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Students' Mathematical Problem-Solving Ability Reviewed from the Self-Confidence of Junior High School Students

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ABSTRACT

This study aims to describe the problem-solving abilities of students reviewed from their self-confidence. This method of this study is a qualitative descriptive research method. This study was conducted at Junior High School in Kampar. The subjects of this study were students of seventh grade in the 2020/2021 academic year as many as 20 students. The data analysis was carried out in three stages, namely data reduction, data presentation, and concluding. The data from this study were obtained by providing 5 items of mathematical problem-solving ability, distributing a questionnaire about self-confidence using a Likert scale in the form of a checklist, and conducting interviews. The results showed that there was a relationship between students' self-confidence and mathematical problem-solving abilities. From the questionnaire score category and the results of the problem-solving ability test given, it can be seen that 25% of students who have high self-confidence have good problem-solving skills because they meet all problem-solving indicators. Sixty percent of students who have moderate self-confidence have fairly good problem-solving abilities because they only meet part of the 4 problem-solving indicators. Fifteen percent of students belonging to the low category of self-confidence have problem-solving skills that are not good enough. The findings of this study can motivate teachers to raise students' self-confidence because students who have good self-confidence have good problem-solving abilities as well. The study's findings suggest that teachers should use methods and techniques to boost students' self-confidence in mathematics learning.

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INTRODUCTION

Mathematics is an exact science that serves as the foundation for all other sciences, so it is inextricably linked to them. The National Research Council (NRC) of the United States has stated the importance of mathematics with the statement "Mathematics is the Key to Opportunity", for students, success in studying will open the door to a brilliant career [1]. Whereas mathematics is a vital science, according to the personal view of [2] stating that mathematics is also required to activate students in realistic learning. As for realizing these efforts, two things must be considered, namely (1) optimizing the participation of elements of the teaching and learning process, and (2) optimizing the participation of all students. This is supported by a study conducted by [3] where the results show that students assume there is only one way to solve the problem correctly, the one that is presented by the teacher in class and the mathematics learned in school has little or no relation to the real world. While this is not solely a function of studying mathematics, the goal of mathematics is to teach students' minds to be able to answer problems creatively, critically, rationally, and exactly. As a result, it is critical for students to master mathematics.

In [4] stated that the standard of mathematical ability that should be possessed by students are problem-solving ability, reasoning and proofing ability, communication ability, connection ability, and representation ability. Problem-solving ability is the ability to find ways to solve a problem by observing then understanding, guessing, and finding and reviewing the solution to a problem. In line with the opinion [5] that mathematical problem-solving ability has a very significant role in learning mathematics so that this ability is an ability that requires attention.

According to Branca in [6], one of the keys aims in learning mathematics is to solve mathematical problems, and the process of solving mathematical problems lies at the heart of learning mathematics. One of the abilities of students in mathematics that is frequently seen as inferior is the ability to solve problems. Based on the results of observations and interviews conducted with one of the teachers of SMP Negeri 1 Kampar, information was obtained that learning at school had been carried out well. However, there are still obstacles in it, such as the lack of students' mathematical problem-solving abilities. This lack of ability of students can be caused by several factors. One of them is the lack of self-confidence of students. The lack of students' mathematical problem-solving abilities found in schools based on interviews with teachers can be seen in the following symptoms:

1. Some students are able to solve mathematical problems but cannot provide evidence and reasons for some solutions.
2. Students are less able to determine the pattern or nature of mathematical phenomena.
3. Students have difficulty in providing explanations and interpretations of what they have learned.

This is in accordance with the results of a study conducted by [7], wherefrom all seventh-grade students who took the midterm examination, it was obtained data that less than 50% of students reached the passing grade, this is because less than 50 % of students who scored 70. This is due to various factors, including (1) students' low KPMM (Mathematical Problem-Solving Ability), (2) students' difficulties solving mathematical problems, and (3) certain students' unwillingness or reluctance to ask questions to the teacher during the implementation of learning in the classroom. There is also a study conducted by [8] on 18 seventh-grade students at MTs Nurul Bilad. The results are based on indicators of mathematical problem-solving ability, namely the indicator of understanding the problem is 77.8%, making a solution plan is 0%, implementing strategies to solve problems is 51.8 %, and explaining or interpreting the results of problem-solving is 14.8%. In addition, in a study conducted by [9] on class VIII students at SMP Negeri 1 Rambah Samo, it was found that subjects who had the problem-solving ability at a very good level were able to solve the Polya stage in sequence but had difficulty in writing down what has been provided and what is being asked, subjects who have the problem-solving ability at a good level is also able to solve the Polya stage correctly and sequentially but do not re-check so that the final results obtained are errors, subjects who have problem-solving abilities at a low level have difficulty in using the concepts and wrong in doing the planning process, while for subjects who have problem-solving abilities at a very low level have difficulty understanding concepts and making a mathematical model so that subjects who have problem-solving abilities are very less able to understand solve problem-solving based on Polya's theory. According to [10], problem-solving ability requires high-level thinking ability that demands students to be able to combine all of their knowledge in order to create one new knowledge that can be used to solve problems. As a result, the problem-solving ability can be defined as students' ability to solve a problem that must meet all problem-solving indicators. The mathematical problem-solving indicators are like the problem-solving ability indicators according to Polya in [11] which consist of four steps, namely: (1) understanding the problem, (2) devising a plan, (3) carry out a plan, and (4) looking back.

Based on the statements presented, it is clear that students have difficulty carrying out problem-solving activities. Students' difficulties in solving mathematical problems can be caused by a variety of circumstances, one of which is a lack of self-confidence. According to prior studies and explanations, students have a difficult inclination to answer mathematical problems because they do not want or are unwilling to inquire. This is, of course, closely related to students' self-confidence. Students with poor self-confidence are typically defined by a number of variables, including afraid to share their ideas or ask questions about things they don't understand. Luxori contends in [12] that feelings of anxiousness and restlessness, as well as the subsequent sensations of sloth, impatience, difficulty, difficulties, or low self-esteem, can all contribute to a lack of self-confidence. According to [13], using self-confidence as a substitute for learning mathematics offers several advantages. According to Lauster's perspective in [14], those with positive self-confidence have faith in their talents, are optimistic, responsible, rational, and realistic. In a study conducted by [15] at SMA Negeri 6 Bengkulu, the results showed that there was an effect of self-confidence on student learning achievement, which was 94.1%. According to this statement, students who have self-confidence are considered as being able to position and modify themselves to think positively and attain their intended goals. This is also consistent with previous research conducted by [16], which used t-test hypothesis testing and found that there was an influence of self-confidence on grasping mathematical concepts with a coefficient of determination of 0.128. This viewpoint is reinforced by research undertaken by [17] theoretically, students' mathematical communication abilities will be good if they have a good level of self-confidence. This is because students who already have a good level of self-confidence will be more willing to communicate their thoughts and will be motivated to enhance their performance.

The problem in this study is how to describe students' mathematical problem-solving abilities in terms of self-confidence in junior high school students based on the results of prior studies. The purpose of the study was to find out how to describe self-confidence in the mathematical problem-solving abilities of junior high school students. Especially if the mathematical problem-solving ability is reviewed based on indicators of self-confidence, namely believing in one's own abilities, being optimistic in facing difficulties, daring to express opinions, and acting independently in making decisions.

METHODS

This method of this study is qualitative descriptive research method. This study was conducted in Kampar Regency, namely in SMP Negeri 1 Kampar. The subjects of this study were 20 students of seventh grade in 2020/2021 academic year. The data from this study were obtained by providing 5 items of mathematical problem-solving ability, distributing a questionnaire about self-confidence using a Likert scale in the form of a checklist, and conducting interviews. The data analysis was carried out in three stages, namely data reduction, data presentation, and drawing conclusions [18].

The process of choosing, concentrating, simplifying, abstracting, and converting raw data in the field is referred to as data reduction. Data is presented by categorizing and identifying data. The conclusion drawing stage is the action of forming conclusions and validating them based on the facts collected. Figure 1 depicts the stages of this research:

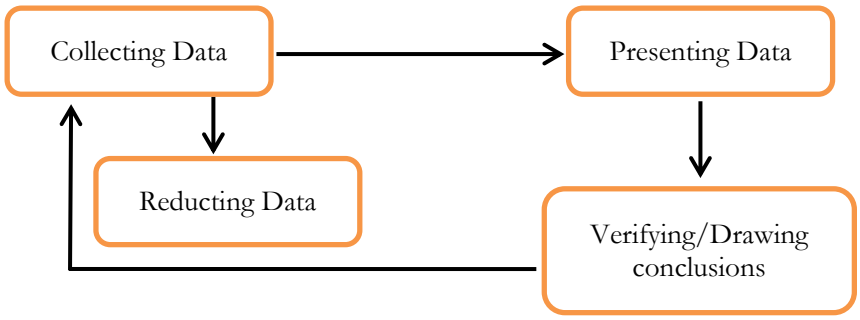

Figure 1. Qualitative Data Analysis Stage

The stages carried out by the researchers were starting from distributing a self-confidence questionnaire instrument with a Likert scale. According to [19] "The Likert scale is used to measure attitudes, opinions, and perceptions of a person or group of people about social phenomena". The self-confidence questionnaire used in this study used a Likert scale in the form of a checklist. Students are then given a problem-solving ability test instrument of 5 questions. Self-confidence questionnaire using indicators from Lauster. According to Lauster self-confidence indicators are believing in one's own abilities, being optimistic in facing difficulties, daring to express opinions, and acting independently in making decisions [20].

Table 1. Student Self Confidence Blueprint

Number	Self Confidence Indicators	Statements		Number of Questions
		Positive	Negative	
1.	Believe in your own abilities	2, 4, 6, 8	1, 3, 5, 7	8
2.	Act independently in making your own decisions	11, 12, 13, 15	9, 10, 14, 16	8
3.	Optimistic in facing difficulties	17, 21, 22, 24	18, 19, 20, 23	8
4.	Dare to express opinions	25, 27, 29	26, 28, 30	6
	Total	15	15	30

Source [21]

The steps of analysis carried out in this study are:

1. Validity Test

According to [21] the first characteristic of a good learning outcome test is that the learning outcome test is valid or has validity. A test is said to have validity if it measures what it is supposed to measure. The formula used is the Pearson Product Moment is [22]:

$$r_{xy} = \frac{N(\sum XY) - (\sum X)(\sum Y)}{\sqrt{\{\sum X^2 - (\sum X)^2\}\{N\sum Y^2 - (Y)^2\}}}$$

Information:

r_{xy} = item correlation coefficient

N = number of respondents

X = score of item

Y = total score

After each item is calculated the magnitude of the correlation coefficient with the total score, then the next steps is to calculate the t-test with the following formula:

$$t_{hitung} = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Information:

t_{count} = value t count
r = correlation coefficient result r count
n = number of respondents

The t_{table} value is obtained based on the t-value table at a significant level α = 5% or 0.05 for the two-tailed test with degrees of freedom (df) = n – 2. The decision rules used are:

a. If $t_{count} \geq t_{table}$, it means valid
b. If $t_{count} < t_{table}$, it means invalid

2. Reliable Test

A test is said to be reliable if the score or value obtained is stable, whenever and wherever, or by whom the test is carried out, checked, and assessed. In this study, the Alpha formula is used because the Alpha formula can be used to find the reliability of an instrument whose scores are not 1 and 0, for example, a questionnaire or question form description. The steps are as follows:

a. Calculating the variance of item scores with the formula:

$$S_i{}^2 = \frac{\sum X_i{}^2 - \frac{(\sum X_i)^2}{N}}{N}$$

b. Find the total variance of the item scores by using the following formula:

$$\sum S_i{}^2 = S_{i1}{}^2 + S_{i2}{}^2 + S_{i3}{}^2 + S_{i4}{}^2 + S_{i5}{}^2$$

c. Calculated the total variance $\left(S_t{}^2\right)$ using the following formula:

$$S_t{}^2 = \frac{\sum X_t{}^2 - \frac{(\sum X_t)^2}{N}}{N}$$

d. Finding the test reliability coefficient by using the *Alpha* formula:

$$r_{11} = \left(\frac{n}{n-1}\right)\left(1 - \frac{\sum S_i{}^2}{S_t{}^2}\right)$$

Information:

$S_i{}^2$ = item score variance
X_i = item score
X_t = total score
N = number of respondents
$S_t{}^2$ = total variance
n = the number of questions issued in the test
r_{11} = test reliability coefficient

The t_{table} value is obtained based on the t-value table at a significant level α = 5% or 0.05 for the two-tailed test with degrees of freedom (df) = n – 2. The decision rules used are [23]:

a. Jika $t_{count} \geq t_{table}$, it means reliable
b. Jika $t_{count} < t_{table}$, it means not reliable

3. Analyzed Mathematical Problem-Solving Ability Reviewed from the Self Confidence

Besides using the normality and Pearson tests, the researchers also analyzed the answers to the mathematical problem-solving ability test in terms of self-confidence based on problem-solving indicators. Then the results of the study were analyzed using a simple percentage formula as proposed

by [21], namely the frequency of the number of students who made mistakes divided by the total number of students multiplied by 100%.

The mathematical problem-solving indicators are like the problem-solving ability indicators according to Polya which consist of four steps, namely: (1) understanding the problem, (2) devising a plan, (3) carry out a plan, and (4) looking back. The scoring guidelines according to Polya are as follows:

Table 2. Scoring Guidelines for Mathematical Problem Solving

Measured Aspects	Score	Information
Understanding the problem	0	If it is wrong to write down what is known and asked from the question or is it wrong at all
	1	If you write only one thing, what is known and asked from the question?
	2	If it is correct, write down what is known and asked from the problem or not write down what is known and asked from the question but immediately write a sketch of the solution
Devising a plan	0	If you do not write down the formula or solution procedure
	1	If you write the formula wrong or only partially correct in writing the formula
	2	If you are correct in writing down the formula or devising plan
Carry out a plan	0	If there is no solution at all
	1	If you write down the solution but the completion procedure is unclear or incorrect
	2	If you use a certain procedure that is correct but the calculation is wrong or incomplete
	3	If you present correct, complete, and systematic completion steps
Looking back	0	If you do not answer what is asked or do not write a conclusion
	1	If you answer wrongly what is asked or the conclusion written is wrong
	2	If you answer what is asked or the conclusion written is correct and appropriate

The following table shows a reference in grouping students' average mathematical problem-solving ability with criteria on a scale of 100:

Table 3. Category of Mathematical Problem-Solving Ability

Category	Score
High	**95 – 100**
Moderate	**61 – 86**
Low	**0 – 60**

RESULTS AND DISCUSSION

The results of research conducted on 20 students in class VII SMP Negeri 1 Kampar obtained the results which will be presented in the table below. The instrument in this study was a non-test in the form of a student's self-confidence scale, mathematical problem-solving ability test questions, and interviews. The initial stage carried out in this research is by compiling a self-confidence questionnaire. In this case, the researcher uses a scale from existing sources, namely from [20], then the researcher modifies the scale which consists of 30 statements, each question is equipped with 5 alternative answers, namely strongly agree, agree, undecided, disagree, and strongly disagree. In addition to using

the scale, the researchers tested the instrument for problem-solving mathematical problems consisting of five questions that had been tested for validity, reliability, and difficulty index. To analyze the test answers, it is done by assessing the test questions according to the scoring rubric that has been provided. In analyzing the data, the data will be presented first with a statistical descriptive table of the two variables to make it easier to understand. The results of the influence of self-confidence and mathematical problem-solving abilities are presented in table 4 below.

Table 4. Data Results from Self Confidence and Mathematical Problem Solving Ability

Variable	N	Mean	Std. deviation
Self Confidence	20	72,20	15,35
Mathematical Problem-Solving Ability	20	78,75	16,45

Based on table 4, it is known that N or the number of data from each variable is 20, the average value of each variable is the self-confidence variable, and the mathematical problem-solving ability variable, then the standard deviation value of the two variables. According to [24] the standard deviation in statistical analysis has a very important position. In table 4 it is known that the value of the standard deviation is smaller than the average, so the existing data has a small distribution so that the data deviation can be said to be good. This is because the standard deviation is a reflection of very high deviations so that the spread of the data shows normal results and does not result in bias.

Furthermore, the results of the analysis of mathematical problem-solving abilities observed from the researcher's self-confidence are described in the following table and description. The results of the self-confidence questionnaire analysis are presented in table 5 below:

Table 5. Category of Self Confidence Group

Self Confidence Category	Score	Number of Students
High	$\mathbf{X \geq 78,5}$	5
Moderate	$\mathbf{62,8 \leq X \leq 78,5}$	12
Low	$\mathbf{X \leq 62,8}$	3

The results of mathematical problem-solving abilities, from 4 indicators, the indicator with the lowest achievement is the second indicator, namely devising a plan. The percentage results based on indicators of students' mathematical problem-solving abilities can be seen in Table 6 below.

Table 6. Achievement of Mathematical Problem-Solving Ability Indicators

Category	Percentage
Understand the problem	90 %
Devising a plan	68 %
Carry out a plan	77 %
Looking back	73,5 %

Furthermore, the test results of students' mathematical problem-solving abilities were grouped based on the categories of high, moderate, and low self-confidence. The results of the mathematical problem-solving ability test are presented in the form of percentages according to the four indicators, namely (1) understanding the problem, (2) making plans, (3) implementing plans, and (4) checking back. The percentage of achievement indicators of mathematical problem-solving ability can be seen in Table 7 below:

Table 7. Percentage of Self Confidence to Mathematical Problem-Solving Ability

Self Confidence Category	Question Indicator			
	1	2	3	4
High	100 %	100 %	74 %	98 %
Moderate	95,8 %	62,5 %	75,5 %	74,2 %
Low	50 %	36,7 %	46,7 %	30 %

Table 7 shows that students with the high self-confidence category have the lowest achievement in mathematical problem-solving skills in indicator 3, namely solving problems according to a plan

(carry out a plan) and indicator 4 which is checking back on all steps that have been taken (looking back). Students with the moderate self-confidence category have the lowest achievement on indicators of mathematical problem-solving ability in indicator 2, namely planning a solution (devising a plan) and indicator 4, re-checking all steps that have been taken (looking back). Students with the low self-confidence category also have the lowest achievement on the indicator of mathematical problem-solving ability in indicator 2, namely planning a solution (devising a plan) and indicator 4, which is checking back on all steps that have been taken (looking back). These results show that students with moderate and low self-confidence have the low achievement of mathematical solving abilities on three indicators, namely devising a plan, carry out the plan, and looking back. The results of this study when associated with the results of research [25] related to self-confidence and mathematical understanding ability, the results are: (1) students with high self-confidence have the lowest achievement indicators, indicators of restating a concept, (2) students with moderate self-confidence, have the lowest achievement indicators on indicators of applying concepts, and (3) students with low self-confidence has the lowest achievement of indicators on indicators of using, utilizing and selecting certain procedures or operations and applying concepts.

Based on the questionnaire score category and the results of the problem-solving ability test given, the following results are obtained:

1. There are 5 research subjects with good problem-solving abilities who have high self-confidence questionnaire results. These students meet 4 indicators of problem-solving ability on the questions that have been given and are classified as students with high self-confidence questionnaire scores. Students are able to understand the questions given, make a correct and complete plan of completion models, carry out the correct procedures and get the right results, and check the correctness of the working procedures. The examples of students' answers with good problem-solving skills and have high category self-confidence questionnaire results are as follows:

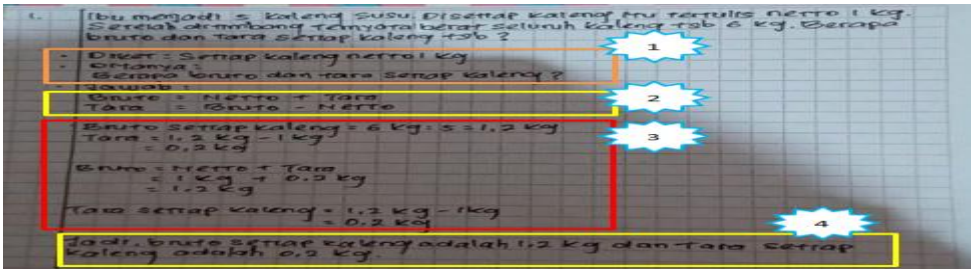

Figure 2. Students' Answers with Mathematical Problem Solving Ability and High Self Confidence (Complete Answers)

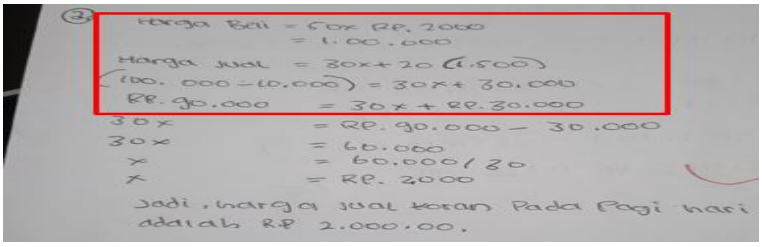

Figure 3. Students' Answers with Mathematical Problem-Solving Ability and High Self-Confidence (Less Complete Answers)

Figure 2 shows that these students are able to meet the 4 indicators of problem-solving

ability on the questions that have been given. The four indicators are as shown in the picture, namely (1) students are able to understand the questions given, (2) students make plans for a correct and complete solution model, (3) students carry out the correct procedures and get the right results, and then (4) students check the correctness of the working procedure. The four indicators of mathematical problem-solving ability can be done well by students who have high self-confidence in the category. While Figure 3 shows that students are able to meet the 4 indicators of mathematical problem-solving ability in the questions that have been given, only in the procedure there are some students who are incomplete in writing the completion plan but are correct in carrying out procedures and settlements, as well as conducting re-examinations on the settlement procedure that has been carried out. These students have good mathematical problem-solving skills and self-confidence questionnaires are in the high category.

2. There are 12 research subjects with sufficient or good problem-solving abilities and have moderate category self-confidence questionnaire results. These students almost meet the 4 indicators of problem-solving abilities on the questions that have been given. Students are able to understand the problem, make a plan for a solution model but it is not complete, carry out the correct procedure but the answer is wrong, and also rarely checking the correctness of the procedure. The examples of students' answers with problem-solving abilities and have moderate category self-confidence questionnaire results are as follows:

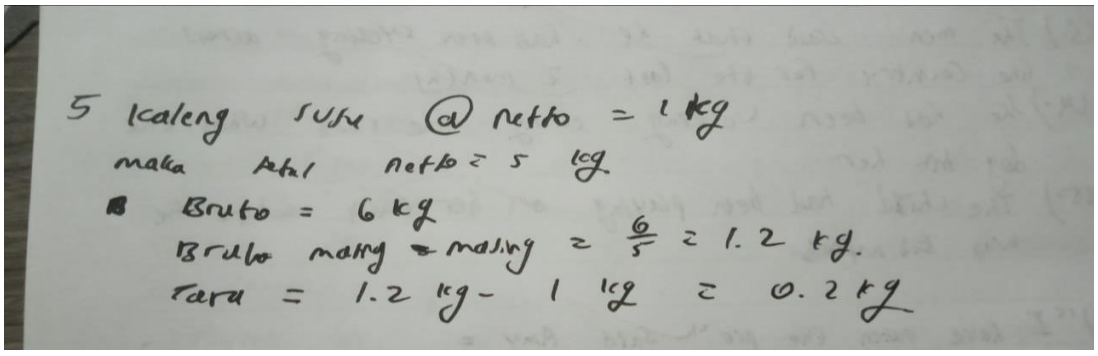

Figure 4. Students with Good Mathematical Problem-Solving Ability and Moderate Self Confidence

Figure 4 shows that these students are less able to meet the 4 indicators of problem-solving ability on the questions that have been given. Students are able to understand the problem, make a plan for a complete model but it is not complete, carry out the correct procedure, but do not re-examine the correctness of the procedure (looking back).

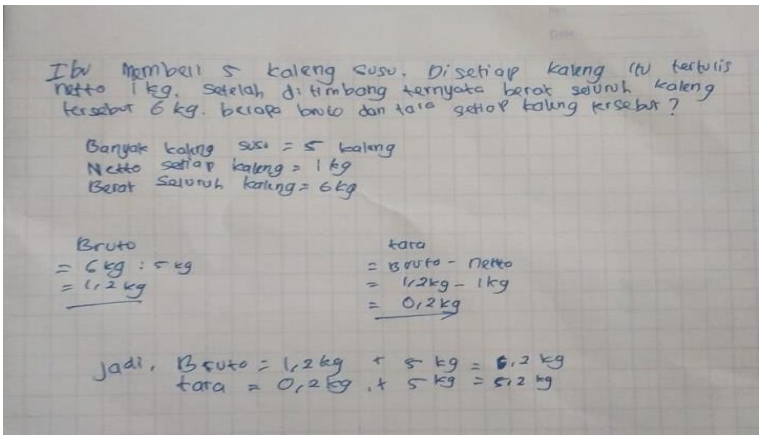

Figure 5. Students with Good Enough Mathematical Problem-Solving Ability and Moderate Self Confidence

As for Figure 5, these students almost meet the 4 indicators of problem-solving abilities on the questions that have been given. Students are able to understand the problem, make a plan for a model of completion but it is not complete, carry out the correct procedure but the answer is wrong, and re-examine but wrong.

3. There are 3 research subjects with problem-solving skills that are not good enough and have self-confidence questionnaire results in the low category. These students did not meet the 4 problem-solving indicators. Students work on the questions given, but the interpretation of the questions is not quite right, makes a model of the complete plan but is incomplete, carries out the procedure, but does not re-examine the results obtained. The examples of students' answers with problem-solving skills that are not good enough and have low self-confidence questionnaire results are as follows:

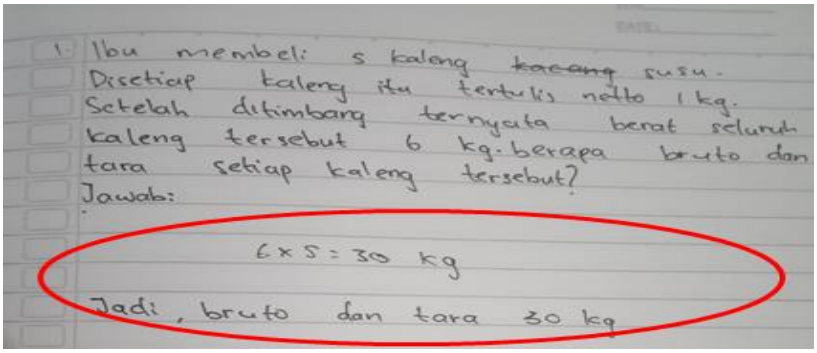

Figure 6. With Problem-Solving Skills That Are Not Good Enough and Have Self-Confidence Questionnaire Results in the Low Category

Figure 6 shows that students do not meet the four indicators of solving mathematical problems. The student did not understand the problem given, did not plan, did the working procedure but the answer was wrong and did a re-examination but the answer was wrong.

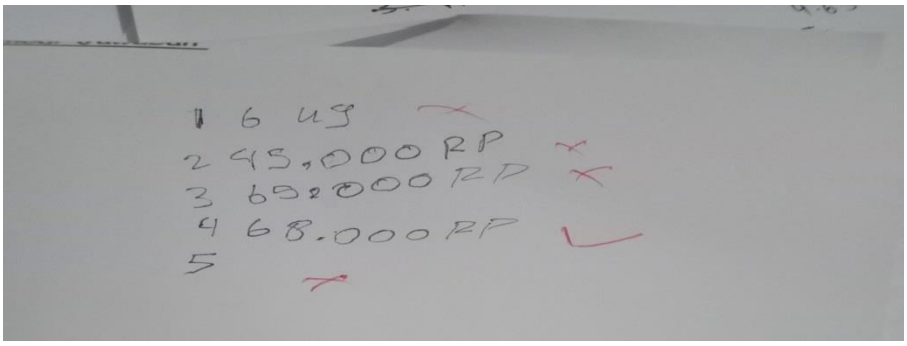

Figure 7. Problem-Solving Ability That is Not Good Enough and Has a Self-Confidence Questionnaire Results in the Low Category of Correct Answers

Figure 7 shows that students do not meet the four indicators of mathematical problem-solving. The student does not understand the problem given, does not plan a solution, does not carry out work procedures, and does not re-examine. These students did not perform the 4 indicators of mathematical problem solving, but these students wrote the correct answers. This proves that there are still some of our students who are careless in answering questions and students are not interested in mathematics or are willing to make a little effort in answering a problem at hand.

CONCLUSIONS AND SUGGESTIONS

The results of research on mathematical problem-solving abilities in terms of self-confidence carried out on 20 students, from the questionnaire score category and the results of the problem-solving ability test given, it can be seen that 25% of students who have high self-confidence have good problem-solving skills because they meet all problem-solving indicators. 60% of students who have moderate self-confidence have fairly good problem-solving abilities because they only meet part of the 4 problem-solving indicators. 15% of students belonging to the low category of self-confidence have problem-solving skills that are not good enough.

From this research, the researcher recommends the following suggesrions:

1. The research can be used as motivation for teachers to increase students' self-confidence because students who have good self-confidence have good abilities in solving mathematical problems.
2. Teachers should apply methods and techniques that can increase students' self-confidence in learning mathematics.

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