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Analysis of Mathematical Resilience on Numeracy Literacy of Junior High School Students

Dita Aurelia Azhara[1] Putri Salvinia Nazam[2] Laelasari[3*] Ferry Ferdianto[4]

Department of Mathematics Education, Faculty of Education and Science, Swadaya Gunung Jati University Cirebon, West Java, Indonesia

* E-mail of the corresponding author: lala.mathunswagati@gmail.com

Abstract

Each student has different characteristics in dealing with difficulties in the process of learning mathematics called mathematical resilience. The purpose of this study was to analyze students mathematical resilience on numeracy literacy questions of junior high school students, this research design used descriptive qualitative research with the research subjects used were grade VIII junior high school students in the city of Cirebon. The instruments used are numeracy literacy test questions and interviews using resilience indicators, namely (1) Emotional Regional, which shows good emotional control in solving a problem, (2) Optimist, which shows a confident attitude with his abilities in solving math problems, (3) Relation, which creates good relationships with the surrounding environment, (4) Analyze, which identifies a mathematical problem and explores the problem to find a solution, and (5) Reaching Out, which is finding solutions to mathematical problems with his creativity. Data analysis techniques used are data reduction, data presentation and conclusion drawing. The results showed that: 1) students with high resilience can answer numeracy literacy test questions well, can analyze information in the table, and achieve systematic steps in solving problems. 2) students with medium resilience can use a variety of numbers and symbols quite well, less specific in answering the mathematical resilience ability test. 3) students with low resilience are less able to solve problems well, students are still not precise in making plans, where students do not write the formula to be used, the solutions obtained are not leading to the right solution and students are less able to express the plans they make.

Keywords: Analysis, Mathematical Resilience, Numeracy Literacy

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1. Introduction

In the world of education students are required to be able to solve math problems in everyday life, mathematics is one of the subjects taught from primary, secondary and higher education levels. Therefore, all students from elementary school to college must be taught mathematics to each logical, analytical, systematic, critical, and creative thinking skills as well as the ability to work together (Sinabang et al., 2023). However, the current condition of mathematics learning in Indonesia is still low (Pulungan, 2022).

Mathematics is one of the main factors that cause high levels of stress or anxiety in learning at school, high anxiety when learning math causes the math learning process to be less effective. (Ansori & Hindriyanto, 2020). Students will face problems and challenges when solving mathematical problems, students must try hard and not give up easily. Therefore, to face challenges or difficulties, an attitude of perseverance and resilience is needed, which is also known as mathematical resilience (Lutfiyana et al., 2022).

Learning math is not only related to formulas, but requires reasoning power or critical thinking patterns to solve any given problem. The numeracy literacy skills of students in Indonesia are still considered low (Saragih et al., 2023). Students' ability in numeracy literacy shows how learning is done at school. In doing so, teachers must have the ability to teach students numeracy concepts by practicing a thorough literacy culture. (Sari & Aini, 2022).

In line with the statement of the Indonesian Ministry of Education and Culture (2021) which states that everyone in Indonesia must have the ability of six basic literacies, one of which is numeracy literacy. The ability to understand and use various symbols and numbers related to basic mathematics to solve everyday problems and analyze the data in an appropriate way is called numeracy literacy (Kemendikbud, 2021).

Numeracy literacy is the ability of humans to utilize various kinds of numbers to solve various conditions

of everyday problems more quickly and easily (Simamora & Akhiruddin, 2022). As one of the branches of mathematics, numeracy literacy is an ability needed by students (Laelasari et al., 2019). Numeracy literacy is different from mathematics learning, it can help students overcome mathematical problems in daily life, such as managing their finances, analyzing data, etc. (Zahwa et al., 2022).

Numeracy literacy skills that students must have to train to get used to facing various problems, both problems in mathematics, problems in other fields of study or problems in everyday life that are increasingly complex. Therefore, mathematical numeracy literacy skills need to be continuously trained so that students can solve the problems they face (Sinabang et al., 2023). Mathematical literacy includes the competence and confidence to apply information to the real world (Ferdianto et al., 2022). Basically, numeracy skills are indispensable for everyone (Laelasari et al., 2022). Mathematics is nicknamed the Queen of Science because it is connected to many other sciences so that math will always be used by humans while living life. Therefore, numeracy skills are indispensable for students in learning mathematics subjects (Mahmud & Pratiwi, 2019).

Numeracy literacy is very important in all aspects of life, whether in education, work, or society. Numeracy literacy that continues to grow requires humans to continue to adapt in various aspects of education. Numeracy literacy is considered an evolution and is the foundation of educational development in Indonesia. (Arrosyad & Nugroho, 2021). Students' numeracy literacy can grow and develop by fostering students' positive attitudes towards mathematics (mathematical resilience). This is because mathematics is a vehicle for numeracy literacy learning (Arbain & Sirad, 2023). Teachers who are aware of numeracy literacy can effectively contribute to the field of education, providing high quality education to their students (Kocabatmaz & Saraçoğlu, 2023).

The inability of students to draw conclusions or interpret the problem solving process is one of the reasons for low numeracy literacy learning outcomes (Pulungan S, 2022). Mathematical resilience affects mathematical literacy indirectly through student learning outcomes. Mathematical resilience is also one of the positive attitudes that a person has when facing fears and overcoming difficulties, especially when learning math (Yohannes & Juandi, 2021).

One of the attitudes that influence success in learning mathematics is mathematical resilience. This attitude includes self-confidence, perseverance, not giving up easily, and the desire to talk to others to get better results (Nurhayati & Nimah, 2023). Mathematical resilience is a qualified attitude towards mathematics that encompasses learning, including belief in success through hard work and perseverance in the face of mathematical difficulties (Ansori & Hindriyanto, 2020).

Students have difficulty in understanding, identifying math problems and difficulty applying mathematical concepts to a problem (Dila & Zanthy, 2020). Students who are able to persist in mathematics can face difficulties and challenges in learning mathematics. One of the factors that cause students to fail to persist in mathematics is a lack of self-confidence or pessimism in the mathematics learning process, especially when they face problems that are quite difficult (Kurniawan et al., 2023). The concept of mathematical resilience refers to students' ability to maintain a positive attitude and overcome difficulties and anxiety while learning mathematics (A. J. Hutauruk & Naibaho, n.d.). It includes the ability to cooperate, communicate, and adapt to various learning environments (Krakovská et al., 2024). Mathematical resilience is considered part of one's mathematical identity and is influenced by psychological, social, and environmental factors (Oszwa, 2022). Therefore, perseverance is needed for students in solving mathematical problems and also with good adaptation in order to turn mathematical problems as a challenge not as an obstacle that makes students give up easily to solve it (Sari & Untarti, 2021).

The indicators of mathematical resilience used in this study are: (1) Emotioal Regional, which shows good emotional control in solving a problem, (2) Optimist, which shows an attitude of confidence in his abilities in solving mathematical problems, (3) Relation, which creates good relationships with the surrounding environment, (4) Analyze, which identifies a mathematical problem and explores the problem to find a solution, and (5) Reaching out, which finds solutions to mathematical problems with his creativity (Sari & Untarti, 2021).

Mathematical resilience impacts the numeracy literacy of secondary school students. Mathematical resilience plays an important role in shaping students' numeracy literacy, with resilient students showing better mathematical problem-solving skills and attitudes towards learning mathematics (A. J. B. Hutauruk & Priatna, 2017). Resilient, determined and enterprising reasoning is necessary in students' efforts to improve literacy and numeracy. If they face difficulties in solving mathematical literacy problems, some students tend to give up and do not try again to solve them, avoiding what they should do (Setiawan et al., 2022).

From the results of research conducted by Rahmatiya & Miatun (2020) it can be concluded that: (1) there are no students in class VII-B who have low resilience, there are only two categories of students who have high

and moderate resilience; (2) students who have high resilience have good mathematical problem solving skills and are confident when faced with various problem problems; and (3) students who have moderate resilience, are still lacking in their mathematical problem solving skills, because they have not been able to achieve systematic steps in mathematical problem solving skills, are less careful, and tend to give up when faced with difficult problems.

The results of research conducted by Kurnia et al, (2018) show that communication skills in students who have high resilience can solve mathematical communication skills test questions well, as well as students who have moderate resilience can solve mathematical communication skills tests well, but students who have low resilience are less precise in completing mathematical communication skills tests.

The results of Olo et al.'s research (2023) show that there is an effect of mathematical resilience on students' problem solving skills, with a large effect of 85%. Research conducted by Setiawan, (2022) from the results of his research concluded that there is an effect of mathematical resilience on students' mathematical literacy, the effect of mathematical resilience on students' mathematical literacy is 30.4%.

Some of the studies above suggest that mathematical resilience affects the level of students' mathematical problem solving ability. Therefore, it is suspected that mathematical resilience can support students' mathematical problem solving ability in numeracy literacy. This study aims to describe and analyze the numeracy literacy skills of junior high school students in terms of their mathematical resilience.

2. Methodology

2.1 Research Design

This research design uses descriptive qualitative research, the instruments in this research are Numeracy Literacy Test Questions and interviews using resilience indicators.

Furthermore, the test results that have been done will be analyzed in accordance with the indicators of numeracy literacy skills, namely: (1) using various numbers and symbols related to basic mathematics in solving practical problems in the context of everyday life; (2) analyzing information displayed from various forms (graphs, tables, charts, etc.); (3) interpreting the results of the analysis to predict and make decisions, and continued with an interview with the selected subject regarding the answers to the numeracy literacy test to confirm the solution process.

The interview used a semi-structured method, with the purpose of the interview to obtain information about the data needed in this study, namely students' mathematical resilience abilities, as well as information about the numeracy literacy test that had been carried out previously.

2.2 Participants

This research was conducted in one of the junior high schools in Cirebon City with the research subjects consisting of 3 classes with a total of 69 students. The research aims to see the level of resilience. Before the research was carried out, the researcher selected 69 junior high school students in grade VIII as prospective subjects.

Table 1. Class VIII Student Data

Class	Number of Students
Class VIII A	29
Class VIII B	21
Class VIII C	19
Total	**69**

2.3 Data Collection Tool

The instruments in this study were Numeracy Literacy Test Questions and interviews about mathematical resilience. The Interview Guidelines instrument is 18 questions adapted from the indicators of mathematical resilience, namely: (1) Emotional Regional, which shows good emotional control in solving a problem, (2)

Optimist, which shows a confident attitude with his abilities in solving mathematical problems, (3) Relation, which creates good relationships with the surrounding environment, (4) Analyze, which identifies a mathematical problem and explores the problem to find a solution, and (5) Reaching out, which finds solutions to mathematical problems with his creativity (Sari & Untarti, 2021).

The numeracy literacy test instrument is 3 items based on Polya's four steps, namely: (1) understanding the problem; (2) planning the solution; (3) solving the problem according to the plan; and (4) checking again (Nuryah et al., 2020).

2.4 Data Collection and Analysis

Data analysis techniques used are data reduction, data presentation and conclusion drawing. The test results that have been done by students will be analyzed by looking at the steps of answers done by students adjusted to the indicators of numeracy literacy skills, from all student answers selected 3 subjects with high, medium and low numeracy literacy categories. Then continued with interviews about mathematical resilience to subjects with high, medium and low literacy ability categories to confirm the solution process.

3 Findings

3.1 Numeracy Literacy Test Results of Junior High School Students

Based on the numeracy literacy test results of all samples analyzed, then categorized into high, medium and low numeracy literacy categories. Here in Table 2 the results of the numeracy literacy category of junior high school students.

Table 2. Categories of Numeracy Literacy Skills

Class	Number of Students
High	40
Medium	19
Low	10

Based on Table 2, it can be obtained the level of numeracy literacy of Class VIII students with a total of 69 students. Students who have high category numeracy literacy skills are 40 students or 58%, while students who have medium category numeracy literacy skills are 19 students or 28%, and students who have low category numeracy literacy skills are 10 students or 14%.

After categorizing based on the numeracy literacy test results, 1 subject was selected for each category of students who had high, medium and low numeracy literacy skills. The subjects were chosen randomly.

Table 3. Numeracy Literacy Subject Codes

Subject Code	Numeracy Literacy Skills
Subject S1	High
Subject S2	Medium
Subject S3	Low

Based on Table 3, the subject codes S1, S2 and S3 based on high, medium and low literacy abilities will be carried out mathematical resilience interviews.

The following presents written test results and interview data for subjects who have high numeracy literacy skills (subject S1), subjects who have medium numeracy literacy skills (subject S2) and subjects who have low numeracy literacy skills (subject S3).

3.2 Subject S1 (Student with High Numeracy Literacy Ability)

BELANJA PAKAIAN LEBARAN

Salah satu kebiasaan masyarakat Indonesia Ketika Hari Raya Idul Fitri adalah membeli pakaian baru.

Tabel berikut menunjukkan harga dan banyak jenis pakaian yang terjual di sebuah toko dalam 1 jam.

No	Jenis Pakaian	Banyak Lusin	Harga Total Rupiah
1	Baju Koko	$\frac{1}{6}$	150.000
2	Kaos	0,5	360.000
3	Celana	25%	270.000
4	Kerudung	$\frac{7}{12}$	560.000

Beri tanda (√) pada kolom benar atau salah untuk setiap pertanyaan.

Pernyataan	Benar	Salah
Harga satuan paling mahal adalah harga kerudung		
Urutan harga satuan dari yang termurah adalah harga celana, kerudung, kaos baju koko		
Urutan harga satuan dari yang termahal adalah harga celana, kerudung, baju koko, kaos		
Harga satuan paling murah adalah kaos		

Figure 1. Question Number 1

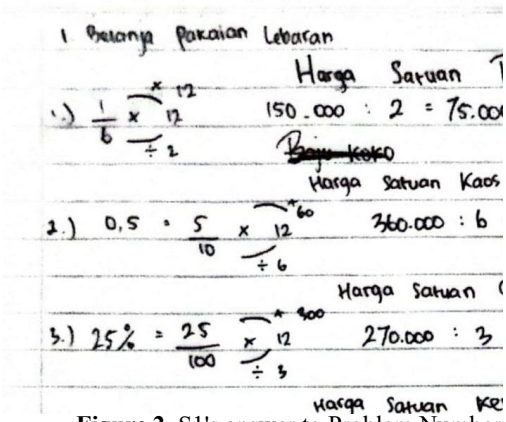

Figure 2. S1's answer to Problem Number 1

Subject S1 has been able to fulfill systematic steps in solving problems, because the solution is done in accordance with the sequence of problem solving steps, namely by changing the number of dozen to an ordinary fraction and then multiplying by 12, because 1 dozen 12 pieces. Furthermore, subject S1 first looks for the unit price of goods by means of the entire price of the goods divided by the multiplication result obtained. Then obtained the unit price of each item. S1 also makes a problem plan that is done starting from understanding the problem, making the implementation of the solution, and re-examining the results of the work. Subject S1 has also been able to solve problems in working on problems comparing statement 1 with others and can interpret the results that have been done and can draw conclusions.

From the results of S1's answers in accordance with the indicators of numeracy literacy because he can use his ability to process symbols and numbers well, subject S1 can analyze the information obtained from the table questions in number 1. Subject S1 can also show a confident attitude in solving mathematical problems with his abilities. This is reinforced by the results of interviews that have been conducted, subject S1 can answer questions correctly. The following are the results of the interview dialog with Subject S1.

P : "What information can you get from the question?"

S1 : "Decimal, percent and fraction numbers"

P : "What are you looking for in the question?"

S1 : "Finding the unit price in each type of clothing to find out the statement in the column and comparing the prices in each type of clothing."

P : "What method do you use to determine the unit price of each type of clothing?"

S1 : "I first determine the price of 1 dozen after that multiply it by the price of many dozen then from the results of many prices divided by the total price of rupiah."

P : "What symbols are used in solving the problem?"

S1 : "Ordinary fractions and decimal fractions."

P : "Are you sure of the answer?"

S1 : "I am sure and inshallah true."

Based on the results of the interview, it can be seen that the subject S1 is able to explain each step of the answer written well and is confident in the answers he has done.

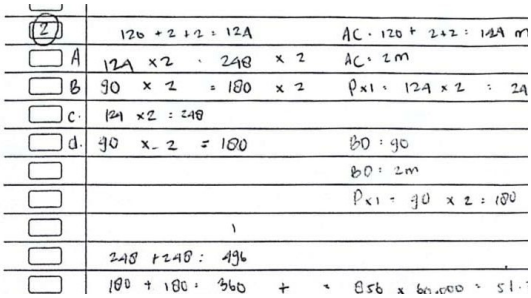

Figure 3. S1**'s** answer to Problem Number 2

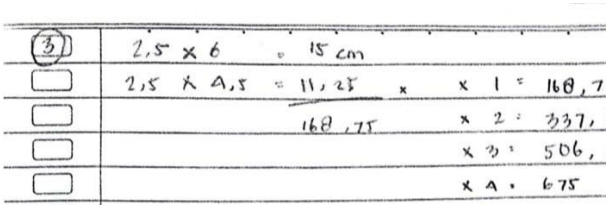

Figure 4. S1**'s** answer to Problem Number 3

Subject S1 is able to understand the problem and analyze the information contained in each question, the implementation plan is well described and detailed. The formula used is in accordance with what is asked. Subject S1 has been able to achieve systematic steps in solving problems, because the solution is done in accordance with the sequence of problem solving steps, using various numbers and basic mathematical symbols and can understand problems related to everyday life and re-examine the results of his work. When an interview was conducted regarding the answers that had been written, subject S1 was able to explain well and clearly, even confidently subject S1 explained in detail every step he took.

In answering question number 2, subject S1 first determines the length of each side of the rectangular flat shape, after all sides are known S1 can determine the area of each flat shape. Furthermore, S1 can calculate the area of paving blocks and can determine the costs involved in making paving blocks in the question. In question number 3, subject S1 answered correctly starting with finding the length of each side of the batik cloth. After the length of the side is known, the next step S1 can calculate the area of the batik cloth and then can answer the question with the correct answer.

From Figure 2, 3 and Figure 4 show that the written answers of subject S1 tend to be consistent and use the appropriate and correct method, and can interpret the results of the analysis that has been done well. When an interview was conducted regarding the written answers he had done, subject S1 was able to explain clearly and confidently every step he took. It can be concluded that subject S1 has fulfilled all indicators of numeracy literacy, and has high resilience.

3.3 Subject S2 (Student with Medium Numeracy Literacy Ability)

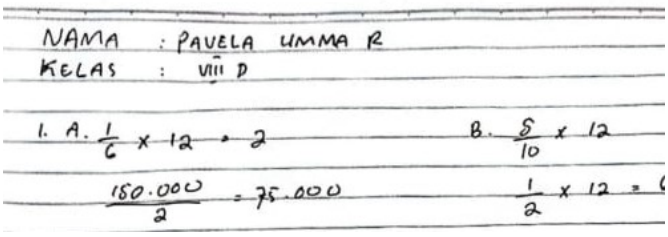

Figure 5. S2's answer to Problem Number 1

Subject S2 in answering question number 1 answered correctly but a little less thoroughly, causing subject S2 to be inconsistent and detailed. In answering question number 1, subject S2 directly operates the fraction multiplied by 12 and then divided by the total price, then the unit price is obtained. This method is correct but incomplete. Subject S2 can analyze the information obtained from question number 1. Can use numbers and basic mathematical symbols well, the implementation plan is described quite well by subject S2 and uses the formula as asked but incomplete.

The solution carried out by subject S2 is in accordance with what is asked in question number 1. Subject S2 re-examines the answers that have been done. In this case the subject S2 has not yet achieved systematic steps in solving problems, the solution done is in accordance with the sequence of problem solving steps starting from understanding the problem, making the implementation of the solution, and re-examining the results of the work but is slightly incomplete. Subject S2 has not fulfilled all indicators of mathematical resilience due to lack of confidence in working on numeracy literacy test questions. This is reinforced by the results of interviews that have been conducted. The following is an interview dialog with subject S2.

P : "What information can you get from the question?"

S2 : "There are percentages, decimals are converted into fractions."

P : "What are you looking for in the question?"

S2 : "To find out the unit price of the clothes"

P : "What method do you use in determining the unit price of each type of clothing."

S2 : "Multiplied and then divided"

P : "What symbols are used in solving the problem?"

S2 : "Ordinary fractions and decimal fractions."

P : "Are you sure of the answer?"

S2 : "Not sure."

Based on the results of the interview, it can be seen that the S2 subject is able to explain each step of the answer written well but lacks confidence in the answers he has done.

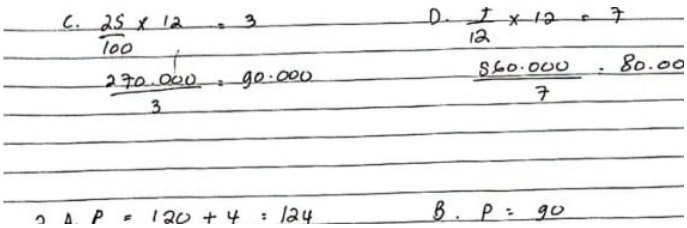

Figure 6. S2's answer to Problem Number 2

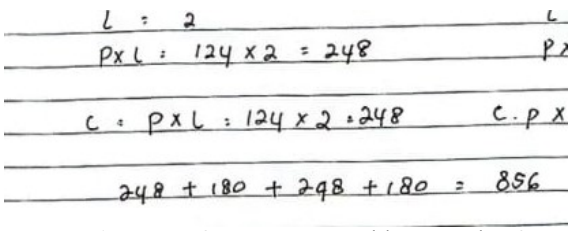

Figure 7. S2's answer to Problem Number 3

Subject S2 was able to understand the problem and analyze the information contained in each question. The implementation plan is well described but not in detail and consistent. The formula used is in accordance with what is asked. Subject S2 has not been able to achieve systematic steps in solving problems, because the solutions that are done are not in accordance with the sequence of problem solving steps. Subject S2 understands problems related to everyday life, makes a plan for the problem being worked on, makes the implementation of the solution, can use various kinds of numbers and basic mathematical symbols well and re-examine the results of his work. However, in number 3 subject S2 answered less thoroughly. When interviewed about the answers that had been written, subject S2 was able to explain well and in detail every step he did, but lacked confidence.

From Figure 5, 6 and Figure 7, it shows that the written answers of subject S2 are appropriate but lack detail in interpreting the results of the analysis he has done. It can be concluded that subject S2 has fulfilled several indicators of numeracy literacy, the indicators that have not been fulfilled are subject S2 has not been able to interpret the results of the analysis to make a decision from the answers that have been done, when interviewed subject S2 admitted that he was not sure of the results of his own answers and S2 has medium resilience.

3.4 Subject S3 (Student with Low Numeracy Literacy Ability)

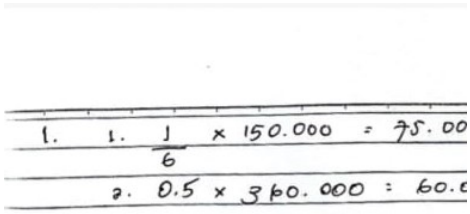

Figure 8. S3's answer to Problem Number 1

Subject S3 can be seen in answering question number 1 has not fulfilled the systematic steps in solving problems, subject S3 can analyze the information obtained from question number 1 but does not write what is known and asked. The implementation plan is described not well enough by subject S3, not using the formula as asked and not being able to use numbers and mathematical symbols properly. The completion of the subject S3 is not in accordance with what is asked in question number 1. In question number 1 subject S3 did not recheck the answers he had done, so the answers obtained were correct but the method was less precise. Subject S3 in answering question number 1 is less thorough, lacks understanding of the concept and tends to memorize formulas, this he admitted during the interview, causing subject S3 to have difficulty answering similar questions. The following is an interview dialog that has been conducted with subject S3.

P : "What information can you get from the question?"

S3 : "Converted into price."

P : "What are you looking for in the question?"

S3 : "I searched for the price of each garment."

P : "What method do you use to determine the unit price of each type of clothing?"

S3 : "Multiplied."

P : "What symbols are used in solving the problem?"

S3 : "Fractions."

P : "Are you sure of the answer?"

S3 : "I'm not sure, because I don't understand the question."

Based on the results of the interview, it can be seen that the subject S3 is less able to explain each step of the answer written well and the lack of confidence in the answers he has done.

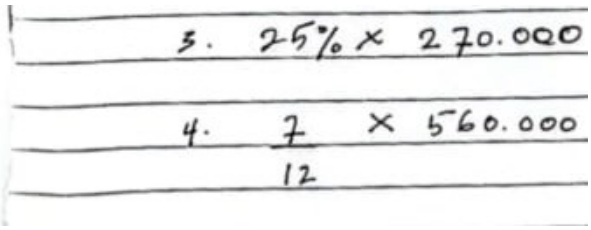

Figure 9. S3**'s** answer to Problem Number 2

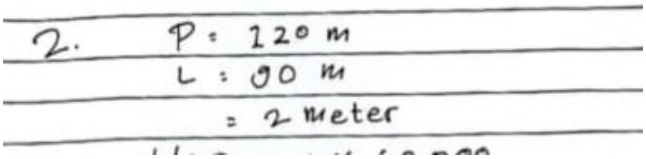

Figure 10. S3**'s** answer to Problem Number 3

In the next question number in answering questions number 2 and 3 can be seen in Figures 9 and 10. Subject S3 is less able to understand the problem and analyze the information contained in each question. The implementation plan is described inappropriately, not in detail and inconsistently. Subject S3 has not been able to analyze problems related to everyday life. The formula used is not in accordance with what is asked. Subject S3 is less able to achieve systematic steps in solving problems, because the solution is done in accordance with the sequence but the problem solving steps are still incorrect, namely not understanding the questions in the problem. Subject S3 does not have confidence in answering test questions, S3 also cannot understand information in pictures, tables and has not used symbols properly.

From Figure 8, 9 and Figure 10 shows that the written answer of subject S3 is less precise, subject S3 has not been able to interpret the results of the analysis he did. It can be concluded that subject S3 has not fulfilled the numeracy literacy indicators, only the indicator of analyzing information in table number 1 has been fulfilled by Subject S3, when interviewed subject S3 admitted that he did not understand the test questions and was not sure of the results of his own answers and S3 had a low level of resilience.

4. Result, Discussion and Suggestion

From the results of the research that has been explained, subject S1 who has high numeracy literacy, is able to answer the numeracy literacy test well, can analyze information in the table, and achieve systematic steps in solving problems. When conducted interviews subject S1 was able to explain the steps of problem solving on each question he had done confidently, clearly and in detail. So that subject S1 has high mathematical resilience. Students with high mathematical resilience show better numeracy literacy skills, including the ability to formulate, use, and interpret mathematical problems (Arjun & Muntazhimah, 2023).

As for subject S2 who has moderate numeracy literacy skills, subject S2 can use various kinds of numbers and symbols quite well, less specific in answering the numeracy literacy test, this is evidenced by his lack of accuracy in answering questions. Subject S2 is assessed from the resilience indicator lacking self-confidence, subject S2 has moderate resilience. Students who have moderate resilience are still lacking in mathematical problem solving because they cannot perform systematic steps in this case, are less thorough, and lack confidence (Rahmatiya & Miatun, 2020).

Meanwhile, S3, who has low numeracy literacy skills, lacks the ability to solve well, the S3 subject makes a plan that is less precise, where students do not write down the formula to be used, and do not reach the steps in working on the test, the solution obtained is not leading to the right solution and students are less able to reveal the plans they make (Nurjanah & Jusra, 2021). Subject S3 has not been able to analyze information related to

everyday life. Giving up when faced with difficult problems and reluctant to check back if he believes that the problem he is doing is wrong. This is caused by several factors, including limited time to ask the teacher, difficulty communicating with other friends, they are not used to speaking or giving opinions in front of friends or teachers, lack of confidence or doubt, and lack of learning ability because they feel they are not in the same class conditions. So that it can affect students' mathematical resilience (Al'atif et al., 2021). When conducted interviews subject S3 tends to lack confidence in the questions asked, subject S3 has low resilience. This is in line with the fact that students who have medium and low resilience categories do not dare to take risks in solving math problems and are afraid and have no interest in mathematics, making students not meet the indicators of the ability to be achieved (Attami et al., 2020).

The purpose of this research is to analyze students' mathematical resilience on numeracy literacy problems, so this research can be a foundation as well as for teachers to further improve students' mathematical resilience by paying attention to the level of numeracy literacy skills that students have. Given the difficulty of each student has different characters and types of learning, these differences will affect the learning outcomes achieved (Soebagyo et al., 2021).

5. Conclusion

Based on these results, it can be concluded that 1) students with high resilience can answer numeracy literacy test questions well, can analyze information in the table, and achieve systematic steps in solving problems. 2) students with medium resilience can use various kinds of numbers and symbols quite well, less specific in answering the mathematical resilience ability test 3) students with low resilience are less able to solve problems well, students are still not precise in making plans, where students do not write down the formula to be used, the solutions obtained do not lead to the right solution and students are less able to express the plans they make.

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