Original Research Article

Analysis of Mathematics Problem Solving Ability Students Based on Mathematical Resilience and Gender

Abstract:
This study aims to describe the ability to solve mathematical problems in terms of mathematical resilience and gender at Junior High School N 5 Tanjung Jabung Timur. This research includes descriptive qualitative research using purposive sampling technique, collecting data on think aloud mathematical problem solve ability, the subject of this research consists of 6 students, each of which consists of 2 students from high, medium and low mathematical resilience and based on gender. This study used non-test instrument in the form of a mathematical resilience questionnaire, an instrument to test mathematical problem solve skills and list of interviews. The results of the study show that the subject of high mathematical resilience, men and women do not give up easily even though they experience difficulties and mistakes in doing and fulfilling the four indicators of mathematical problem solve ability, female students are complete than male students. Subject with moderate mathematical resilience, female students were able to fulfill the four indicators of problem solve abilities, female students did not give up easily, were only less thorough when carrying out the plan arithmetic operations, while male students were only able to fulfill 2 indicators of problem solving and felt themselves unable to survive in solving problems. Subject with low mathematical resilience, male and female students were only able to meet 2 indicators of problems solving ability, both subject were unable to make a complete plan, both low resilience subject gave up easily when experiencing difficulties and were unable to develop in difficult situations.

Keywords : Analysis, Mathematical Problem Solving Ability, Mathematical Resilience, Gender.

INTRODUCTION

Education is a conscious effort that is systematically planned to create a learning environment where students play an active role in improving the abilities that are within them (UU RI No. 20 2003). Education is able to change people's mindsets to make innovations or innovations in thinking which in turn make innovations in solving problems. One sign of the success of a country in educating students can be seen from the ability to solve problems.

One of the requirements in education in the 21st century is problem solving skills which are considered a necessity. Based on the PISA (Program for International Student Assessment) ranking that was named by the Organization for Economic Co-operation and Development (OECD) in 2018 consisting of 76 countries, it has an average score of 489, Indonesia's score is 379 which is in 71st place (Rizqy and Jusra,2021). This fact indicates that Indonesia is low in problem solving, so this requires more attention to fix it.

Problem Solving is a tool for students to digest problems, plan strategies and solve problems with systematic strategies and methods. Mathematics learning in secondary schools is directed so that students are able to solve problems.

Based on NCTM data (National Council of Teachers of Mathematics, 1980) recommends problem solving as the focus of school mathematics. It is even said that problem solving is the "heart" of mathematics.

Problem solving abilities emphasize the selection of methods (strategies) and the use of procedures that can be proven systematically which are used as a means for students to digest problems, plan strategies, and solve problems systematically. Researchers analyzed using the problem solve framework with 4 steps to solving the problem, namely understanding the problem, making a plan, carrying out the plan, and looking back (Polya,1985).

Problem solving ability is one of the important skills in life, one's success in solving the problems one has in life, is inseparable from the ability of how one understands the problem (Cognitive Psychology, Sternberg 2011).

The results of an interview with one of the mathematics teachers said that there were still many students who were not used to it and had difficulty working on non-routine questions. This was reinforced by the results of the initial test for students' mathematical problem solve abilities which were conducted on September 2022, which showed that students' abilities were still relatively low. in solving math problem solving problems.

There are several factors resulting from the low ability of solving mathematical problems, such as students not liking mathematics. Mathematics is often seen as a subject that is less desirable or avoid if possible, this is because mathematics is an exact science, which is always associated with numbers that are considered complicated to solve (Syaiful et al., 2018). Negative attitudes and perspective often appear among students due to the difficulties and obstacles experienced by students during the mathematics learning process so as to provide bad experiences to students (Hutauruk & Priatna,2017).

In addition to the factors that cause low mathematical problem-solving abilities, there are also factors that can help students in solving student problems, including motivational factors

from within students, student confidence and student strength or persistence in solving problems. One of the steps to overcome this negative attitude, students must have an attitude of never giving up, high self-confidence and perseverance in dealing with mathematics is called mathematical resilience.

Mathematical resilience is an important concept in education, because many students still experience difficulties and failures in learning mathematics. Students who have mathematical resilience have the ability to grow their self-confidence (Wilder and Lee, 2010). Mathematical resilience is the attitude of students in dealing with difficulties when learning mathematics such as being diligent, willing to work hard, and persistent (Rahmatiya and Asih,2020). There are 4 correlated indicators of mathematical resilience, namely value, struggle, development and resilience (Megan et al., 2015).

The results of the research conducted by (Rizqy and Jusra,2021) showed that students in the good category in mathematical problem solving abilities had high resilience, did not give up easily when experiencing difficulties and were able to fulfill the four indicators but women were better than men, while students the moderate category is only able to fulfill three problem solve indicators, students are less able to carry out plans and are less thorough in solving problems, but male subjects are better than women.

The results of the research conducted by Rahmatiya showed that students in the good category in problem solving abilities had high resilience, and students in the less able category had moderate mathematical resilience However, the research conducted was limited to the high and medium resilience categories without any low resilience subjects.

From some of the research results above, there is no research that provides an overview of mathematical problem solve abilities with 3 categories of mathematical resilience, high, medium and low categories and based on gender as well, the purpose of this study. is analyzing students' mathematical problem-solving abilities by considering 3 categories of mathematical resilience, namely high, medium, and low and paying attention to gender in each category.

METHODS

This research is a qualitative method with a descriptive approach, which is a type of research used with the aim of explaining the subject's ability to solve mathematical problems by paying attention to mathematical resilience and gender.

The selection of subjects used a purposive sampling technique and used video recordings of students (*think aloud*) in solving math problem solving problems. In selecting the subject, there were 6 subjects who met the research criteria, the research subjects were class VIII students with 2 high resilience subjects, 2 moderate resilience subjects, and 2 low resilience subjects with different genders in each category.

To determine the categories of high, medium and low mathematical resilience using the analysis of the average score of the mathematical resilience questionnaire data. Furthermore, the results of the tests that have been carried out in a think aloud manner are analyzed according to the indicators of mathematical problem solve ability according to problem solve and continued with interviews with 6 selected subjects regarding answers to math questions on arithmetic sequences and series material to confirm the completion process.

In collecting data, this study used test instruments and non-test mathematical resilience questionnaires consisting of 25 statements by adopting instruments from the Development and Validation of the Mathematical Resilience Scale (Kooken, 2013) the instrument used a likert scale for each statement item consisting of 4 scale options. While the test instruments used are 2 items with problem solve indicators: (1) understanding the problem, (2) making plans, (3) implementing plans, (4) looking back.

Structured interview techniques are used in research but the questions can change according to the answers from students. Triangulation of sources to collect data from 6 research subjects with the same information gathering process, then selecting unnecessary sentences from research subjects (data reduction) is then followed by presenting data and finally drawing conclusions (Rijali,2019).

RESULTS AND DISCUSSION

The mathematical resilience questionnaire was given to class VIII students. Analysis of the average score is used to determine the categories of high, medium and low mathematical resilience which produce output as shown in table 1. The mathematical resilience data shows that there were 28 students who filled out the mathematical resilience questionnaire consisting of 13 female students and 15 male students.

Table 1. Mathematical Resilience Data

No	Kode Siswa	Gender	Skor	No	Kode Siswa	Gender	Skor
1	AZ	P	87	15	RAS	L	76
2	EA	P	85	16	TBP	L	76
3	AM	P	73	17	DN	P	79
4	DMP	P	84	18	AL	L	74
5	CA	P	82	19	GA	L	77
6	UII	P	76	20	YO	L	74
7	AS	L	83	21	RMFP	L	88
8	AR	L	83	22	FIP	L	70
9	AP	L	77	23	JMR	P	82
10	HKL	L	82	24	LN	P	73
11	CSB	P	79	25	ASN	P	79
12	MZ	L	81	26	ZA	P	80
13	MH	L	77	27	RHN	P	70
14	IG	P	79	28	MKS	L	71

Then to determine the category of mathematical resilience using the average score with the criteria contained in the table.

Table 2. Mathematical Resilience Category Criteria

Interval	Kategori
$X \geq 83$	High
$73 < X < 83$	Moderate
$X \leq 73$	Low

After the categorization criteria were completed, 4 students with high mathematical resilience were obtained consisting of 3 female students and 1 male student, 19 students with moderate resilience consisting of 8 female students 11 and male students, and 5 students with low resilience consisted of 3 female students and 2 male students.

After the mathematical resilience data was categorized, then the results of the video recordings of students in solving problem solving questions were given to 28 students and worked on think aloud. The results of the students' work in think aloud were 6 students who were able to solve the questions given and these six students were used as research subjects and would be interviewed about the process of working on the questions given.

Subjects who can solve problem solving questions are students with the codes AZ(P), CA(P), and RMFP(L), AM(P), FIP(L) and HKL(L).

Then the 6 subjects were coded with the High Female Mathematical Resilience (RMPT), Moderate Female Mathematical Resilience (RMPS), Low Female Mathematical Resilience (RMPS) and the subject of man High Male Mathematical Resilience (RMLT), Medium Male Mathematical Resilience (RMLS) and Mathematical Resilience Low Male (RMLR)

The following is an analysis of the answers to the test of the subject's mathematical problem solve abilities selected from the 3 categories of mathematical resilience in number 1.

High Mathematical Resilience

a. Understanding Problems

In Figures 1 and 2 below it is known that the RMPT and RMLT subjects have understood the problem, this statement is strengthened by the results of the interviews. The RMPT subject wrote down what was known and what was asked in full and in detail, while the RMLT erred in writing down what should have been known.

b. Devising a plan

Based on the test results, RMPT and RMLT were able to make plans, the two subjects wrote the formula correctly, then performed addition, subtraction, multiplication and division using moving segments.

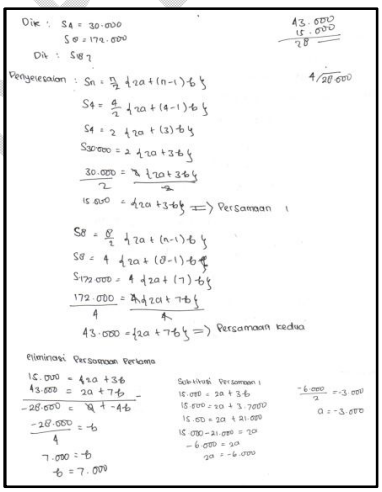

Figure 1. RMPT work results

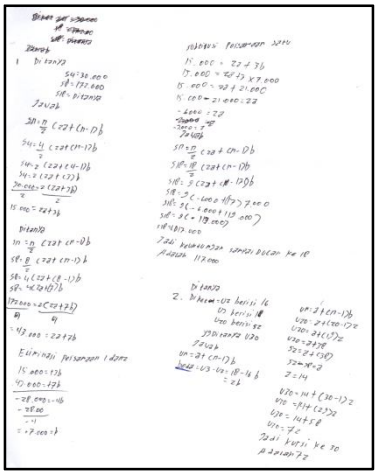

Figure 2. RMLT work results

c. Carrying out the plan

From the picture above it is known that the RMPT and RMLT subjects were able to carry out the plan, RMPT and RMLT used the same method, after the two subjects were able to make an equation and substitute the value of the first term and the value of the difference, the two subjects then looked for the tribe in question using the same formula. was made in the previous process.

d. Looking back

The RMPT subject did this step well, both subjects had checked the answers they received, but the RMLT subject made a mistake in rewriting the answer, which obtained a value of 1.017.000, written as 117.000

The following are the results of interviews with RMPT subjects or first subjects (S1):

Q : What information is known?
S1 : 4th month profit or S4=30.000, and S8=172.000
Q : Then, what was asked?
S1 : who was asked about the profit of month 18 or S18
Q : What conclusions did you draw?
S1 : The 18th month profit is 1.017.000
Q : Did you double-check the answers you made?
S1 : Yes. I check it.

Following are the results of the RMLT interview or the fourth subject (S4):

Q : What information is known?
S4 : Fourth term 30.000, and eighth term 172.000
Q : Then, what was asked?
S4 : the one asked for the 18th term or S18
Q : What conclusions did you draw?
S4 : S18's profit is 1.017.000
Q : Did you double-check the answers you made?
S4 : Yes sir, but we were in a hurry so we wrote it wrong sir, it should have been 1.017.000

Moderate Mathematical Resilience

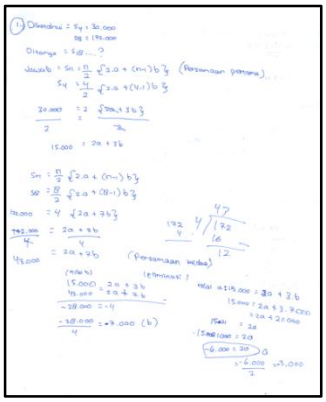

Figure 3. RMPS work results

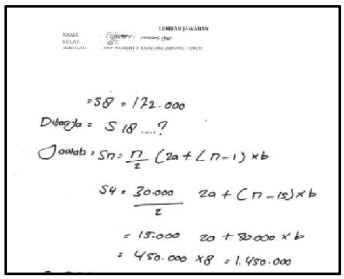

Figure 4. RMLS work results

a. Understanding problems

From the picture above it is known that the RMPS and RMLS subjects were able to understand the questions given, the RMPS subjects were detailed in writing their answers and the results of the interviews were also that the RMPS subjects were more direct and clear in explaining the process.

b. Devising a plan

The RMPS subject was able to make a plan to be used, was able to use the information obtained and make an equation, while the RMLS subject only wrote down the plan in the form of the formula used.

c. Carrying out the plan

The RMPS subject can carry out the plan with a strategy, namely making an equation first to get the value of the first term and the difference value and in this calculation the RMPS subject has an error in the calculation, after obtaining the value correctly the RMPS enters the value obtained into the initial plan or formula used. While RMLS subjects cannot carry out any plans.

d. Looking back

RMPS subjects were able to re-check their answers by looking back at what was asked and the calculations that had been made, while RMLS subjects did not draw conclusions.

The following are the results of interviews with the RMPS subject or the second subject (S2):

Q : What information is known?

S2 : 4^{th} month means S4 30,000, S8

equals 172.000

Q : Then, what was asked?

S2 : asked the 18th month or S18.

Q : What formula is used?

S2 : Arithmetic series formula, Sn= n/2(2a+(n-1))b

Q : What conclusions did you draw?

S2 : The profit until the 18th month is 1.017.000

Q : Did you double-check the answers you got?

S2 : Yes. We looked at it again, afraid that it was wrong

Following are the results of the RMLS interview or the fifth subject (S5):

Q : What information is known?

S5 : he knows, S4 thirty thousand, S8 one hundred and seventy two thousand.

Q : Then, what was asked?

S5 : asked the profit month 18 or S18 is the same.

Q : What`s the next step??

S5 : We make the formula Sn equal to n/2 (2a+(n-1) times b.

Q : After creating the formula, what's the next step?

S5 : I don't know sir, it's difficult sir, I can`t conclusion.

Low Mathematical Resilience

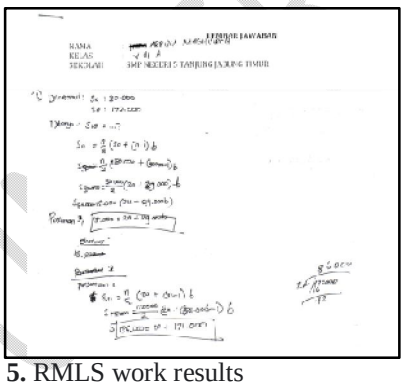

Figure 5. RMLS work results

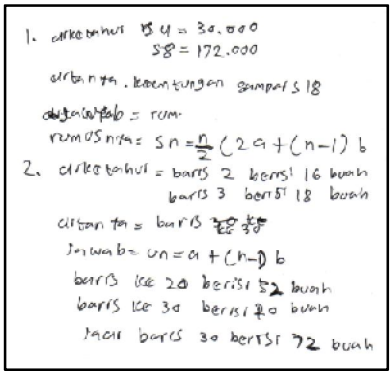

Figure 6. RMLS work results

a. Understanding problem

From the picture above it is known that the RMPR subject was able to understand the problem completely and in detail, this statement was strengthened by the results of the interview. While the RMLR subject understands the problem but lacks detail in writing down what is known.

b. Devising a plan

RMPR and RMLR subjects have not been able to use the information obtained correctly, these two subjects wrote formulas and tried to make equations but found nothing, so the equations made were wrong equations.

c. Carrying out the plan

From the picture above it is known that RMPR and RMLR subjects cannot carry out plans, because these two subjects are unable to use the information obtained to be used as a strategy that leads to an unknown value, namely the first term and the difference value.

d. Looking back

The RMPR and RMLR subjects were not able to do this at this stage, because the two subjects did not receive an answer.

The following are the results of interviews with RMPR subjects or third subjects (S3):

Q : What information is known?
S3 : known fourth month 30.000, eighth month profit equals 172.000.
Q : Then, what was asked?
S3 : asked about the profit of the eighteenth month.
Q : After making the formula used, what are the next steps?
S3 : We try to enter it directly using the formula we created.
Q : Did you get the results?
S3 : Can't get it, sir, we're confused, sir.
Q : And then, what did you do next?
S3 : We don't know again sir.

Following are the results of the RMLR interview or the sixth subject (S6):

Q : What information is known?
S6 : 4 month profit, S4 thirty thousand, S8 one hundred and seventy two thousand.
Q : Then, what was asked?
S6 : asked about profit until month 18, S18.
Q : Why after writing the formula, do not continue the next process?
S6 : We don't know how anymore.

Q : What do you do next??
S6 : We just read the questions again and again..
Q : Did you get the results?
S6 : No sir. I did not.

CONCLUSIONS AND RECOMMENDATIONS

According to the results of data analysis, subjects belonging to the high resilience category were able to fulfill the four indicators of problem solving according to Polya, female and male students were able to fulfill indicators 2 and 3, while women were better than men on indicators 1 and 4, women more thorough, more complete and systematic in solving mathematical problems.

Female subjects with moderate mathematical resilience are able to fulfill 4 problem solving indicators according to Polya, in problem solving questions female students with moderate mathematical resilience do not give up easily but are less thorough and careful in calculating so that they require repeated calculations to get the correct answer while male students with moderate mathematical resilience can only fulfill indicator 1 for indicators 2, 3 and 4 cannot be fulfilled.

For subjects in the low resilience category, both subjects (women and men) have not been able to fulfill the four indicators but women are better than men, subjects with low mathematical resilience give up more easily when experiencing difficulties.

Based on the constraints and limitations of this study, the researcher provides suggestions for researchers who wish to conduct similar research in order to perfect this research, preparation in terms of tools and other supporting instruments must be more mature so that the data collection process runs more precisely in terms of time.

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