

# The Mathematical Literacy Process Viewed From Mathematical Resilience

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## ABSTRACT

*Mathematical literacy is essential for the quality of education. However, Indonesia's mathematical literacy is still low. This study aims to describe how to process of mathematical literacy is viewed from mathematical resilience. This research uses qualitative methods. The subject of this study was a grade VIII student at a junior high school in Semarang City. The research subjects were selected using a random sampling technique which resulted in two students each category of low, medium, and high mathematical resilience. Data collection using observation, interviews, documentation, tests, and questionnaires. Data analysis uses triangulation, data reduction, data presentation, and drawing conclusions. The results showed that students with low mathematical resilience categories could not achieve mathematical literacy indicators, students with medium mathematical resilience could not reach using concepts, procedures, facts, acids, and abilities in mathematical literacy, while high mathematical resilience could achieve well in mathematical literacy. Based on the results of the study, it can be concluded that students' mathematical literacy is still low and therefore requires improvement through the project experiential learning (Proleg) model.*

### Keywords:

*literacy; mathematics; resilience; proleg*

## INTRODUCTION

Humans are social creatures who always need education in everyday life. This is because education is something that must be taken by humans in order to become quality beings so that it can be used as a benchmark for development of a nation (Ritonga & Hasibuan, 2022); (Tuankotta & Jana, 2021). This is also in line with (Andriawan et al., 2018) which says that education becomes a good element as a determinant of one's progress or not. One of the goals of the Indonesian nation is to educate the nation's life which can be realized by one of them is quality education (Kustini, 2016).

The government has made various efforts to improve the quality of education, one of which is by implementing a policy of eliminating the National Examination (UN). The reason for the abolition of this national exam, in some circles argues that the factor that hinders student graduation is mathematics. This is based on the national examination result report uploaded by the Education Assessment Center of the Ministry of Education and Culture which states that the UN mathematics results in the 2019/2020 school year occupy the lowest position both at the junior high school level and the equivalent high school level (Tuankotta & Jana, 2021). The abolition of the UN was replaced by a National Assessment (Raini et al., 2022); (Rokhim et al., 2021).

The national assessment is a new educational evaluation launched by the Government consisting of three parts, namely the Minimum Competency Assessment (AKM), character survey, and learning environment. National assessment is carried out to change the paradigm of educational evaluation as a form of evaluation efforts and map the education system which includes inputs, processes, and results. National assessment using assessment instruments are PISA (Programme for International Student Assessment) and TIMSS (Trend in International Mathematics and Science Study). AKM is used to measure literacy and numeracy results. Numeracy is part of mathematical literacy.

Mathematical literacy is the ability of students to formulate, apply, and interpret mathematics in a variety of contexts which include mathematical reasoning and also using mathematical concepts, procedures, and facts (OECD, 2023); (Stacey & Turner, 2015); (Setiawan et al., 2023). Mathematical

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literacy is the most important ability to support students' mathematical abilities (Pradana et al., 2020); (Abylkassymova et al., 2020) however, students' mathematical literacy results are low. This is evidenced by the results of the assessment conducted by PISA with Indonesia's ranking of 67 with a score of 379 in 2018 and ranked 69 with a score of 388 in 2022 (Nurutami et al., 2019); (Wesna et al., 2021); (OECD, 2023).

Based on a preliminary study conducted by researchers at one of the junior high schools in Semarang City, it shows that students' mathematical literacy is still low. This is because mathematical literacy is not a lesson taught in Indonesia but can be integrated through mathematics learning to students. Based on the results of interviews also conducted by researchers, the results were obtained namely 1) students' still have difficulty in doing math problems in the form of literacy; 2) students' still have many mistakes in solving questions because students are accustomed to the questions given by the teacher in simple form so it is difficult to accept different questions; 3) students' in understanding and analyzing problems in literacy problems have difficulties and make students lazy to do it; 4) students' have difficulty formulating literacy problems before doing them.

Based on this explanation, researchers suspect that students' low mathematical literacy is not only caused by lack of mastery of mathematics, but there are factors that cause students' abilities have not been achieved optimally. Students efforts in improving students' mathematical literacy require an attitude to remain tough, diligent, and active in dealing with mathematical literacy problems. This attitude is known as mathematical resilience.

Mathematical resilience is a positive attitude to make students' never give up in the face of difficulties when solving a mathematical problem through discussion and investigation of mathematics (Hafiz et al., 2017). According to Lee & Johnston in (Ghifari et al., 2022) which states that mathematical resilience is an important concept in education, because students still experience difficulties and failures in learning mathematics. The importance of mathematical resilience can be seen in mathematics learning where students experience obstacles, difficulties, and anxiety in learning mathematics which results in students' dislike of mathematics (Zanthy, 2018); (Warsiyah, 2021)

## **METHOD**

This research design is a qualitative descriptive research design by describing mathematical literacy viewed from students' mathematical resilience. This research was taken from grade 8 junior high school students' in one of the cities of Semarang. The study sample consisted of 30 students. Sampling technique using random sampling technique. In this study, samples were taken with mathematical resilience in the high, medium, and low categories with each category taken by two students. Students with high mathematical resilience are namely is S1, students with medium mathematical resilience are namely is S2, and students with low mathematical resilience are namely is S3.

Data collection in this study used questionnaires, test, and interviews. Questionnaires are used to measure mathematical resilience categories, tests are used to measure students' mathematical literacy and interviews are used to obtain more in-depth information and data related to mathematical literacy viewed from students' mathematical resilience. The data that has been collected is analyzed through data reduction, data presentation, and conclusions. Students are given a mathematical resilience questionnaire and a mathematical literacy test. Based on the results of the mathematical resilience questionnaire, researchers grouped students' mathematical resilience with high, medium, and low criteria. Based on the grouping of students' mathematical resilience criteria, an analysis of the mathematical literacy that has been done by the student is carried out and an in-depth interview is conducted with the students.

## **RESULTS AND DISCUSSION**

The results of the study were divided based on the level of mathematical resilience of the research subjects, such as low, medium, and high mathematical resilience. A mathematical classification of resilience is obtained based on the results of questionnaires given to subjects. The students' work can be seen in the figure 1.

$x = \text{Supersemar}$   
 $y = \text{Ra Kartini}$   
 $z = \text{Cornelise}$

$$x + y + z = 5441 \dots (1)$$

$$z = y + 87$$

$$z = x + 370$$

$$x + y + z = 5441 \dots (1)$$

$$-y + z = 87 \dots (2)$$

$$-x + z = 370 \dots (3)$$

$$x + y + z = 5441$$

$$-y + z = 87$$

$$x + 2z = 5528$$

$$z = 5528$$

$$z = 2764$$

$$-y + 2764 = 5441$$

$$-y = 5441 - 2764$$

$$-y = 2677$$

$$y = -2677$$

$$x + (-2677) + 2764$$

$$x + y + z = 5441$$

$$-y + z = 87$$

$$x + 2z = 5528$$

$$x + 2z = 5528$$

$$-x + z = 370$$

$$3z = 5898$$

$$z = 1966$$

$$-x + 1966 = 370$$

$$= 370$$

$$1966 -$$

$$-x = -1596$$

$$x = 1596$$

$$x + y + z$$

$$1596 + y + 1966 = 5441$$

jadi  $z = \text{Supersemar} = 1966$   
 $y = \text{RA Kartini} = 1879$   
 $x = \text{Cornelise} = 1596$

$$y = 1879$$

Figure 1. Answer subject S1 with high mathematical resilience

Based on Figure 1 above, subjects S1 with high mathematical resilience are able to perform mathematical literacy well. Subjects S1 have been able to model mathematics correctly and solve literacy problems correctly, but subjects S1 are less precise in concluding or drawing conclusions. This can be seen in the answer of subjects S1 who rewrite it in its true form before being modeled mathematically, there was a mistake in writing the supersemar year with cornelius de houtman. Researchers conducted in-depth interviews to find out the mindset of the answers given by subjects S1 to make it clearer.

- (Q) : "What is the first thing you do to solve the problem?"
- (S1) : "Read the question and understand it, sir"
- (Q) : "What do you do next?"
- (S1) : "I write x, y, and z, sir. Actually not only x, y, and z but can be a, b, or c, etc."
- (Q) : "Why are you writing this? How do you determine where x, where y, and where z?"
- (S1) : "In order to make it easier for me to solve the problem, sir. I have to specify x, y, and z by using keywords in the question, meaning is what is asked in the question and I search for those keywords"

Based on the interview results, it shows that subjects S1 have high mathematical resilience according to the results of the questionnaire. Another thing obtained is that the subjects S1 explained that before the subjects S1 does the problem, the first thing to do is to understand the question and then from the question search for keywords or simplify according to what is asked in the question. Then from these keywords a mathematical model is created, subjects S1 uses variables x, y, and z in the process. Then find the value of the variable and deduce it.

Diket: Supersemar (x) = 87      Jumlah = 5.441  
 R. Kartini (y) = 370  
 Ditanya: K. Belanda (z) = ...  
           = Misal, tahun:

$$x + y + z = 5.441$$

$$x = y + 87$$

$$x = z + 370$$

$$x + y + z = 5.441$$

$$x + y = 87$$

$$x + z = 370$$

$$x + y + z = 5.441$$

$$\underline{x + y = 87}$$

Figure 2. Answer subjects S2 with medium mathematical resilience

Based on Figure 2 above, subjects S2 with medium mathematical resilience are still lacking in doing mathematical literacy. Subjects S2 have been able to model mathematics and have not been able to solve problems well. This can be seen with subjects S2 which has for example with variables but the writing is known and asked which is not clear, but subjects S2 is able to model the problem mathematically. Researchers conducted in-depth interviews to find out the mindset of the answers given by subjects S2 became clearer.

- (Q) : "What's the first thing you do to solve the problem?"  
 (S2) : "Read the question, sir"  
 (Q) : "What do you do next?"  
 (S2) : "I used logic sir then I understood the problem."  
 (Q) : "Why is that?"  
 (S2) : "Because I understand it logically if there is a question like this question, sir"  
 (Q) : "Do you have any difficulties in solving this question?"  
 (S2) : "Yes, sir. I couldn't understand the problem very well because I was confused by the question"

Based on the results of the interview, it was shown that the subjects S2 had medium mathematical resilience according to the results of the questionnaire. Another thing obtained was that the subjects S2 explained that the subjects S2 had difficulty understanding the questions because they were confused with the questions given. Subjects S2 are able to model mathematics well, but the problem solving is still not optimal. Subjects S2 use logic in doing problems before understanding them. This led to the subjects S2 being able to model mathematics.

$\Rightarrow = 5441 - 370 - 80$   
  $= 5071 - 370$   
  $= 4701$   
             
           

Figure 3. Subjects S3 answer with low mathematical resilience

Based on Figure 3 above, subjects S3 with low mathematical resilience have not been able to achieve good mathematical literacy. Subjects S3 have not been able to model mathematics and have not been able

to solve problems well. This can be seen from the results of S3 work which directly reduces the known number in the questions regardless of which way the questions are going. Researchers conducted in-depth interviews to find out the mindset of the answers given by subjects S3 to be clearer.

- (Q) : “How do you solve problems?”  
(S3) : “I don’t know, sir. I only answered that question out of confusion”  
(Q) : “Why are you confused?”  
(S3) : “Because, I don’t understand the question”  
(Q) : “Didn’t you read the question?”  
(S3) : “Honestly, sir. I didn’t read it, because I was confused about what it mean, I really didn’t understand”  
(Q) : “Didn’t you get the SPLDV materials?”  
(S3) : “Forget, sir”

This study aims to describe the process of students’ mathematical literacy based on students’ mathematical resilience and to find out the factors that cause low mathematical literacy in students. This research focuses on how the students’ mathematical literacy process is viewed from the students’ mathematical resilience so that the results of the analysis will be obtained from the results of students’ answers. Then from the results of the analysis of students’ answers, new solutions will be obtained in the stage of mathematical literacy. The results of the students’ mathematical literacy process can be concluded that students’ have difficulty understanding math problems in the form of literacy or stories. There needs to be steps in understanding math problems in the form of stories so that students will be able to work on math literacy problems. In addition, the questions given previously were changed to questions in the form of literacy or stories so that students’ would be trained to the maximum. If this is not done, then students will have difficulty in dealing with problem situations if they are not routinely done (Temur, 2012).

Based on the results of the answers made by students, it can be seen that in addition to difficulties in understanding the questions, students also have not been able to model the questions in mathematical form well. Problem modeling in mathematical form can be done by simplifying mathematical literacy problems or other problems. One of the ways to simplify mathematical literacy problems is to look for keywords in each questions so that students will be able to model mathematics with well. The results of the subject of S1 answer in the results of the research above, the work of mathematical literacy is done well through the steps in the mathematical literacy process but in writing the conclusions it is still not optimal, eventhough writing the conclusions is very important in the mathematical literacy problem. The results of the subject of S2 answer are still incomplete because the solutions have not been answered due to the focus on understanding story problems, while the subject of S3 have very poor mathematical literacy work because they can not understand story problems in mathematical form.

Based on the results of interviews conducted by researchers, it can be seen that the factors that cause students’ low mathematical literacy are 1) students have never encountered math problems in the form of literacy; 2) students are onlu fixated on one source that is facilitated by the school, so that students are less in developing themselves; 3) math literacy questions that are only done for classes that take AKM make them (classes that don’t take AKM) confusion after being given the sam questions as classes that take AKM; 4) math literacy questions that are packaged in the form of stories make it difficult for students to understand the problem; 5) students’ thinking power is still lacking because they want questions that are straight to the point. Based on the explanation above, it shows that 1) students have not implemented the steps of mathematical literacy; 2) students can not solve the problem because of the lack of students’ understanding of mathematical literacy; 3) students are not optimal in modeling mathematics through mathematical literacy questions.

## CONCLUSION

The results showed that students with low mathematical resilience categories could not achieve mathematical literacy indicators, students with medium mathematical resilience could not reach using concepts, procedures, facts, acids, and abilities in mathematical literacy, while high mathematical resilience could achieve well in mathematical literacy. Based on the results of the study, it can be concluded that students’ mathematical literacy is still low and therefore requires improvement through the project experiential learning (Proleg) model.

## ACKNOWLEDGEMENTS



We are very grateful to the headmaster of junior high school students' in one of the cities of Semarang.

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