IMPROVING STUDENT'S MATHEMATICAL PROBLEM-SOLVING ABILITY BY USING MISSOURI MATHEMATICS PROJECT AT SMP NEGERI 4 MEDAN

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Abstract. This study aims to improve students' mathematical problem-solving skills through the Missouri Mathematics Project (MMP) model on the material of a Linear Two Variable System in grade VIII-6 students of SMP N 4 Medan as a subject or this research. The type of this research is classroom action research. The instrument used the collect the data are essay test and observation sheet. Before giving the action in initial test to 32 students obtained the average score is 50.46 with the classical completeness is 34.37% or only 11 students achieve the completeness criteria. The completeness criteria is the standard point that must be reached by students namely at least 65 and classical completeness is the standard percentage that must be reached by the class namely at least 85%. After given the action in the first cycle namely the implementation of MMP learning model to 32 students, obtained the average score is 63.9844 with the classical completeness 50% or 16 students achieve the completeness criteria. Then given the second cycle namely increasing MMP learning model, obtained the average score is 82.11 with the classical completeness 93.75%. Based on the observation done by teacher obtained that the point of second cycle is higher than the point of first cycle. Based on the average gain score, obtained that the average gain score in Cycle I test-Cycle II test is higher than Initial Test-Cycle I Test. From the result of research, can be concluded that the mathematical problem-solving ability of students can be increased or improved especially on the topic of Linear System with Two Variable by using Missouri Mathematics Project Learning Model.

Keywords : Missouri Mathematics Project, Mathematical Problem-Solving Ability

Abstrak. Penelitian ini bertujuan untuk meningkatkan kemampuan pemecahan masalah matematis siswa melalui model Missouri Mathematics Project (MMP) pada materi Sistem Persamaan Linier Dua Variabel pada siswa kelas VIII-6 SMP N 4 Medan sebagai subjek atau penelitian ini. Jenis penelitian ini adalah penelitian tindakan kelas. Instrumen yang digunakan untuk mengumpulkan data adalah tes essay dan lembar observasi. Sebelum

diberikan tindakan pada tes awal terhadap 32 siswa diperoleh nilai rata-rata 50,46 dengan ketuntasan klasikal 34,37% atau hanya 11 siswa yang mencapai kriteria ketuntasan. Kriteria ketuntasan merupakan standar nilai yang harus dicapai oleh siswa yaitu minimal 65 dan ketuntasan klasikal merupakan standar persentase yang harus dicapai oleh kelas yaitu minimal 85%. Setelah diberikan tindakan pada siklus pertama yaitu penerapan model pembelajaran MMP kepada 32 siswa, diperoleh nilai rata-rata 63,9844 dengan ketuntasan klasikal 50% atau 16 siswa mencapai kriteria ketuntasan. Kemudian diberikan siklus kedua yaitu peningkatan model pembelajaran MMP, diperoleh nilai rata-rata 82,11 dengan ketuntasan klasikal 93,75%. Berdasarkan hasil observasi yang dilakukan oleh guru diperoleh bahwa nilai siklus kedua lebih tinggi dibandingkan dengan nilai siklus pertama. Berdasarkan rata-rata gain score, diperoleh bahwa rata-rata gain score pada Tes Siklus I-Tes Siklus II lebih tinggi dari Tes Awal-Tes Siklus I. Dari hasil penelitian, dapat disimpulkan bahwa kemampuan pemecahan masalah matematis siswa dapat ditingkatkan atau diperbaiki khususnya pada materi Sistem Linear Dua Variabel dengan menggunakan model pembelajaran Missouri Mathematics Project.

Kata Kunci: Missouri Mathematics Project, Kemampuan Pemecahan Masalah Matematis

INTRODUCTION

Mathematics is an abstract science and is developed from general to specific with the truth of a concept and the previous truth being related. Mathematics is a subject that is not foreign to students. Since elementary school students have been introduced to mathematics. So far, mathematics has become a subject that is less attractive to students because most students have difficulty in mathematics (Ariantini, 2014: 56).

In learning mathematics, learning does not only require students to consider the material at the time, but also learn with understanding and actively developing new knowledge from previous experience and knowledgethat the learning more meaningful. For this to be realized, the NTCM (2000) Plans five processes that students need through mathematics learning which are included in the standard process, namely: (1) Problem Solving, (2) Reasoning and Proof ,(3) Communication, (4) Connection; and (5) Representation.

Problem solving is not just a skill to be taught and used in mathematics but also a skill that will be brought to students' daily problems or decision-making situations, thus problem-solving abilities can help someone in his life. However, in reality there are still many students who have problems in learning mathematics. One of them is the lack of

ability to solve problems. Lack of problem-solving skills will result in poor learning outcomes. One of the causes of the low ability of students in solving problem solving problems, among others, is because the learning that is built in the classroom is not directed at honing problem solving skills. Good learning planning will at leastcontribute to the teaching and learning process in the classroom, but in reality the teacher is less than optimal in making lesson plans so that the learning process runs as low as possible.

From the diagnostic test of problem-solving ability above, many students still cannot understand the problem, make the question into mathematics model and solving the problem exactly. The result can be explained as follows:

- The first indicator is understanding the problem. there are 43.75% students have been understood the problem well and 56.25% of students have not been understood the problem or the condition that presented by the problem.

- The second indicator is devising a plan there are 50% of students have devised a plan and 50 % of students have not been devised a plan to solve the problem.

- The third indicator is carrying out a plan, there are 37.5% of students have been carried out the plan and 62.5% of students have not been carried out the plan and could not see clearly that be step is correct

- The fourth indicator is looking back, there are 21.875% of students have been looked back carefully and 78.125% of students have not been looked back.

Based on the results of observations, observations and interviews conducted by researchers with class teachers in class VIII-6, Mr. Hadi Ismanto Walesa Panjaitan, S.Pd at SMP Negeri 4 Medan on February 8, 2022 he said that "there were several problems from class VIII- 6, the most prominent problem is the low value of student learning outcomes in several subjects, and the lowest is mathematics in class VIII-6 ". This is because teachers are still using conventional and monotonous learning models, lack of student concentration, there are still many students who are busy alone or chatting when learning takes place, so that many students' scores are low and do not reach the KKM for mathematics that has been determined, which is 65.

This is in line with the results of the diagnostic tests given to students of class VIII-6 SMP N 4 Medan, where the tests given to students are in the form of a diagnostic test of mathematical problem-solving abilities. Based on the results of these observations, it was concluded that the mathematical problem-solving ability of students in class VIII-

6 N 4 Medan was still low. The results obtained are that there are 14.8% of students who score in the high category, 66.6% of students who score in the middle category, 18.5% of students who score in the low category. So it can be concluded that the mathematical problem solving ability of the students of SMP N 4 Medan is low.

One of the learning models considered by researchers to motivate students in improving their mathematical problem-solving ability is the Missouri Mathematics Project (MMP) learning model. Missouri Mathematics Project (MMP) learning model demands student activity in learning because the teacher is only a facilitator who accompanies and only helps students find their knowledge". The Missouri Mathematics Project (MMP) learning model trains students to be independent, collaborative, and think creatively in solving math problems.

The Missouri Mathematics Project (MMP) learning model is a structured learning model consisting of 5 steps, namely review, development, cooperative work (controlled exercise), seatwork (independent work) and assignment (PR). With the elements of cooperative work and seatwork in this model, it is hoped that students can practice solving problems more both independently and in groups so that the difficulties faced by students can be minimized and students can be more skilled in working on problems independently.

In addition, this MMP model is considered suitable to help students improve problem solving skills. This is because each stage in this model is very helpful for students to solve problems. In the review step, students are given material that has been studied previously related to the material to be taught, so that they can explore and remind the prerequisite material. In the development step, students are given an expansion of the material by presenting new ideas and expanding concepts. After being given the material in the review and development step, then students are divided into several groups to solve the problems/problems given. In this step students can exchange ideas to find solutions to problems and are also given the opportunity to ask questions. Then in the seatwork step (self-employed), students are given another problem and do it independently, not in groups, this is to train students' independence in solving problems. And so that students are more skilled in solving problems students are given homework.

LITERATURE REVIEW

The mathematical problem-solving process is one of the basic abilities that students need to have. National Council of Supervisors of Mathematics (1997) stated that learning to solve problems is the principal reason for studying mathematics. Problem-solving abilities are needed in dealing with daily life issues, especially in math learning. When a student is trained to solve a problem, the student will have the ability to collect relevant information, analyze information and realize how much research needs to be re-examined. As per Ahghar (2012:689), problem-solving ability is an intellectual, logical and systematic method which helps individual when dealing with problems, to search for multiple solutions then, select the bestsolution with to the conditions.

According to Polya (1973:6), solutions contain 4 (four) problem-solving steps:

1. Understanding the problem

   This seems so obvious that is often not even mentioned, yet students are often stymied in their efforts to solve problem simply because they don't understand it fully, or even in part. In this step, students have to understand the problem like what is know, what are the data, what is unknown, what is condition? Is there enough information tp enable you to find a solution?

2. Devising a plan

   The skill at choosing an appropriate strategy is best learned by solving many problems. In general, more varied their experience, students will find choosing a strategy increasingly easy. In this step, each student has to devise a plan and make a sketch drawing, Find the connection between the data and the unknown, which solution that accordance to the problem.

3. Carrying out the plan

   In this step, a student continues to excute the plan which already chosen and accordance with the problem. They also have to check eachstep carefully to know that step is correct or not.

4. Looking back

   Polya mentions that much can be gained by taking the time to reflect and lock back at what you have done, what worked, and what didn't. Doing this will enable you to predict what strategy to use to solve future problems. In this step, students examine the solution obtained.

Missouri Mathematics Project (MMP) is a learning model mathematics applied in Missouri, a state of the United States under the Missouri Department of Primary and Secondary Education by Thomas L Good and Douglas A. Grows (Good and Grouws,1979 : 355). Good and Grows suggest that MMP is focused on how teacher behavior impacts student achievement thus following the process-product paradigm. The results of research conducted by Good and Grouws showed that in the experimental group the number of questions answered by students on average increased, the percentile ranking increased, the performance of the treatment group increased significantly from the control group, and the post-test score was much higher than the pretest score.This shows that the MMP learning model is a model learning that is suitable for use in learning mathematics. The study conducted by Good and Grouws aimed at making mathematics more meaningful so as to improve the learning carried out by students.

The main objective of MMP is to improve students' skills in do math problems with controlled exercises, seatwork or practice independently and giving homework. Characteristics of the Missouri Mathematics Project learning model (MMP) This is practice question. These exercises are Characteristics of the Missouri Mathematics Project learning model (MMP) This is a practice question. These exercises are intended, among other things, to improve students' problem-solving skills. These exercises are an assignment that asks students to produce something (new concept) from himself (student) himself. Missouri Mathematics Project learning model contains five steps of learning can be seen in the table below:

Table 1. CAR Research Procedure

Steps	Learning Activities
Reviewing the material (daily review)	The stage of reviewing the past material, what teachers and students have covered in the previous lesson, some things that need to be reviewed in this activity are apperception, motivation and lesson objectives
Development	The teacher presents new ideas and expansion of previous mathematical concepts. Students are told the learning objectives that have about the objectives of the lesson.
Controlled exercises or cooperative learning	in this step student's work on exercises supervised by the teacher. Students are asked to respond to a series of questions in agroup, while the teacher observes if a misconception occurs.
Self-training (seatwork)	Self-training phase (seatwork) students are asked to work on a series of questions in order to develop material by solving problems individually.
Assignments	At this stage the teacher gives assignments to students to be done at home.

The Missouri Mathematics Project (MMP) learning model has several advantages, including:

1) A lot of material can be conveyed to students because it does not take too much time. That is, the use of time can be regulated relatively tightly.

2) Lots of practice so that students are easily skilled with a variety ofquestions.

The Missouri Mathematics Project (MMP) learning model has several disadvantages, including:

1) Maybe students get bored quickly because they hear more.

2) Lack of placing students in an active position.

The hallmark of MMP is that each student individually learns the learning material delivered by the teacher. Results from individuals are brought to the group to be discussed and mutually discussed by group members21. The main goal of MMP is to improve students' skills in working on math problems with controlled exercises, seatwork or independent exercises and giving homework. By giving lots of practice questions to

students, it indirectly hones students' problem-solving skills because students are used to working on various kinds of questions. Based on the opinions of several researchers above, it can be concluded that MMP is a learning model that focuses on providing student activities in the form of exercises both individually and in groups in order to improve problem solving abilities and student learning achievements.

RESEARCH METHODOLOGY

In accordance with this type of research namely Classroom Action Research (CAR), this study has several phases in the form of cycles. Each cycle is carried out according to the changes that will be achieved. If in the first cycle which carried out unsuccessfully, then the second cycle will be carried out.

1. Data Analysis of Student's Activity and Teacher's Activity

Data of students' activity and teacher's activity is obtained from observation sheets. From observation result is done by researches, analysis is done by using the formula:

$$M_1 = \frac{total\ of\ all\ aspects\ that\ observed}{number\ of\ aspects\ that\ observed}$$

2. Analysis Of Mathematical Problem-Solving Ability

After conducted the students' mathematical problem-solving ability test, test result were analyzed by the criteria of problem solving of students. So, problem solving ability test were measured for each category using the formula:

$$PSA = \frac{score\ obtained}{max\ score} x 100\%$$

3. Increasing Criteria Of Mathematical Problem-Solving Ability

The increasing of student's mathematical problem-solving ability can be seen from gain every cycle by calculate the gain from test result. According to Hake (1999) the value of gain can be use the formula as follow:

$$g = (PSA_{ii}) - (PSA_i)$$

From that data can be determined the average of gain that normalization based on criteria of learning affectivity. According Hake (1999) by using the formula as:

$$(g) = \frac{g}{(4) - PSA_i}$$

4. Student's Learning Completeness

- To know the individual completeness namely the criteriaso the each of students pass the learning material, used the formula:

$$PLC = \frac{Score\ Obtained\ by\ a\ student}{Maaximum\ score} \times 100\%$$

Where :

PLC : Percentage of Learning Completeness

The PLC has reached if a score of student is   65%

- To know the classical completeness namely the criteria so the class or all of students pass the individual completeness, used the formula:

$$PCC = \frac{The\ number\ of\ students\ pass\ criteria}{The\ number\ of\ all\ students}$$

Where:

PCC : Percentage of Classical Completeness

The PCC has reached if there are   85% of students who have achieved at least medium level.

RESULT AND DISCUSSION

A. RESULT

In this part will be explain research result and discussion through improving of Missouri Mathematics Project (MMP). The purpose of this research is to describe the students' mathematical problem-solving ability of grade VIII-6 at SMP N 4 Medan in Academic Year 2022/2023. According to the purpose of research, this study included data description of students' mathematical problem-solving ability as a result of the worksheet using MMP model.

Description of Initial Test Result

From the implementation result of initial test known that students learning outcomes are still low. The average value obtained by the students in doing this initial test is 50.46 and only 11 students who achieve learning completeness. The classical learning completeness is 34.37% it means the value has not yet reached at least 80% of students who pass the learning completeness criteria. From 32 students, there is 1 student

received very high level, 3 students who received high level, 7 students received medium level, 4 students received low level and 17 of students got very low level.
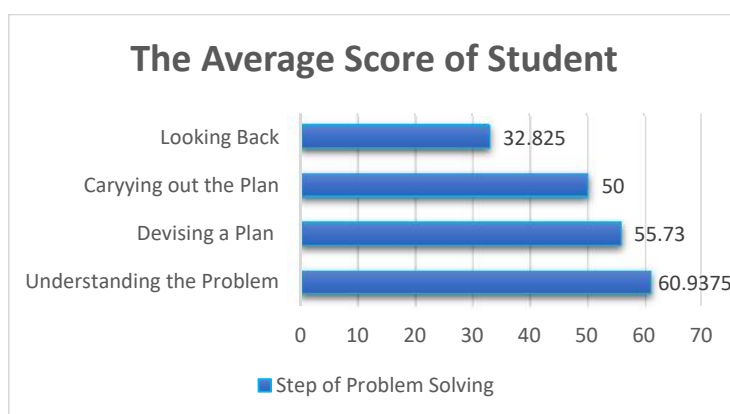

Figure 1. The Diagram of Students' Average Score in Initial Test

Description Of Test Result In Cycle 1

From the initial test results, there are some things that become difficult in completing the question, namely:

1. Most students have not been able to write down what is known and asked on the question.
2. Students have not been able to link between what is known and asked from the given question.
3. Most students have not been to work on the problems thoroughly.
4. Students are less able to describe the conclusion of a matter that has been resolved

Table 2. Description Of Problem-Solving Ability Test In Cycle 1

Range	Criteria	Number of students	Percentage of Students	Average Of Students Ability
90-100	Very High	2	6.25	
80-89	High	5	15.62	
65-79	Standard	9	28.12	
55-64	Low	4	12.5	63.98
0-54	Very Low	12	37.5	
Total		32	100	

Analysis of observation I

Based on the teacher's observations in the first cycle, it was found that the final meeting of observations was 2.64 (good) and the second observation was 2.71 (good). the average final value of the observation is 2.67. This is included in the good category. according to observers, in general, researchers have carried out learning well with the following descriptions:

a. Researchers are able to apply the Missouri Mathematics Project (MMP) learning model even though it is not fully in accordance with the lesson plans that have been made

b. Researchers are able to communicate well to students but there are still students who do not respond to what the researchers say.

Description of research in cycle II

Problems in cycle II are problems that cannot be solved in cycle I as follows:

a. The activeness of students who are still lacking when carrying out the discussion process

b. students still cannot be active in discussions during the learning process

c. lack of students' understanding of story problems

Table 3. Description Of The Problems Solving Ability Test In Cycle II

Range	Criteria	Number of students	Percentage of Students	Average Of Students Ability
90-100	Very High	11	34.37	
80-89	High	11	34.37	
65-79	Standard	8	25	
55-64	Low	2	6.25	82.11
0-54	Very Low	0	0	
Total		32	100	

Analysis of observation II

Based on the results of teacher observations in cycle II, processed at the first meeting the final score of observations was 2.92 (good) and at the second meeting it was obtained 3.14 (good). This can be seen from the results of teacher observations in cycle II, which has increased from the results of observations in cycle I. The implementation of the teaching and learning process carried out by teachers in cycle II has also maximized

the achievement of increasing student learning motivation seen in student activities during the learning process through the research objectives The implementation of learning activities carried out to the maximum by students supports maximum achievement as well as student learning outcomes can be seen from the work of students in cycle II.

B. DISCUSSION

Looking at the research results that have been put forward in the previous sub-chapter, it was found that each student's ability to apply mathematical problem solving to the two-variable linear equation system material experienced an increase. Data obtained from initial test to 32 students obtained the average score is 50.46 with the classical completeness is 34.37% or only 11 students achieve the completeness criteria. The completeness criteria is the standard point that must be reached by students namely at least 65 and classical completeness is the standard percentage that must be reached by the class namely at least 85%. After given the action in the first cycle namely the implementation of MMP learning model to 32 students, obtained the average score is 63.98 with the classical completeness 50% or 16 students achieve the completeness criteria. Then given the second cycle namely increasing MMP learning model, obtained the average score is 82.11 with the classical completeness 93.75%.

This proves that applying MMP learning can improve students' mathematical problem solving abilities. The description is described as follows:

Table 4. The Comparison Of Average Score, Classical Completeness, Observation And Gain In Each Test

Test	Average Score	Classical Completeness	Teacher Observation	Compared Gain	
				IT-PSA I	IT-PSA II
Initial Test	50.46	34.37	-	0.27 (Low)	
PSA I	63.98	50	2.7		0.5 (Medium)
PSA II	82.11	93.75	3.03		

Note:
IT   : Initial Test
PSA I : Problem-Solving Ability I
PSA II : Problem-Solving Ability II
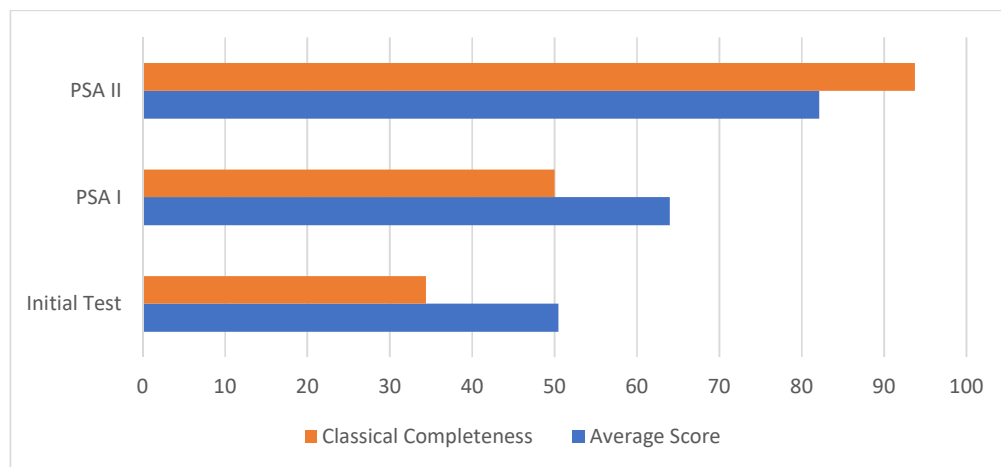For details, it can be seen from the following diagram:

Figure 2. The Diagram Of Classical Completeness And Average Score

From the Figure 2, there is an improvement of average class, teacher observation and the comparison of gain. Thus, based on the data description, it can conclude that the ability of students to solve the problem has increased and students have achieved classical completeness. As expected, it shows the success of the researcher in giving the action in Cycle II and in the last cycle, the completeness criteria have been fulfilled. Because of that, the researcher doesn't have to continue to the Cycle II.

Vygotsky's theory says that the implications of his theory for MMP learning are seen in the fourth characteristic of utilizing the interactions between learning elements. interaction between students and teachers, students and students, and students with learning tools is very important in MMP. Forms of interaction such as: negotiation, explanation, justification, agreement, statement or reflection are used to look for forms of informal mathematical knowledge that are found by students themselves. in learning students discuss and collaborate, argue with classmates so that they can find out for themselves and in the end use mathematics to solve problems both individually and in groups.

Based on the results of analysis of research data and theoretical studies, it is proven true that the Missouri Mathematics Project learning can be used to improve the mathematical problem solving abilities of class VIII-6 students of SMP Negeri 4 Medan A.Y 2022/2023. this is also reinforced by the results of research conducted by Handayani (2016), namely on the effect of Missiouri Mathematics Project learning model on students' mathematical problem-solving abilities.

CONCLUSION

Based on result of analysis and observation, so it can be taken some conclusions such as:

The level of problem-solving ability in the initial test is most very low. It can be seen from the average score which is below the completeness criteria. After given the action in the Cycle I with the learning model of Missouri Mathematics Project, the level of problem-solving ability increases but has not reached yet the classical completeness. It can be seen from the average score increasing compared to initial test. Furthermore, after the action in the cycle II with the addition action, the level of problem-solving ability increases and has reached the classical completeness. Based on the analysis of data, it shows that is a change of learning outcomes in the increase namely mathematical problem-solving ability of students after using the learning model of Missouri Mathematical Project (MMP) which is done in VIII-6 graders at SMP N 4 Medan on the topic of SPLDV.

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