



**ANALYSIS OF MATHEMATICAL PROBLEM SOLVING
ABILITY OF CLASS VII STUDENTS SMP IT MUTIARA
GLOBAL ON SOCIAL ARITHMETIC MATERIALS**

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Abstract

The purpose of this research is to describe student's mathematical problem solving abilities, especially in social arithmetic material uses descriptive research method. This research uses descriptive method. The subjects were class VII students of SMP IT Mutiara Global Pekanbaru as many as 15 even semester students for the 2020/2021 academic year. Written instruments test of KPMM with 3 questions and 4 aspects of KPMM according to Polya were used in this research. From this research, the average indicator of understanding the problem is 91.85%, planning solution is 51.11%, completing solution plan is 75.55%, and interpreting the results is 37.78%. Student's KPMM of SMP IT Mutiara Global Pekanbaru class VII are included in medium criteria with an average value of 64.07%. The results of research showed that students have not experienced working on non-routine questions (different), and need to be accustomed to working on non-routine questions to train students' KPMM.

Keyword: *Mathematical problem solving, social arithmetic.*

INTRODUCTION

Learning in schools is an effort made to prepare themselves, especially students, in dealing with various problems that arise in line with the development of science and technology. Learning means the interaction between students, educators and learning resources. The interaction process that occurs in mathematics learning activities in the

classroom involves the abilities of the people in it. According to NCTM 2000, mathematics has 5 basic skills in standard processes, including problem solving, connection, representation, reasoning and proof, and communication.

According to Ulva et al. (2020) KPMM is the ability of students to complete and determine the answers to



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questions in a text, story, and task in learning mathematics according to problem solving steps. Polya in Nasution & Oktaviani (2020), KPMM is an effort to find solutions of problems to achieve goals that cannot be achieved quickly. Purwosusilo (2014) stated KPMM is the ability of students to understand, plan solutions, and do calculations and recheck the results. From this opinion, it can be concluded that the KPMM is the students' skills in understanding and overcoming the problems they face using the KPMM steps. Through KPMM students are expected to be able to find mathematical concepts independently.

KPMM is a basic skill in learning mathematics (Badrulaini et al., 2020). KPMM is important for students in learning mathematics. Husna et al. (2013) mentions that KPMM is important in curriculum achievement. According to Erman (2003) KPMM is important because it can develop various facets of mathematical skills, including the application of rules to non-routine problems and the creation of patterns. Giving non-routine questions can train students' KPMM. KPMM is important for students because it includes the main process of the mathematics curriculum and the standard objectives of learning mathematics, it is also the heart of mathematics (Akbar et al., 2018).

According to Polya in Nuryana & Rosyana (2019) There are four KPMM indicators, namely understanding the problem, building solution plan, completing solution plan, and re-checking. Understanding the problem is conducted by showing what is known and asked, making a solution plan by assuming variables,

forming mathematical model, choosing plan, and writing down the steps to be used. Completing solution plan is carried out by carrying out predetermined plan, at this stage students' ability in mathematical calculations is very necessary in carrying out problem solving. The stage of re-checking is done by reflecting to check the solutions that have been obtained.

High student achievement is closely related to learning that emphasizes problem solving. Ulvah (2016) stated that active students in learning usually have better KPMM than passive students. If learning is done well, students will not feel bored, and the KPMM of students will develop.

Almost every basic competency and competency standard contains aspects of problem-solving abilities. But in fact, there are still students who are not able to solve problems well. PISA results in 2015, Indonesia ranked 63 of 70 members on student math scores. In the TIMSS report in 2011, Indonesia ranked 38 of 42 members (Utami & Wutsqa, 2017) and in 2015 ranked 45 of 50 member countries with score 397 of the international average score of 500 (Nahdi & Cahyaningsih, 2019).

Based on the research of KPMM by Bernard et al. (2018) KPMM of students is low, while research by Latifah & Widjajanti (2017) and also Susanti (2017) stated that KPMM of students SMP/MTs is still in the low category. Fatmala et al. (2020) mentioned that KPMM of students class VII in one SMPN Purwakarta Regency is low category. Several students has wrong interpretation to the KPMM indicator because of lack of

experience in solving KPMM questions. It resulted students find it difficult to understand the existing problems, erroneous in calculation and do not re-check the results that have been obtained. This is agree with the research by Andayani & Lathifah (2019) that the KPMM of students at SMPN 3 Cimahi is low, students made a lot of errors in the indicators of understanding the problem so it is important to give non-routine questions so that students get used to and can train students' abilities. Similar to the result of research by Yustianingsih et al. (2017) that the low KPMM of students is due to the fact that many students find it difficult when working on problem solving questions in the reality because students are not accustomed to working on non-routine problems. Teacher usually only gives routine questions, the problems on the questions given by the teacher are similar to the example questions. So that it makes students think that it is enough to follow the example given by the teacher to solve the problem. Suraji et al. (2018) also mentioned that the KPMM of students in SMP/MTs Pekanbaru is still low, students have difficulty working on problem solving questions. Students have difficulty if the questions given are not the same as the teacher's example.

Putra et al. (2018) mentions that sometimes students do not want to solve problems because of the lack of students' knowledge to solve problems. Fitria (2018) From the results of interviews conducted with several mathematics teachers, it is said that there were still students who found it difficult to work on problems if the process required process of reasoning

and analysis, students could only work on similar problems such as the teacher's examples and questions that were almost the same as in books. Social arithmetic is material that requires thought process to solve problems in determining the results.

Social arithmetic is an algebraic material that students must master well (Rokhimah, 2015). Learning material on social arithmetic is directly related to everyday life. Some sub-topics of arithmetic are profit and loss, percentage gain and percentage loss, tax, discount, single interest, gross and tare (Yunia & Zanthi, 2020). Problems on arithmetic material are usually in the form of story or narrative questions related to reality (Halim & Rasidah, 2019). In solving the problems, story problems usually use numeracy skills. Yuliasuti (2014) and Erfani et al. (2020) mentions that many students have difficulty working on social arithmetic problems. Similar to the result of research by Setyono & Sutarni (2013) which states that when solving problems of social arithmetic material, the student error rate is quite high at 57.84%. The error is because students have difficulty in reading, understanding, and interpreting the questions. Students have not mastered the prerequisite material, and students have not been skilled at working on social arithmetic problems. Mulyani & Hanifah (2018) in their research stated that students have difficulty solving arithmetic problems because students were inaccurate and misunderstand the questions which resulted difficulty to determine the appropriate concept and difficulty forming mathematical models.

KPMM analysis of student is one of the many ways to find out the cause

of low KPMM of students. Based on some of facts explained, further research is needed to describe students' KPMM in working on questions about social arithmetic. Through KPMM analysis, students are expected to be able to find out the causes of the low KPMM. It is also expected to minimize similar errors and can be avoided by teachers and students. The purpose of this study is to describe students' KPMM, especially in social arithmetic material.

METHODS

This research uses descriptive method. The subjects were class VII

students of SMP IT Mutiara Global Pekanbaru as many as 15 even semester students for the 2020/2021 academic year. The object of this research is students' KPMM on social arithmetic material regarding unit price and overall price, selling price, purchase price, profit, loss and discount based on problem solving indicators. The data collection technique used test instrument in the form of story questions.

Student's KPMM data obtained from test results that refer to scoring guidelines with criteria based on KPMM indicators according to Polya in Table 1 below.

Table 1. Student's KPMM scoring guidelines

Indicator	Annotation	Score
Understanding problem	do not write 'what is known' and 'what is asked'	0
	write 'what is known' but did not write 'what is asked' or vice versa	1
	write 'what is known' and 'what is asked' but not suitable	2
	write 'what is known' and 'what is asked' perfectly	3
Planning solution	do not make problem solving plan made problem solving plan by writing mathematics model and formula but not suitable	0
	make problem solving plan by writing mathematical model and formula perfectly	1
		2
Completing solution plan	do not write the problem solution	0
	write the solution but incorrect or only partial solution is correct	1
	write the partial solution correctly	2
	write the full solution correctly	3
Interpreting the result	no conclusion	0
	describe the solution obtained by writing conclusion but incorrect	1
	describe the solution obtained by writing conclusion correctly	2

Modified from Mawaddah & Anisah. 2015.

The following are the KPMM test instruments that are tested on students.

1. Mother told Linda to buy instant noodles of Supermi brand and rice of Mas Koki's brand at the shop with two banknotes of fifty

thousand. The price of one box of instant noodles containing 40 packs is Rp. 60,000.00 and the price of one sack of rice weighing 10 kg is Rp. 110,000.00. How much change does Linda have if she buys 5 packs of instant noodles and 5 kg of rice?

2. Mr. Saiful is a rabbit seller. He bought 100 local rabbits for IDR 4,000,000.00. During the trip, 10 rabbits died. The other thirty rabbits were sold for Rp. 50,000.00/tail, and the rest for Rp. 40,000.00/tail. Calculate the amount of profit or loss that Mr. Saiful gets.

3. Siska wants to buy sportswear and shoes at the mall. The price of sportswear is Rp. 250,000.00 and the price of shoes is Rp. 300,000.00. It turned out that Siska got 30% discount on sportswear and 20% discount on shoes. Calculate the money Siska has to pay to buy sportswear and shoes.

The data analysis technique was carried out by correcting the results of student work, doing the level of difficulty of the questions, reliability, and validity testing using the Anates application, followed by analyzing students' KPMM.

Table 2. Item validity criteria

The value of r	Correlation	Interpretation
$0,80 < r \leq 1,00$	Very High	Very Good
$0,60 < r \leq 0,79$	High	Good
$0,40 < r \leq 0,59$	Medium	Medium
$0,20 < r \leq 0,39$	Low	Bad
$0,00 < r \leq 0,19$	Very low	Very Bad

Reference: Lestari & Yudhanegara (2015)

Table 3. Instrument reliability interpretation criteria

Correlation Coefficient	Correlation	Reliability Interpretation
$0,90 \leq r \leq 1,00$	Very High	Very Good
$0,70 \leq r < 0,90$	High	Good
$0,40 \leq r < 0,70$	Medium	Medium
$0,20 \leq r < 0,40$	Low	Bad
$r < 0,20$	Very low	Very Bad

Reference: Lestari & Yudhanegara (2015)

Table 4. Difficulty criteria

Difficulty Value	Annotation
$0,00 \leq TK \leq 0,30$	Difficult
$0,31 \leq TK \leq 0,70$	Medium
$0,71 \leq TK \leq 1,00$	Easy

Reference: Arifin, 2012.

Student's KPMM score was analyzed using following formula.

$$\text{Value} = \frac{\text{Student Score}}{\text{Ideal Score}} \times 100\%$$

The result of value calculation obtained was qualified based on criteria on Table 5.

Table 5. Student's KPMM criteria

Value (%)	Criteria
85,00 – 100	Very Good
70,00 – 84,99	Good
55,00 – 69,99	Medium
40,00 – 54,99	Bad
0 – 39,99	Very Bad

Reference: Mawaddah & Anisah, 2015

RESULTS AND DISCUSSION

The purpose of this study was to describe student's KPMM, especially in social arithmetic. The KPMM indicators assessed were understanding the problem by writing 'what is known and 'what is asked' questions, carrying out solving plan,

completing solution plan, and re-checking the solution.

Based on the result of instrument test, validity test, difficulty level of question and reliability using Anates application, the results obtained as shown in Table 6, Table 7, and Table 8 below.

Table 6. Instrument validity correlation coefficient results

No item questions	Correlation	Interpretation
1	0,705	Good
2	0,748	Good
3	0,827	Very Good

Table 7. Reliability result

Coefficient Correlation	Correlation	Reliability Interpretation
0,54	Medium	Medium

Table 8. Instrument difficulty results

No item questions	TK	Significance
1	71,25	Easy
2	73,75	Easy
3	66,25	Medium

Based on the results of instrument test, in Table 6 instrument validity correlation coefficient results on number one and two item questions are in good criteria and number three item question is in very good criteria.

It means that all of three item question tested is valid questions. So does the reliability in Table 7 with coefficient correlation 0,54 with reliability interpretation is good enough with medium category. The result of

difficulty level of instrument test on Table 8 obtained number one and two item questions are in easy category while number three is in medium category.

On the following Table 9 is the percentage of student's KPMM scores based on each aspect of mathematical problem solving.

Table 9. The percentage of student's score

No	KPMM Aspect	Percentage	Criteria
1	Understanding problem	91,85%	Very Good
2	Planning solution	51,11%	Bad
3	Completing solution plan	75,55%	Good
4	Interpreting the result	37,78%	Very Bad

Average of student's KPMM score of class VII SMP IT Mutiara Global is 64,07% in medium category.

From the score obtained, and then the ability of student in completing the question about unit price and overall price, selling price, purchase price, profit, loss and discount on social arithmetic material were analyzed.

The following is description of the KPMM indicators analysis for class VII students.

Aspect 1: Understanding Problem

Understanding problem is done by making 'what is known' and 'what is asked' based on the problem. In Table 9 the criteria for understanding the problem are classified as very good with value 91.85%. It indicates students of class VII are very good in understanding problem. However there were 3 students whom made error in understanding problem. It can be seen in Figure 1 and Figure 2 below.

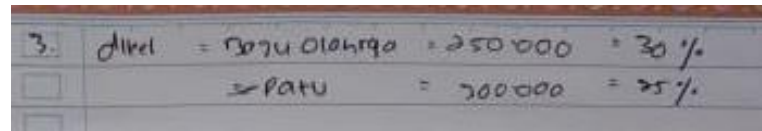


Figure 1. The first error in understanding problem

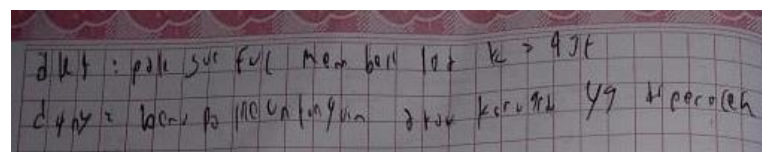


Figure 2. The second error in understanding problem

In Figure 1 and Figure 2, students attempted to write 'what is known' and 'what is asked' from the problem, however it was not complete. Students only wrote one of the information known whereas there were more information should be written from the problem given. It indicates students have not understood the problem given, not precise and

thorough in reading the problem. It is also similar with the research by Erfani et al. (2020), students did not mention 'what is known' and 'what is asked'. The same thing was obtained from the results of Hidayah's research (2016) as well as Andayani & Lathifah (2019) that students make error on indicator of understanding problem because of less precise and less thorough in reading

the problem. Students did the problem given in hurry so that there was some information provided not written.

Aspect 2: Planning solution

The second indicator in Table 3 with value 51,11% classified in bad

category. It indicates several students is still not good in choosing the formula to solving the problem. Error founded on this step can be seen in Figure 3 and Figure 4 below.

$$\begin{aligned}
 \text{Jb: } & \frac{1}{40} \times 60.000,00 = 1.500 \\
 & \frac{1}{10} \times 110.000,00 = 11.000 \\
 & 1.500 \times 5 = 7.500 \\
 & 11.000 \times 5 = 55.000 \\
 & \quad \quad \quad \underline{\quad \quad \quad} + \\
 & \quad \quad \quad 62.500
 \end{aligned}$$

Figure 3. The first error in planning solution

$$\begin{aligned}
 \text{Jb: } & \frac{30}{100} \times 110.000 = 75.000 = 210.000 - 75.000 \\
 & \quad \quad \quad = 135.000 \\
 & \frac{25}{100} \times 300.000 = 75.000 = 300.000 - 75.000 \\
 & \quad \quad \quad = 225.000 \\
 & = 135.000 + 225.000 \\
 & = 400.000 \quad \text{jadi yg dibayar Rp 400.000,-}
 \end{aligned}$$

Figure 4. The second error in planning solution

Figure 3 and 4 showed that students are capable of planning solution, calculating correctly, however students directly write the calculation without writing the formula used. There were some students who written the formula however it was still not correct. This result also found in research of Hidayah (2016), students did the error on the indicator of planning solution because students have not experienced in making the planning used to solve the problem. Many students did not make the mathematical model and the correct formula.

Aspect 3: Completing solution plan

In Table 9 showed that the third aspect is in good category which means students of class VII is good in completing solution plan. Error found in this aspect is students have not finished the problem solving plan. Students only finished the problem in the first two aspects and did not finished completely as the early planning. Because of unfinished step resulted in error for the next step. It is because of student negligence so that two indicators missed without complete the problem. The result also the same with the research by Andayani & Lathifah (2019), students did error by not apply the planning solution which arranged previously, and only did the first two aspect so that

other two aspects missed. It is also because students found difficulty in doing the calculation.

Aspect 4: Interpreting the result

In this indicator, examination is done by writing the conclusion. In Table 9 this aspect has value 37,78% with very bad criteria. This is showed average qualification of this aspect lower than planning solution and become the lowest aspect with lowest average. This is because many students did not write the conclusion and only several students written the correct conclusion. Students only did the problem until the planning solution aspect. This is similar to the result of research by Nurhidayah (2016) and Erfani et al. (2020) that many students did not write the precise conclusion from the problem given. It also because students have not experienced re-check the solution they obtained systematically. This is in line with research by Fatmala et al. (2020) that during the time working on questions, students were not precise and in a hurry because they wanted to finish quickly so that the answers obtained were not re-checked. Students already did the good job in solving the question however several students have not written the conclusion because they were forget whereas the question is in the form of story.

CONCLUSION

Student's KPMM of SMP IT Mutiara Global Pekanbaru class VII are included in medium criteria with an average value of 64.07%. The average indicator of understanding the problem is 91.85%, planning solution is 51.11%, completing solution plan is 75.55%, and interpreting the results is

37.78%. The errors experienced by students are students are able to write 'what is known' and 'what is asked' but not complete, students have been plan the solution but not write the formula but directly did the calculation. Students did not work according to the planning previously arranged because of their lack of precise and lack of accuracy, students did not write the conclusion and only several students wrote the conclusion correctly. Based on these results showed that students have not experienced working on non-routine questions (different), and need to be accustomed to working on non-routine questions to train students' KPMM.

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