities in solving mathematical problems in terms of logical intelligence. This research was conducted at SMP Negeri 1 Gebang with subjects as many as 32 students in class VIII C. This research used a qualitative approach with descriptive methods . Data collection techniques in this research were a mathematical literacy ability test , a logical intelligence questionnaire and an interview guide. Logical intelligence is divided into three categories, namely high, medium and low , 1 student is taken from each category to be interviewed . The results of the research show that students' mathematical literacy abilities in solving mathematical problems in terms of high category logical intelligence can fulfill three indicators of mathematical literacy abilities . Mathematical literacy ability in solving students' mathematical problems in terms of logical intelligence in the moderate category can fulfill two indicators of mathematical literacy ability . Mathematical literacy ability in solving students' mathematical problems in terms of low category logical intelligence can fulfill two indicators of mathematical literacy ability . The average mathematical literacy ability of all categories of students' logical intelligence contains two indicators of mathematical literacy ability.

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1. INTRODUCTION

Learning activities are conscious efforts made by a teacher to help students learn according to their own needs and interests, including learning mathematics. Mathematics can used For develop ability think creative Which systematic, logical, creative, discipline And effective For Work The same in life modern Which competitive (Handoko, 2017) . The aim of mathematics learning is to create an environment in which students can carry out activities and processes related to mathematics learning, with an emphasis on mathematics teaching and with appreciation for students' active participation in learning (Asmara & Sari, 2021) . Education has a major role in this era in increasing intelligence and developing skills and personal potential (Saluky, 2016) . By incorporating literacy activities into the learning process, it is hoped that the quality of teaching will meet educational needs, students will understand the role and use of mathematics in everyday life, and will be ready for social interactions in today's society (Allo et al., 2021) .

Mathematical literacy is the ability to formulate, apply and interpret mathematics in different situations. This is in accordance with the mathematical concept of describing, explaining and interpreting the concepts of facts, procedures and phenomena (Purwanti et al., 2021) . Indonesian students are weak in mathematical literacy. The questions taught in schools do not teach problem solving skills that require logical thinking, so Indonesian students are used to solving problems with theoretical and procedural answers. Mathematical literacy can be defined as the ability to understand and apply mathematics in different contexts to solve problems, and the ability to explain the use of mathematics to others (Milsan & Wewe, 2019) .

Based on the results of a survey conducted by the Program for International Student Assessment (PISA), students' mathematical literacy abilities in Indonesia are still low. Indonesia is below the international average (Kusumawardani et al., 2018) . Understanding mathematical literacy skills is very important to be able to apply mathematics in everyday life from simple to complex to abstract, mathematics contributes to daily life and encourages the ability to develop critical, creative, systematic and logical thinking (Jufri, 2015) .

Literacy mathematics influenced by a number of factor, among them intelligence students (Bernard et al., 2022) . Intelligence man divided become eight intelligence, Wrong the only one is logical intelligence mathematics. Intelligence mathematical-logical understood as ability somebody For solve problem in context Which different with help draft mathematics. Intelligence mathematical-logical required moment finish test literacy mathematics, Because student with intelligence mathematical-logical capable understand problem, do calculation, as well as capable reasoning And finish problem in a way abstract (Kurniawati & Kurniasari, 2019) . Logical intelligence is a person's ability to calculate, measure and solve problems systematically to analyze problems in a way logical, solve problem mathematics, And learn problem in a way scientific (Kamsari & Winarso, 2018) .

Logical intelligence equips students with the ability to calculate and reason to solve basic mathematical problems (Irvaniyah & Akbar, 2014) . Students with different levels of mathematical logical intelligence have a tendency to use their own abilities to solve different problems. So that it influences how quickly students find something to solve a problem logically. As a result, different levels of mathematical logical intelligence in learning will influence the problem solving process. Therefore, not all students can easily understand mathematics (Fakhriyana et al., 2018) . Ability literacy mathematics student with intelligence mathematical-logical that is student can recognize variable And aspect mathematics, use Language Which not enough communicative And informative moment write task in accordance with situation Which is known in task, determine idea original And recognize limitation And assumption, know structure mathematics (characteristics orderly, relation, And pattern) but No write it down on sheet answer test ability mathematics (Ulfah et al., 2020) . Logical intelligence is intelligence that makes a significant contribution to learning because logical mathematical intelligence is important, it is necessary to develop basic mathematical knowledge in student learning. The process of completing mathematics learning tasks can be completed with standards of perfection (Sukada et al., 2013) .

Previous research has shown a positive relationship between logical intelligence and mathematical literacy abilities. Students who have high logical thinking abilities tend to find it easy to understand and solve mathematical problems, while students who have moderate and low logical

thinking abilities tend to experience difficulty and difficulty understanding and solving mathematical problems (Nisa et al., 2020). However, intelligence logical it's not the only one factor Which influence ability literacy mathematics. There are other factors in increasing mathematical literacy.

Based on observations that mathematical literacy skills are still lacking. In addition, students' literacy skills are still lacking and students' interest in mathematical literacy has not grown. Likewise, students' logical intelligence has not been developed well. Good mathematical aptitude is essential. Students must be equipped with logical mathematical intelligence to improve their mathematical literacy skills to successfully solve everyday mathematical problems. Researchers are interested in conducting research on "Analysis of Students' Mathematical Literacy Ability in Solving Mathematical Problems in View of Logical Intelligence".

2. METHOD

In study This approach Which used is a qualitative approach with descriptive methods. Study qualitative is study Which aim For understand in a way together phenomenon Which experienced researcher through action, observation, motif, Act in demand And others (Harahap, 2020) . Study This tries to analyze students' mathematical literacy abilities in solving problems in terms of logical intelligence. In this research, researchers will take research subjects in class VIII C of SMP Negeri 1 Gebang with a total of 32 students. In process processing subject, study This will use purposive sampling method (Sugiyono, 2017) . Retrieval process The sample using purposive sampling was carried out upon entry field during study based on the score results of filling out the logical intelligence questionnaire through questionnaire calculations which are categorized into three categories, namely high, medium and low categories. In each category of logical intelligence, 1 student was taken as the research sample analyzed.

The data collection technique in this research is using mathematical literacy ability test instruments, logical intelligence questionnaires and interview guides. The test given to these students is descriptive with 5 questions. These questions were created to measure students' mathematical literacy. The logical intelligence questionnaire was created based on indicators of logical intelligence given to respondents with a total of 25 statements using the scale method. likert . Guidelines interview Which used in study This is interview semi- structured. Interview semi- structured is interview Which the respondent must answer question Which has prepared by interviewer (Bastian et al., 2018) .

Checking the validity of the data is used to confirm that the information and sources of information are correct and valid with the method used is the triangulation technique (Khanifah et al., 2019) . Data analysis is used to compile or process data obtained by researchers during research systematically , then a conclusion or research result is drawn. Data analysis is carried out during the process in the field at the same time as data collection. Data analysis was carried out based on Miles and Huberman 1992 includes collecting data , data reduction, data presentation and conclusions/verification (Sugiyono, 2017)

3. RESULT AND DISCUSSION

Based on the results of research carried out by researchers regarding students' mathematical literacy abilities in solving mathematical problems in terms of logical intelligence in class VIII C of SMP Negeri 1 Gebang, totaling 32 students.

Students' mathematical literacy abilities

The researcher gave 5 essay test questions in the form of story questions using material that had been presented or studied previously, namely about systems of linear equations in two variables. The indicators of mathematical literacy abilities used in this research include:

1. Formulate the problem in solving problem
2. Using mathematics in solving problem
3. Interpreting solutions in problem solving
4. Evaluate solutions in problem solving

Based on the table above, the number of indicators of students' mathematical literacy is obtained as shown in the following table.

Table 1 . Average Mathematical Literacy Indicator

Average Mathematical Literacy Indicator	Amount
1 Indicator	8
2 Indicators	16
3 Indicators	7
4 Indicators	1
Total	32

From the table above, it can be seen that there are 8 students who meet one indicator of mathematical literacy ability, 16 students who meet two indicators of mathematical literacy ability, 7 students who meet three indicators of mathematical literacy ability, and 1 student who meets four indicators of mathematical literacy ability. The number of students for each indicator of mathematical literacy ability is presented in diagram form as follows.

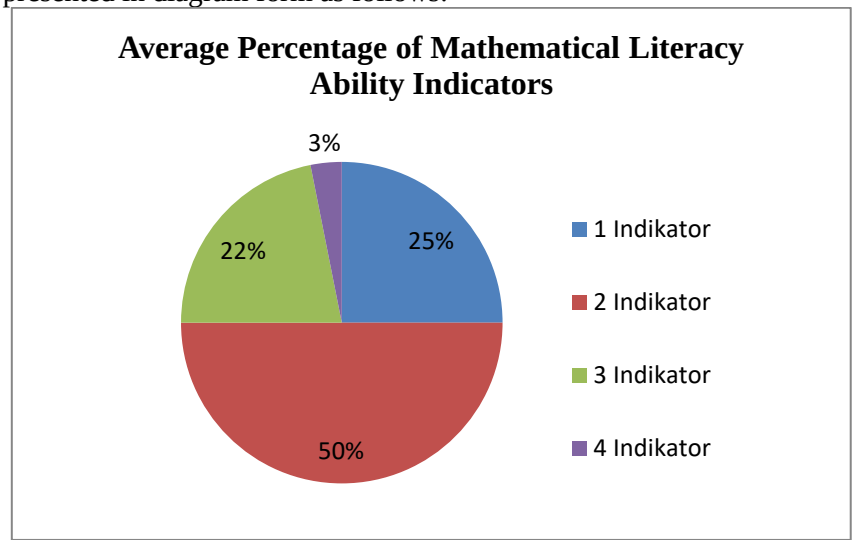

Figure 1 . Average Percentage of Mathematical Literacy Ability Indicators

Based on the picture, it is explained that 22% of students in class VIII C of SMP Negeri 1 Gebang fulfill 1 indicator of mathematical literacy, 50% of students fulfill 2 indicators of mathematical literacy, 25% of students fulfill 3 indicators of mathematical literacy, and students fulfill 4 indicators. mathematics literacy as much as 3%. Thus it can be seen that students in class VIII C of SMP Negeri 1 Gebang are dominated by students who meet 2 indicators of mathematical literacy.

Logical intelligence

To obtain data, the researcher gave a logical intelligence questionnaire to students in class VIII C. The logical intelligence questionnaire consisted of 25 statements that would be used and given directly to students and they were given 40 minutes to fill in the questionnaire. The statements contained in the questionnaire are made based on indicators of logical intelligence. The following are indicators of a logical intelligence questionnaire.

1. Calculating mathematically
2. Think logically and reason
3. Solution to problem
4. Deductive and inductive thinking
5. Sharpness of patterns and relationships

Based on the results of the logical intelligence questionnaire, the range of scores based on the categories of high, medium and low logical intelligence is obtained as follows.

Table 2 . Range of Logical Intelligence

Category	Intervals	Frequency
Tall	92-125	2
Currently	59-91	18
Low	25-58	12

The results of giving a questionnaire about logical intelligence, researchers will process the logical intelligence questionnaire data to determine the category of students' logical intelligence. There are 3 categories grouped based on their logical intelligence abilities, namely students with high logical intelligence, students with medium logical intelligence and students with low logical intelligence. The following are the number of students who have high, medium and low logical intelligence as shown in the table below.

Table 3 . Logical Intelligence Category.

Logical Intelligence Category	Amount
Tall	2
Currently	18
Low	12
Total	32

From the table above it can be seen that there are 2 students with high logical intelligence, 18 students with moderate logical intelligence, and 12 students with low intelligence. The number of students in each logical intelligence category is presented in diagram form as follows.

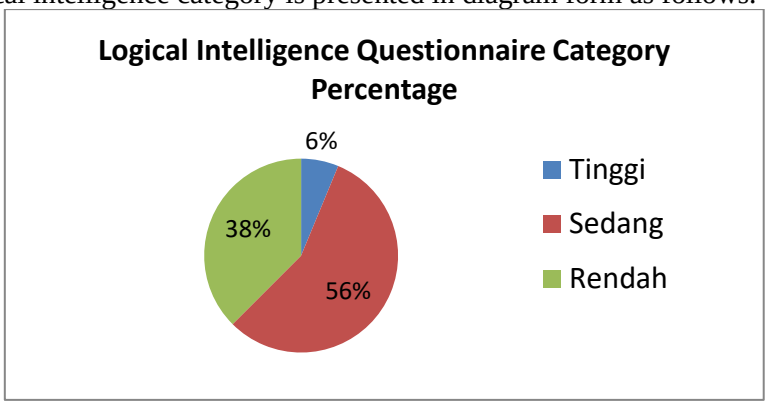

Figure 1. Percentage of Logical Intelligence Category

Based on the picture, it is explained that 6% of students in class VIII C of SMP Negeri 1 Gebang have the high logical intelligence category, 56% of the students have the moderate logical intelligence category and 38% of the students have the low logical intelligence category. Thus it can be seen that students in class VIII C of SMP Negeri 1 Gebang are dominated by students who have moderate logical intelligence.

Mathematical literacy abilities are viewed from logical intelligence

Based on the research that has been carried out, the results of the mathematical literacy ability test for each category of logical intelligence can be seen as follows.

Table 4 . Average Mathematical Literacy Ability Test Results Judging from Logical Intelligence

Logical Intelligence Category	Indicators of Mathematical Literacy Ability			
Average	1 Indicator	2 Indicators	3 Indicators	4 Indicators
Tall	-	-	1 student	1 student
Currently	5 students	8 students	5 students	-
Low	3 students	8 students	1 student	-

Based on the table above, it can be seen that the results of the test scores for mathematical literacy skills are high in terms of logical intelligence in the high category, seen from the average of the 5 test questions that students have completed. The results of the mathematical literacy ability test are viewed from the high category of logical intelligence, namely 1 student contains 3 indicators and 1 student contains 4 indicators of mathematical literacy ability. The results of the mathematical literacy ability test are viewed from the moderate category of logical intelligence, namely 4 students contain 1 indicator, 8 students contain 2 indicators and 5 students contain 3 indicators. The results of the mathematical literacy ability test were viewed from the low category of logical intelligence, namely 3 students contained 1 indicator, 8 students contained 2 indicators and 1 student contained 3 indicators. It can be seen from the overall data that the average student can fulfill 2 indicators of mathematical literacy ability from the three categories of logical intelligence.

The results of the students' mathematical literacy ability test and the logical intelligence questionnaire selected 3 students who would be interviewed by the researchers for further analysis of the students' mathematical literacy abilities in terms of logical intelligence from each high, medium and low category. The following 3 students have been selected to represent each category of logical intelligence who will be interviewed directly to be analyzed and described based on indicators of mathematical literacy ability.

Table 5 . Logical Intelligence Subject

No	Name	Student Code	Logical Intelligence Category
1	A	S-04	Currently
2	DA	S-06	Low
3	GP	S-10	Tall

Discussion

Mathematical Literacy Ability on the Logical Intelligence of High Category Students

The following are answers to students' mathematical literacy ability tests which are supported by interview results which show that students with high logical intelligence have been able to achieve mathematical literacy indicators in solving story problems given by researchers.

The following are answers to students' mathematical literacy ability tests which are supported by interview results which show that students with high logical intelligence have been able to achieve mathematical literacy indicators in solving story problems given by researchers.

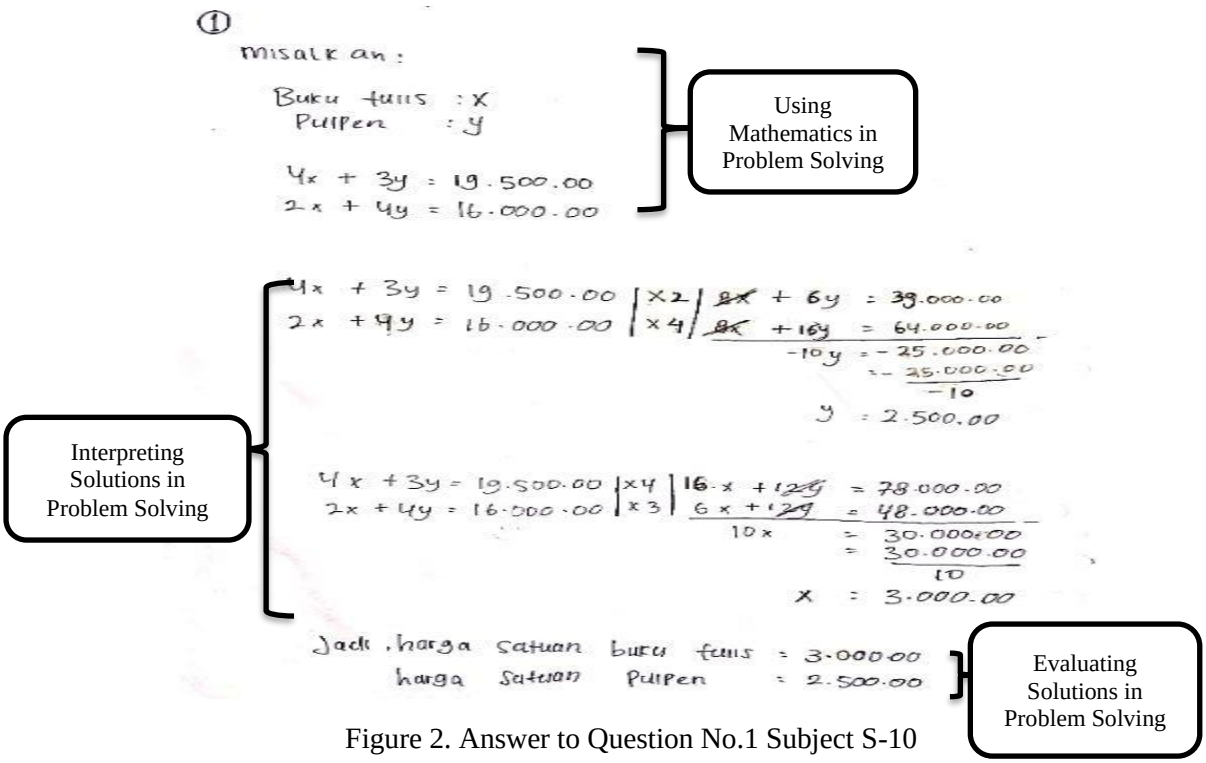

Figure 2. Answer to Question No.1 Subject S-10

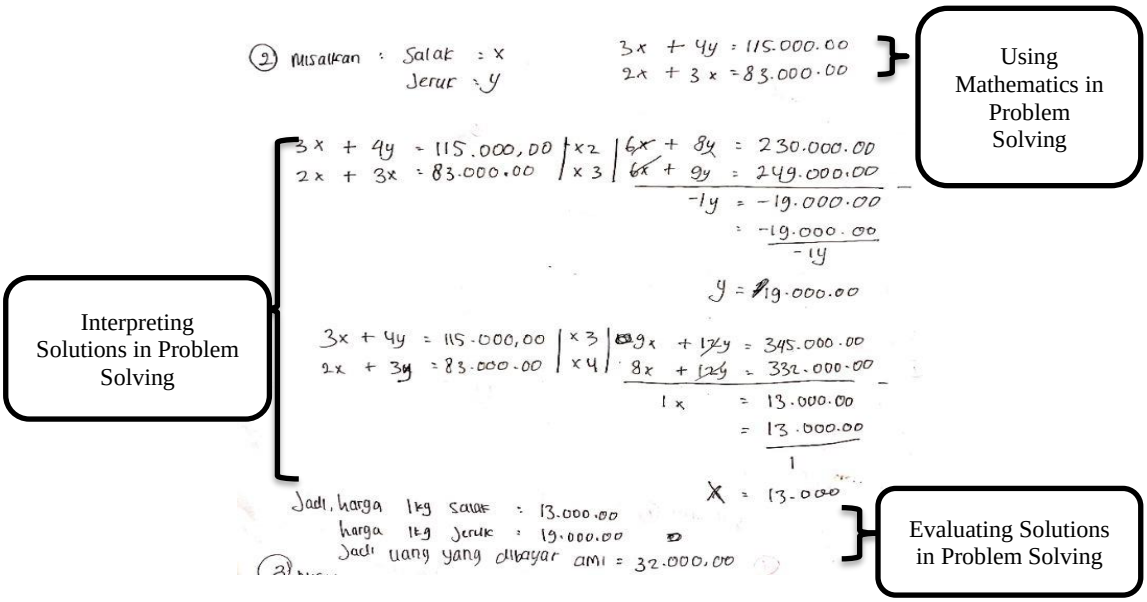

Figure 3. Answer to Question No.2 Subject S-10

Based on the answers to questions no. 1 and 2, the S-10 subject in solving mathematical literacy questions has met three indicators of mathematical literacy ability, namely the indicator of using mathematics in solving problems, indicators interpret solutions in problem solving. and indicators evaluating solutions in problem solving. Students do not meet the indicators of formulating problems in solving problems by answering what is known and asked in the questions completely and in the answers students write directly in mathematical models.

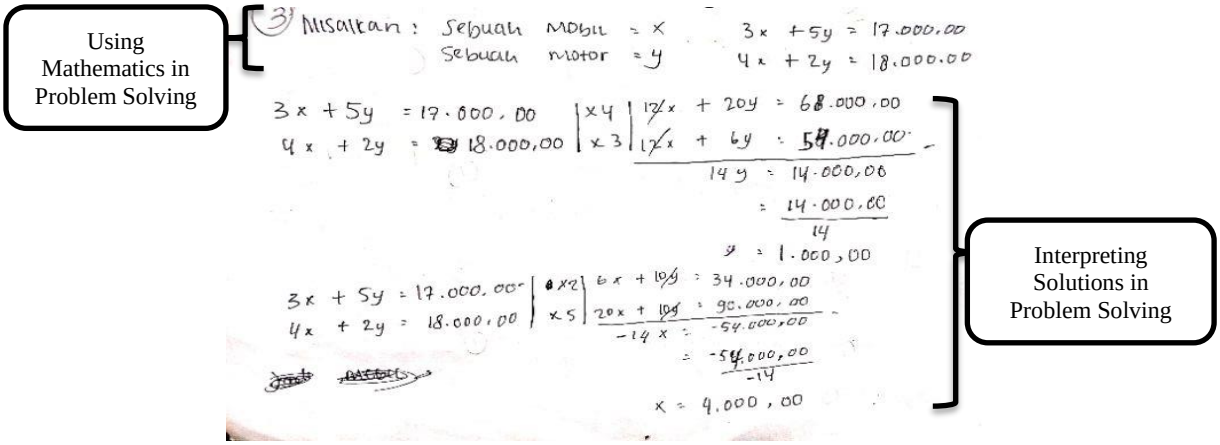

Figure 4. Answer to Question No.3 Subject S-10

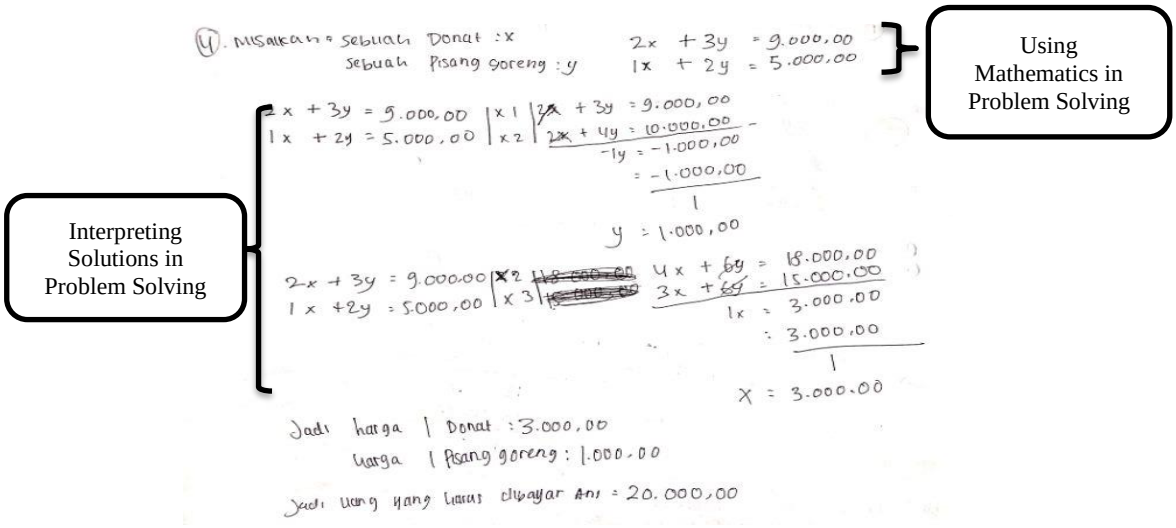

Figure 5. Answer to Question No. 4 Subject S-10

Based on the answers to questions no. 3 and 4, the S-10 subject in solving mathematical literacy questions has met two indicators of mathematical literacy ability, namely the indicator of using mathematics in solving problems, and indicators interpret solutions in problem solving. Students do not meet the indicators of formulating problems in solving problems by answering what is known and asked in the question completely. Students are also less able to fulfill the indicators for evaluating solutions in problem solving by concluding the results of problem solving correctly explained on the answer sheet or in interviews and students do not provide proof of the results they have worked on. In student number 5's answer, the money that Ami had to pay was Rp. 20,000 ,- which is not correct. The correct answer is that the money that Ami has to pay is IDR 8,000. S-09 students also have not been able to prove the results carried out during the interview.

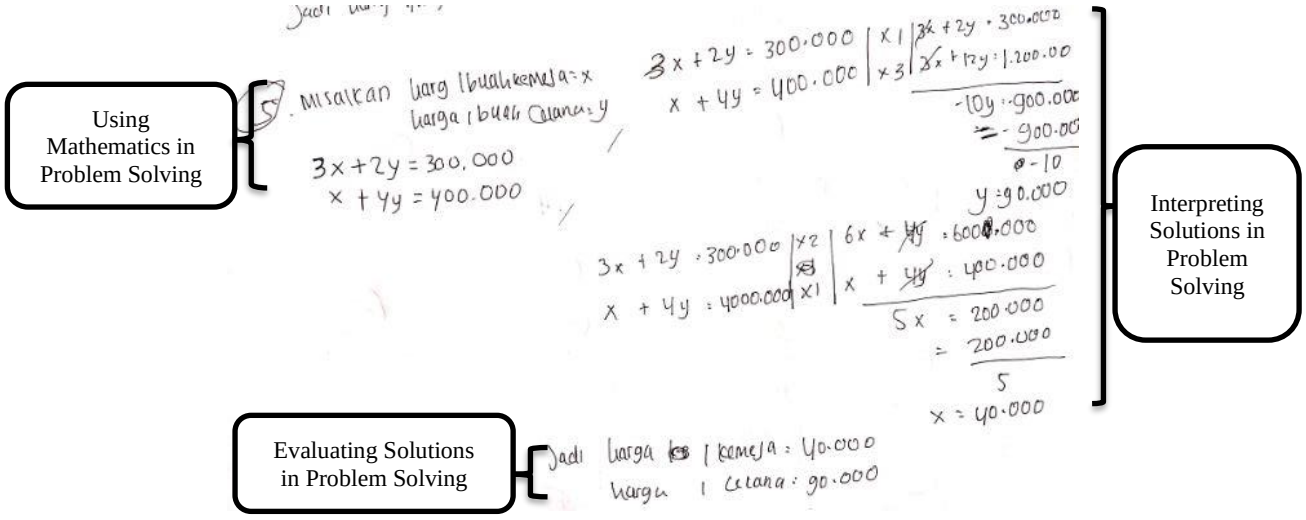

Figure 6. Answer to Question No. 5 Subject S-10

Based on the answer to question no. 5, the S-10 subject in solving mathematical literacy questions has fulfilled three indicators of mathematical literacy ability, namely the indicator of using mathematics in solving problems, indicators interpret solutions in problem solving. and indicators evaluating solutions in problem solving. Based on the interview answers, students did not meet the indicators of formulating problems in solving problems by answering what was known and asked in the questions completely, but in interviews students were able to answer. In the answers students directly write in mathematical models.

The results of the analysis between the mathematical literacy ability test and interviews with S-10 subjects, on average, from all the questions on the mathematical literacy ability test, S-10 met three indicators of mathematical literacy ability, although there were questions that only met some of the mathematical literacy indicators.

Based on the data that has been explained, it can be concluded that students' mathematical literacy abilities in solving mathematics problems in terms of logical intelligence in the high category seen from the results of test and interview answers, on average have met three indicators of mathematical literacy, namely the indicator of using mathematics in solving problems. , interpreting solutions in problem solving and evaluating solutions in problem solving. Students still need to improve their mathematical literacy skills, especially in the high category, so that they are able to use their logical intelligence well and can train students in solving questions or problems in everyday life.

Mathematical Literacy Ability on the Logical Intelligence of Medium Category Students

The following are answers to students' mathematical literacy ability tests which are supported by interview results which show that students with moderate logical intelligence have been able to achieve mathematical literacy indicators in solving story problems given by the researcher.

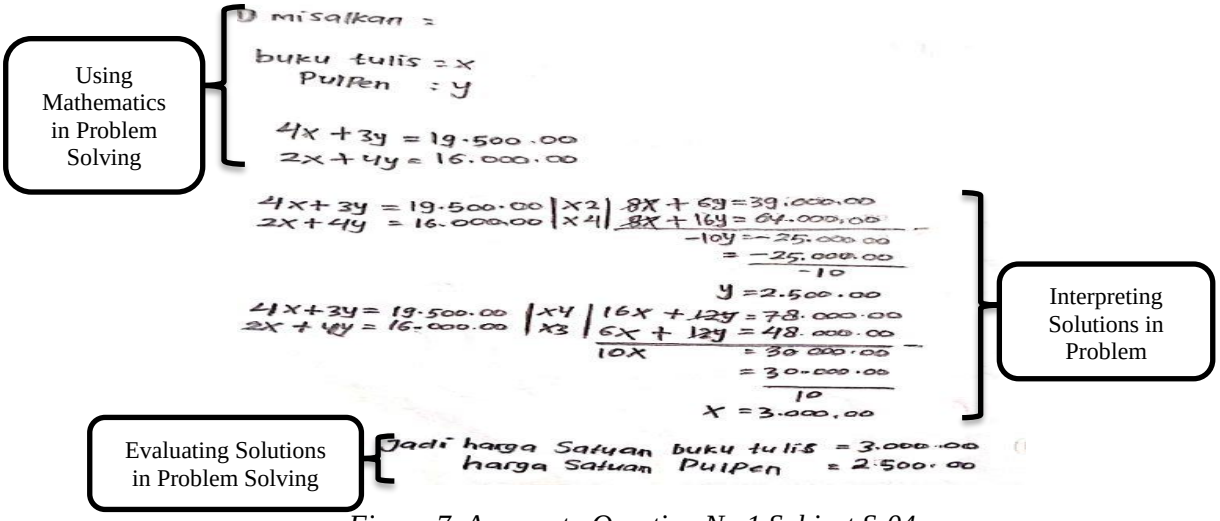

Figure 7. Answer to Question No.1 Subject S-04

Based on the answer to question no.1, subject S-04 in solving mathematical literacy questions has fulfilled three indicators of mathematical literacy ability, namely the indicator of using mathematics in solving problems, indicators interpret solutions in problem solving and indicators evaluate solutions in problem solving. Based on the results of answers and interviews, students were not able to fulfill the indicators of formulating problems in solving problems by answering what was known and asked in the questions completely, but in interviews students were able to answer.

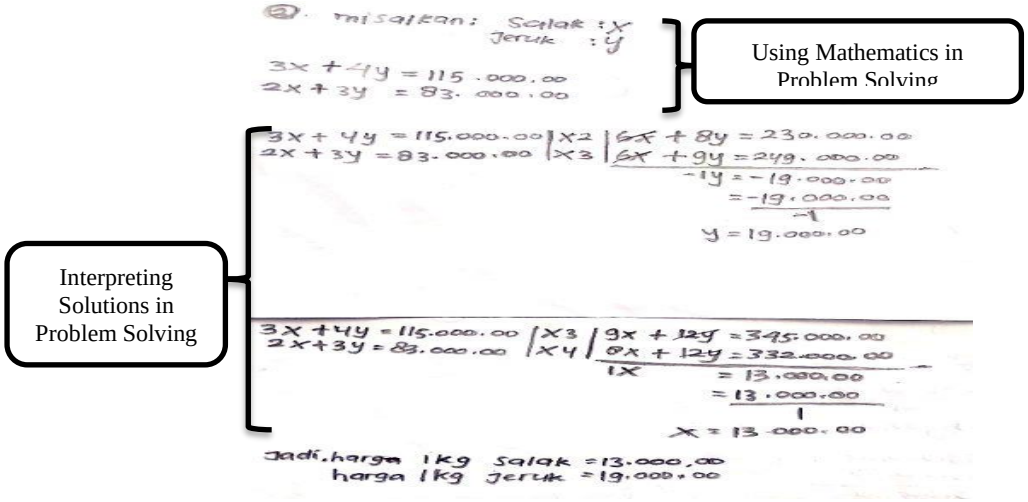

Figure 8. Answer to Question No.2 Subject S-04

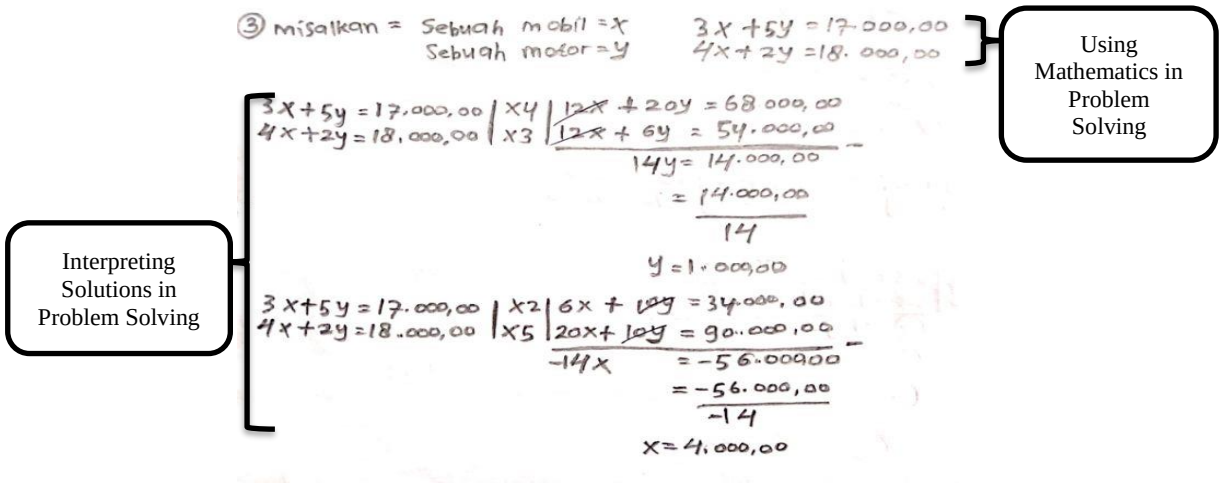

Figure 9. Answer to Question No.3 Subject S-04

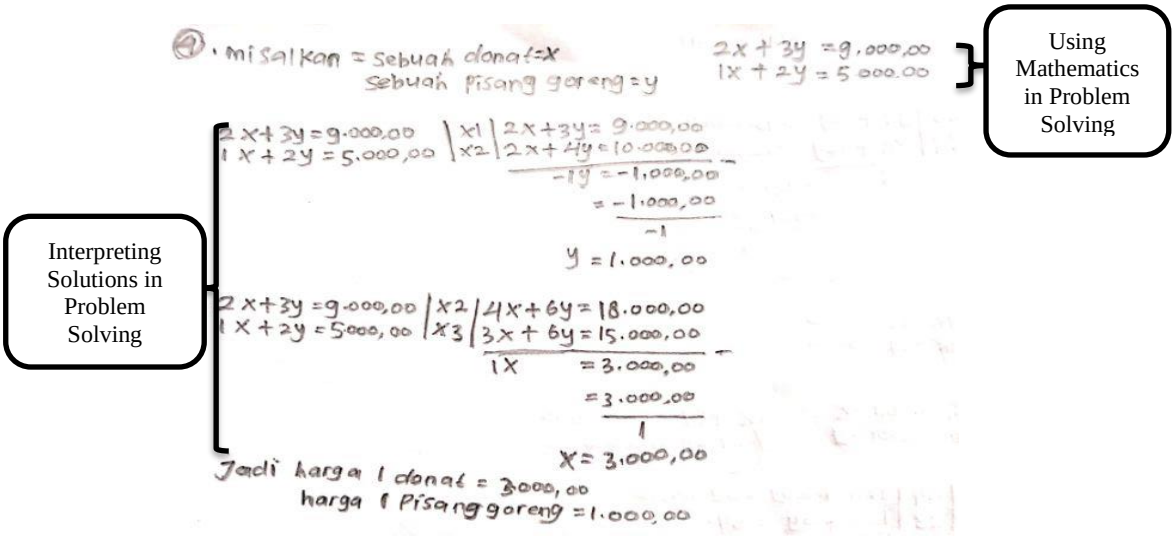

Figure 10. Answer to Question No.4 Subject S-04

Based on the answers to questions no. 2, 3 and 4, subject S-04 in solving mathematical literacy questions has met two indicators of mathematical literacy ability, namely the indicator of using mathematics in solving problems, and indicators interpret solutions in problem solving. Students have not been able to formulate problems in problem solving by writing down what is known and asked in the question completely and correctly. Students are less able to fulfill the indicators of evaluating solutions in problem solving by concluding the results of problem solving correctly explained on answer sheets and interviews. Students are unable to provide statements to conclude the results of their work on the questions.

The student's answer to question number 2 did not write down the amount that Ami had to pay, 13,000+19,000 = 32,000 in the answer because he did not focus on what was asked in the question. The student's answer to question number 4 does not answer what was asked in the question, which should be able to conclude that the money Ani paid was Rp. 8,000.00, so the student's answer is still not correct and complete, and the student also did not provide proof of the results.

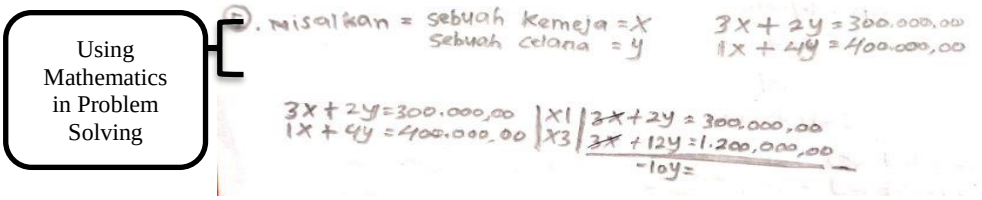

Figure 11. Answer to Question No.5 Subject S-04

Based on the answer to question no. 5, subject S-04 in solving mathematical literacy questions has fulfilled one indicator of mathematical literacy ability, namely the indicator of using mathematics in solving problem. Students have not been able to formulate problems in problem solving by writing down what is known and asked in the question completely and correctly. Students have not been able to interpret solutions in solving problems by applying the solution method, namely the elimination method in the solution steps to determine the x and y values correctly because they have not finished working because there is not enough time. Students are also not able to evaluate solutions in problem solving by concluding the results of problem solving.

The results of the analysis between the mathematical literacy ability test and interviews with subject S-04, the average of all the mathematical literacy ability test questions is that S-04 has met two indicators of mathematical literacy ability even though there are questions that only meet some of the mathematical literacy indicators.

Based on the data that has been explained, it can be concluded that students' mathematical literacy abilities in solving mathematical problems in terms of logical intelligence in the medium category seen from the results of test and interview answers, on average have met two indicators of mathematical literacy, indicators of using mathematics in problem solving and interpreting solutions in problem solving. There were several students' answers who were not able to prove their answers and were only able to conclude from the existing results. So, students still need to improve their mathematical literacy skills, especially in the medium category, in order to improve students' abilities, especially literacy skills in solving problems.

Mathematical Literacy Ability on the Logical Intelligence of Low Category Students

The following are answers to students' mathematical literacy ability tests which are supported by interview results which show that students with low logical intelligence have been able to achieve mathematical literacy indicators in solving story problems given by researchers.

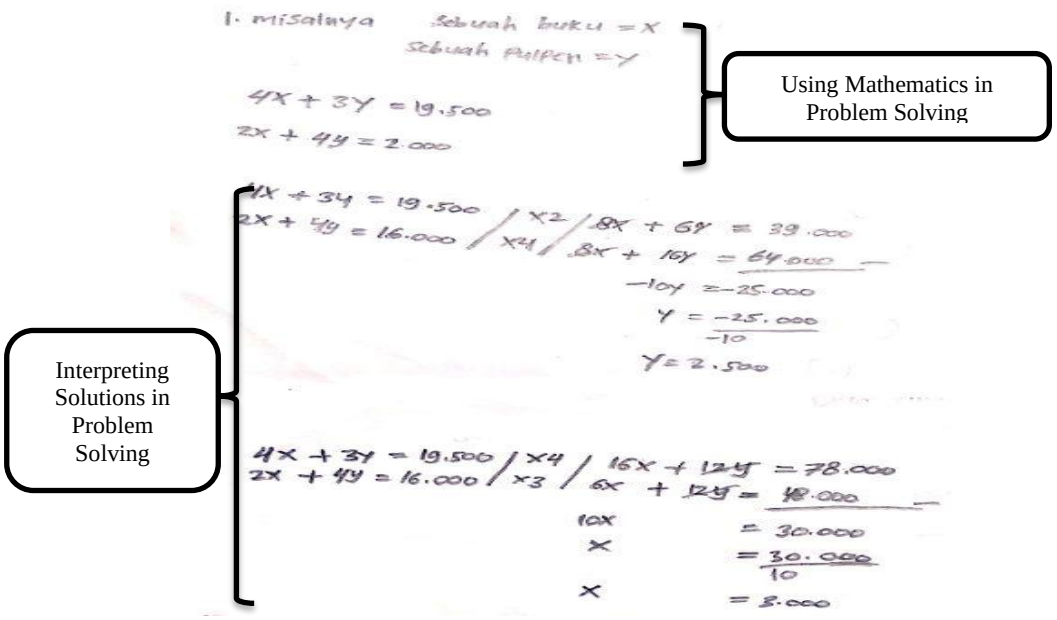

Figure 12. Answer to Question No.1 Subject S-06

Based on the answer to question no.1, subject S-06 in solving mathematical literacy questions has fulfilled two indicators of mathematical literacy ability, namely the indicators of using mathematics in problem solving and interpreting solutions in problem solving. S -06 students have not met the indicators of formulating problems in solving problems by writing down what is known and asked in the questions completely and correctly because the S-06 students' answers directly answer mathematical models. Then students also cannot meet the indicators of using mathematics in solving problem by formulating the problem in a mathematical model. Student S-05 writes on the answer sheet, for example, a book = x and a pen = y. Students are not yet able to evaluate solutions in solving problems by providing conclusions from the results of problem solving that are correctly explained on the answer sheet and providing proof of the results.

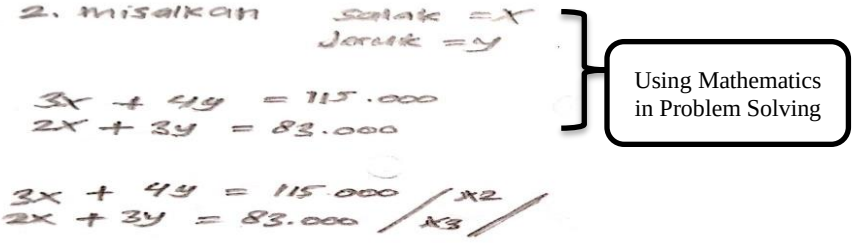

Figure 13. Answer to Question No.2 Subject S-06

Based on the answer to question no.2, subject S-06 in solving mathematical literacy questions has fulfilled one indicator of mathematical literacy ability, namely the indicator of using mathematics in solving problem. S-06 students have not met the indicators of formulating problems in solving problems by writing down what is known and asked in the questions completely and correctly. Students have not been able to interpret solutions in solving problems by applying the solution method, namely the elimination method in the solution steps to determine the x and y values correctly because they have not finished working because there is not enough time. Students are also not able to evaluate solutions in problem solving by concluding the results of problem solving. In answering questions, S-05 students did not answer all the steps to solve question number 2 due to limited time and lack of understanding of the contents of the questions to solve them.

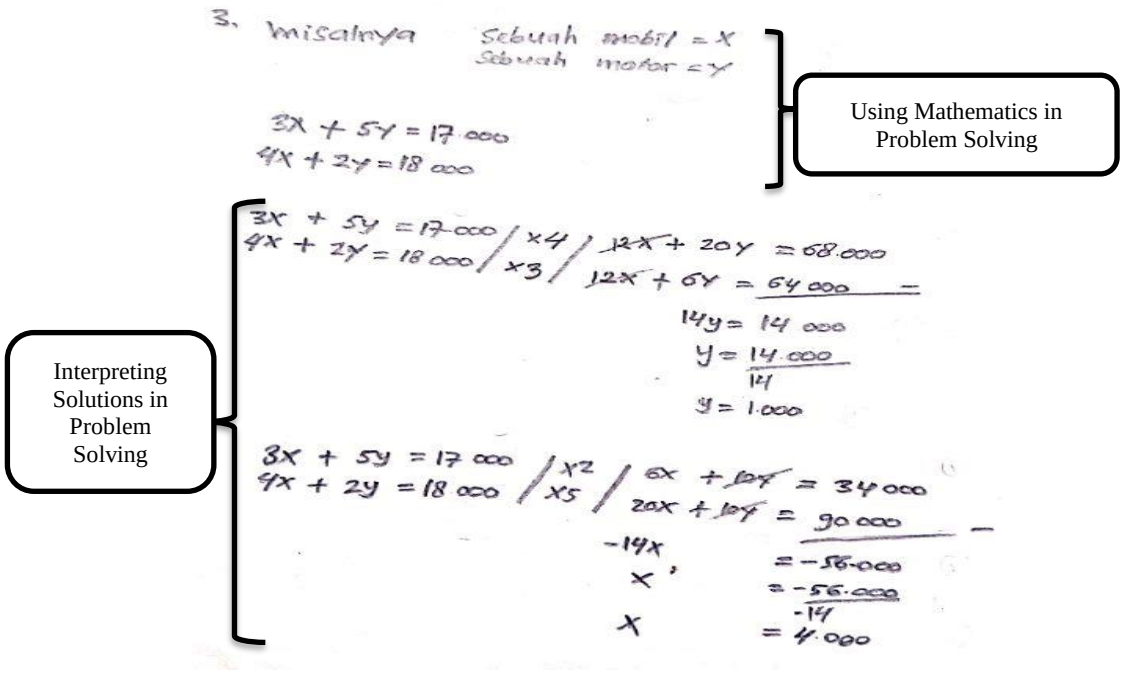

Figure 14. Answer to Question No.3 Subject S-06

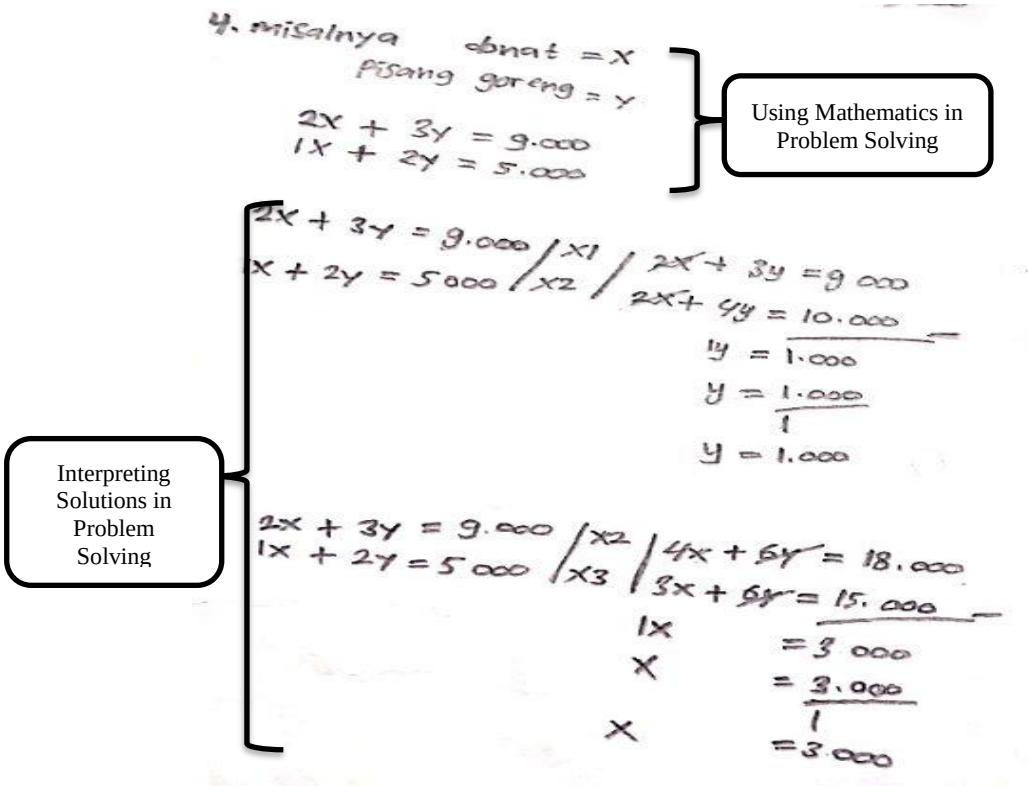

Figure 15. Answer to Question No.4 Subject S-06

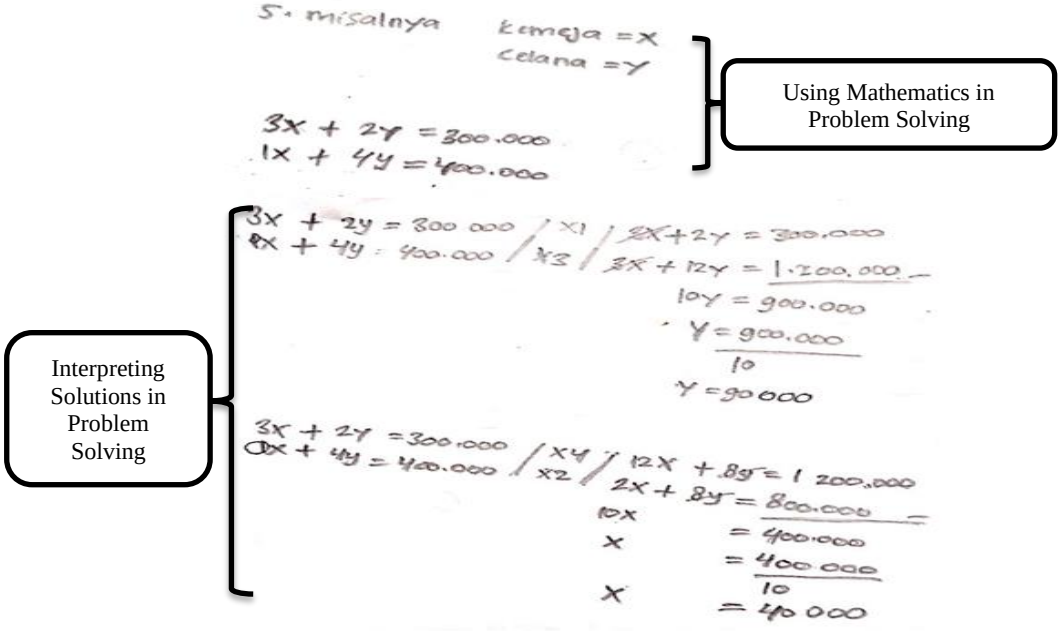

Figure 16. Answer to Question No.5 Subject S-06

Based on the answers to questions no. 3, 4, and 5, subject S-06 in solving mathematical literacy questions has met two indicators of mathematical literacy ability, namely the indicator of using mathematics in solving problems, and indicators interpret solutions in problem solving. S-06 students have not met the indicators of formulating problems in solving problems by writing down what is known and asked in the questions completely and correctly because the S-05 students' answers directly answer mathematical models. Students are not yet able to evaluate solutions in problem solving by providing conclusions from the results of problem solving correctly explained on the answer sheet and providing proof of the results.

The results of the analysis between the mathematical literacy ability test and interviews with subject S-04, the average of all the mathematical literacy ability test questions is that S-04 has met two indicators of mathematical literacy ability even though there are questions that only meet some of the mathematical literacy indicators.

Based on the data, it can be concluded that students' mathematical literacy abilities in solving mathematical problems in terms of logical intelligence are in the low category seen from the results of test and interview answers, on average each student only meets two indicators, namely the indicator of using mathematics in solving problems and interpreting. solutions in problem solving. Each student has different abilities and influences students in solving problems, including solving problems. Students with low logical intelligence categories are still unable to convey what they know and are asked in the questions. They immediately answer questions using the methods they remember without first formulating complete and precise steps for solving them. Students still experience many errors in writing answers or calculating operations on numbers because this has a big influence on solving problems. If the calculation operation is inaccurate, the next answer will be the same as the previous one. Then, because they don't understand the content of the questions, students will answer questions for a long time and they will run out of time to complete them first, so there are several questions that have not been answered. So, there is still a need to improve mathematical literacy skills, especially in the low category.

4. CONCLUSION

Based on the results of data analysis and research discussion regarding the analysis of students' mathematical literacy abilities in solving mathematical problems in terms of logical intelligence, it can be concluded that out of a total of 32 students in class VIII C of SMP Negeri 1 Gebang, there are 8 students or 25% who meet one indicator of mathematical literacy ability, 16 students or 50% met two indicators of mathematical literacy ability, 7 students or 22% met three indicators of mathematical literacy ability and 1 student or 3% met four indicators of mathematical literacy ability. There were 2 students in the high logical intelligence category or 6%, 18 students in the moderate logical intelligence category or 56% and 12 students in the low logical intelligence category or 38%.

Students with high logical intelligence have good mathematical literacy skills in solving mathematical literacy test questions which can fulfill three indicators of mathematical literacy ability, namely the indicator of using mathematics in solving problems, indicators interpret solutions in problem solving, and indicators evaluate solutions in problem solving. Students with moderate and low logical intelligence have quite good mathematical literacy skills in solving mathematical literacy test questions which can fulfill two indicators of mathematical literacy abilities, namely indicators of using mathematics in problem solving and interpreting solutions in problem solving. Therefore, students need to improve their mathematical literacy skills, whether they have high, medium or low logical intelligence in order to meet the mathematical literacy indicators.

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