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THE IMPLEMENTATION OF PROBLEM BASED LEARNING MODEL TO INCREASE STUDENTS' MATHEMATICAL PROBLEM SOLVING FOR GRADE VIII AT SMP NEGERI 37 MEDAN 2019/2020

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Abstract: This study aimed to increase students' mathematical problem solving ability in the numerical pattern material by using problem based learning model in grade VIII of SMP Negeri 37 Medan.. This research was a classroom action research conducted in 2 cycles, each cycle consisted of two meetings, where at the end of each cycle a test of students mathematics problem solving ability (TKPM) was given. The results showed that: in the cycle I, the level of TKPM was moderate with an average value of 68.22, the students who achieved the target of success were 21 students from 32 students (65.625%), in the cycle II the level of TKPM was high with an average value of 80.82, the students who achieved success targets were 28 students from 32 students (87.5%). Based on the those results, it was concluded that the problem-based learning model increased students' mathematics problem solving ability in class VIII of SMP Negeri 37 Medan in the academic year 2019/2020.

Keywords: Problem Based Learning Model, Mathematics Problem Solving Ability

Abstrak Penelitian ini bertujuan untuk meningkatkan kemampuan pemecahan masalah matematika siswa dengan menerapkan model pembelajaran berbasis masalah di kelas VIII SMP Negeri 37 Medan. Penelitian ini merupakan penelitian tindakan kelas yang dilaksanakan dalam 2 siklus, masing-masing terdiri dari dua pertemuan, dimana di akhir setiap siklus diberikan Tes Kemampuan Pemecahan Masalah (TKPM). Hasil penelitian menunjukkan bahwa: Pada siklus I, hasil TKPM siswa adalah sedang dengan nilai rata-rata 68,22, dimana siswa yang mencapai target keberhasilan adalah 21 orang dari 32 orang siswa (65,625%), pada siklus II TKPM siswa adalah tinggi dengan nilai rata-rata 80,82, dimana siswa yang mencapai target keberhasilan adalah 28 orang dari 32 orang siswa (87,5%), Berdasarkan uraian diatas disimpulkan bahwa model pembelajaran berbasis masalah dapat meningkatkan kemampuan pemecahan masalah matematika siswa di kelas VIII SMP Negeri 37 Medan T.A. 2019/2020.

Kata Kunci: Model Pembelajaran Berbasis Masalah, Kemampuan Pemecahan Masalah Matematika

INTRODUCTION

In facing globalization era, human resources (HR) who have critical, systematic, logical, creative and willingness to work effectively are needed. This encourages the world of education to make innovations and relevant learning formulations. The purpose of education in general is to form the environment that allows students to develop their talents and abilities optimally, so that they can realize themselves in accordance with personal and community needs. This is closely related to the quality of education provided by teachers to students. One of the subjects in school that can be used to achieve these goals is mathematics.

Mathematics is a field of study that is studied by all students from elementary to high school and even in college. So far, students have previously assumed that mathematics is a difficult subject because it has many and difficult formulas. This is also stated by Abdurrahman (2012: 252) "From various fields of study taught in schools, mathematics is a field of study that is considered the most difficult by

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students, both those who have no learning difficulties and more so for students who have learning difficulties". Angriani, et al. (2018: 213) states that: "Based on the PISA test, the Indonesian state is still in a relatively low order. The latest results from PISA 2015, this shows that the ability of Indonesian students is still low compared to other countries. Based on this, it is increasingly clear that the ability of Indonesian students to solve problems that demand the ability to study, give reasons and communicate effectively, and solve and interpret problems in various situations is still lacking. Based on the results of 76 participating countries in PISA 2015, Indonesia ranks 69th for PISA Mathematics with a score of 386 points. Therefore there needs to be an effort to improve Indonesia's achievements in the field of mathematics, one of which is by increasing students' mathematical problem solving abilities. "

Abdurrahman (2012: 204) states that: "The curriculum in the field of mathematics studies should include three elements, (1) concepts, (2) skills, and (3) problem solving". Then the National Concil of Mathematics (NCTM) explained that mathematics standards in school include the standard content or material (mathematical content) and standard processes (mathematical processes). Standard processes include problem solving, reasoning and proofing, connection, communication, and representation. According to NCTM that both material standards and process standards together are basic skills and understanding that are needed by students in the 21st century. NCTM also emphasized that problem solving is an integration in mathematics learning, so that it cannot be separated from mathematics learning.

From the statements above, one aspect that is emphasized in the curriculum is to improve students' problem solving abilities. Rusman (2011: 232) states that, "PBM is the use of various kinds of intelligence needed to confront real world challenges, the ability to deal with new things and existing complexities." Istarani (2012: 32) states that: "Learning based the problem is one of the student-centered learning model by confronting the students with various problems encountered in their lives. Indicators of problem solving according to Polya (1973) namely 1) understanding the problem, 2) planning problem solving, 3) carry out problem solving according to plan, and 4) recheck the results of the settlement.

Polya (1973) states that there are Polya's principle namely, 1) understanding the problem, 2) devising a plan, 3) carrying out the plan, 4) looking back.

According to Kannan, et al. (2016: 797), "Problem-solving is considered as the heart of mathematics learning because the skill is not only for learning the subject, but it emphasizes on developing thinking skill as well. Therefore, the development of problem solving ability in mathematics is an important mission that teachers are about to concern with in order to develop such the necessary skill for their students."

According to Ardeniyansah and Rosnawati (2018:1), "Problem based learning is one of the learning models centered on the learner by confronting the learners with the various problems they face in their lives. PBL is a learning model that presents learning material from making problems as a starting point for discussions that will be analyzed and synthesized is an effort to find solutions or answers by students. Problems can be submitted or given by teachers to student, from students with teachers, or from students themselves, who then made the discussion and sought to solve it as a student learning activity." According to Santrock (2011) stated, "PBL is a learning that gives emphasis on authentic problem solving as it happens in everyday life. PBL is very effective in helping students

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develop strong interests and desires in improving their thinking skills"

Problem-based learning will lead students to understand the concept of the material that starts from a problem that is presented at the beginning of learning. Students are given freedom of thought in finding solutions to problems that are given. Fathurrohman (2015: 116) states the stages of problem-based learning consist of 5 stages listed in table 1.

Table 1. Problem-Based Learning Stages

Phase	Master's Behavior
Phase 1: Provides an orientation about the problem to the students	Teachers discuss learning objectives, describe important logistical needs, and motivate students to engage in problem-solving activities.
Phase 2: Organize students for researching	The teacher helps the individual to define and organize learning tasks related to the problem
Phase 3: Helping self-investigation and group	Teachers encourage students to men to Purchase the right information, carry out experiments and searching for explanations and solutions.
Phase 4: Develop and present artefacts and exhibits.	Teachers assist students in planning and preparing are faxappropriate artifacts such as reports, video recordings, and model, as well as helping them to pass it on to others.
Phase 5: Analyze and evaluate troubleshooting process.	Teachers help students to reflect on their investigation and the processes they use.

RESEARCH METHOD

The method used in this study was Classroom Action Research (CAR). which was done collaboratively with teacher in the class. This study was done at SMPN 37 Medan which was located in Jl. Timor No. 36B Medan, Gaharu, Kecamatan Medan Timur. The subject of this research was VII-F at SMP Negeri 37 Medan with 32 students each class. The object of this study was students' ability to solve matemathic problems about numerical pattern material.

In accordance with this research type which was Classroom Action Research, thus this research had some steps namely cycles. Each cycle was already done with some changes that were going to be reached. In this research, if Cycle I was not succeed, such as learning process that was not running well and the ability of problem-solving for each aspect did not reach the target, then Cycle II has to be done and the Cycle will be stopped if the students were already able to solve the problems for each aspect as targeted. The procedure for Classroom Action Research as stated by Raka Joni (Ningrum, 2014: 57) can be seen in Figure 1.

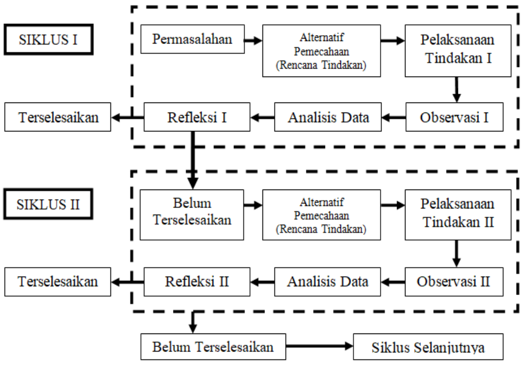

Figure 1. CAR Procedures Scheme

Before the test was given to the students, the arranged test had to be validated by validator. Validator consisted of 2 lecturers of Matemathic Education in Universitas Negeri Medan and 1 matemathic teacher at SMP Negeri 37 Medan. The tools used in data collection in this study were in the form of tests of problem solving abilities, observations, interviews and documentation.

To determine the students' completences category in problem solving abilities, the total score of each problem solving indicator contained in the problem problem is used and the total score of all the questions. The steps are as follows:

a. Calculating the percentage of total scores for each indicator of problem solving ability:

$$\%STI_k = \frac{PSTI_k}{MSTI_k} \times 100$$

Where:

$\%STI_k$: The percentage of total score on the k-th indicator = 1, 2, 3, 4

$\%PTI_k$: Total score on the k-th indicator = 1, 2, 3, 4

$MSTI_k$: Maximum score on the k-th indicator = 1, 2, 3, 4

The criteria for the mastery level of problem solving ability of each indicator can be seen in table 2.

Table 2 The Criteria for the Mastery Level of Problem Solving Ability of Each Indicator

Score (%)	Ability Level
90 ≤ S ≤ 100	Very High (ST)
80 ≤ S < 90	High (T)
65 ≤ S < 80	Moderate (S)
55 ≤ S < 65	Low (R)
0 ≤ S < 55	Very Low (SR)

b. Calculating the percentage of students' individual mastery learning can be calculated by

$$KB = \frac{T}{T_t} x\ 100\%$$

Where:

KB = Percentage of matery learning

T = Scores obtained by students

T_t = Total Score

(Trianto, 2011: 241)

c. Calculating the percentage of class ability to resolve problems:

$$DSK = \frac{X}{N} \times 100\%$$

Where:

DSK = The percentage of classes that completely solved the problem

X = Number of students who completely solved the problem

N = Number of students in the class

With criteria:

0% ≤ DSK < 85% : Class that hasn't finished solving the problems

85% ≤ DSK ≤ 100% : Class that has finished solving the problems

d. Determination of Teacher Skills (Researchers) in the Learning Process

To determine the category of the teacher (researcher)'s ability in the learning process seen from the score obtained by the teacher (researcher) at each meeting of each cycle which was assessed by the observer or teacher of the field of study. From observations made by the observer, an analysis is performed using the formula:

$$P_i = \frac{score\ obtained}{total\ score}$$

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Where P_i = Observation result of meeting 1

(Arikunto, 2012: 198)

The criteria for the ability of the teacher (researcher) in the learning process are described in table 3 as follows:

Tabel 3. The Criteria for Teacher's Ability in Learning Process

Scores value	Teacher ability level
$3,50 \leq P_i < 4$	Very good
$3,00 \leq P_i < 3,50$	Good
$2,00 \leq P_i < 3,00$	Enough
$1 \leq P_i < 2,00$	Very bad

The success indicators in this study are:

1. A student is categorized to have finished learning if the level of students' mathematical problem solving ability seen from the score of the Problem Solving Ability Test (TKPM) reaches a value of ≥ 70%
2. One class is said to be complete learning (classical completeness) if at least 85% of students in the class the level of mathematical problem-solving ability obtained reaches a value of ≥ 70%
3. The teacher's ability to implement learning is at least well categorized. It is seen from the results of the observation assessment that the average value reaches ≥ 2.50.
4. Increased problem solving ability means an increase in the average value of the initial mathematical problem solving ability test to the mathematical problem solving ability test given after classical learning is complete.

If the success indicators in the first cycle have not been reached, then it will be proceeded to the next cycle.

FINDINGS

The improvement of students' mathematical problem solving skill among before and after the given action can be seen from the results of the Initial Ability Test (TKA), Problem Solving Ability Test I (TKPM I), and Problem Solving Ability Test II (TKPM II). The average percentage score on this test takes into consideration indicators of problem solving ability, namely: 1) understanding the problem, 2) devising a plan, 3) carrying out the plan, 4) looking back.. These indicators are then transferred into the form of scores, then reduced and presented in tables and graphs. The following are the results of the students' mathematical problem-solving ability tests before and after the action.

Table 4. Students Mathematical Problem Solving Ability Test Result

Indikator	TKA		TKPM I		TKPM II	
	Percentage (%)	Category	Percentage (%)	Category	Percentage (%)	Category
I	65,62	S	90,62	ST	95,83	ST
II	32,98	SR	70,13	S	83,68	T
III	22,91	SR	60,06	R	79,51	S
IV	15,10	SR	55,20	R	78,125	S

Sitinjak, Simanjuntak. *The Implementation of...*

The following diagram shows the increasement of students' mathematical problem solving ability starting from before the given action (TKA) to the after being given the given action cycle I (TKPM I) and cycle II (TKPM II)

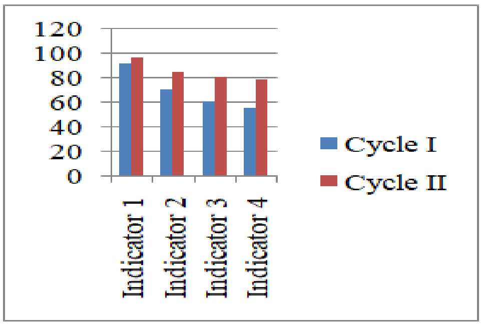

Figure 2. The Improvement of Students' Mathematical Problem Solving Ability

Based on the results of TKPM I, the percentage of students' ability to understand problems reached 90.62% (very high), the percentage of students' ability to plan problem solving 70.13% (moderate), the percentage of students' ability to implement problem-solving plans 60.06% (low), the percentage the ability of students to re-examine the solutions obtained by 55.20% (low), students who have achieved mastery learning as many as 21 students from 32 students or by 65.625%, the ability of teachers (researchers) in carrying out learning in the first cycle is 2.53 with enough categories. Reflection results from both test and nontest data in the first cycle have not yet reached maximum results. The results of the reflection as a reference to improve the results in the second cycle, so that the results achieved are more leverage. To fix weaknesses in cycle I, improvements were made in cycle II.

Based on the results of TKPM II, the percentage of students' ability to understand problems reached 95.83% (very high), the percentage of students' ability to plan problem solving 83.68% (high), the percentage of students' ability to implement problem solving plans 79.51% (moderate), the percentage the ability of students to re-examine the solution obtained by 78.125% (moderate), students who have achieved mastery learning as many as 28 students from 32 students or 87.5%. and the ability of teachers (researchers) in carrying out learning in cycle II is 3.43 with good categories. The results of reflection both from test and nontest data in cycle II have reached indicators of success, so that the next cycle does not need to be done.

Tabel 5. The Result Comparison of Cycle I and Cycle II

	Cycle I	Cycle II
The averages scores at TKPM	68,22	80,82
TKPM classical completeness	65,625% (21 students)	87,5% (28 students)

Based on Table 5, it can be seen that there is an increase in the grade average obtained by students. The average grade obtained by students in TKPM cycle I was 68.22 while in TKPM cycle II the average value obtained was 80.82. The increase in the number of students who achieved mastery learning in TKPM cycle I and cycle II also increased. The number of students who achieved mastery learning in cycle I was 21 students (65.625%) while the number of students who achieved mastery learning in cycle II was 28 students (87.5%).

DISCUSSION

From the initial test results, it was found that the ability to solve mathematical problems was still low and students had difficulty in solving mathematical problems. This can be seen from the indicators of planning problem solving, implementing problem solving, and re-checking the solutions obtained are still in the very low category. To improve students' problem solving abilities, researchers conduct research using problem-based learning models.

From the results of TKPM I, it was obtained the indicators percentage of students' ability to understand the problem 90.62% (very high), indicators planning problem solving 70.13% (moderate), indicators implementing problem solving 60.06 (low), indicators re-checking solutions obtained 55 , 20%, (low) and students who completed only 21 students out of 32 students (34.375%). The low ability of students' mathematical problem solving skills is because there are still 10 students who have not finished completing the problem solving plan and there are still 13 students who have not yet finished checking the solutions obtained. The indicator checks the solution obtained is the lowest ability students have. Student activities to solve problems or find ways

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to solve problems in group discussions also pass the tolerance time given. This is because students are not accustomed to learning by solving problems in group discussions, so teachers must pay more attention to guide students during group discussions. Students also have not reached classical completeness. Because the results in the first cycle have not yet reached the success criteria so the cycle continues.

In cycle II, an action plan was carried out to correct the existing problems in cycle I. The first meeting was held on Wednesday, July 31, 2019 with the material being taught was an arithmetic sequence pattern. The second meeting was held on Friday, August 2, 2019 with arithmetic series material. In this second cycle, the teacher emphasizes the application of Polya's problem solving steps, especially on the indicators of carrying out problem solving and re-examining the solutions obtained. In the guiding stage of the investigation, the teacher conducts scaffolding. Janneke, (2010: 272) states that: "Scaffolding is assistance given by the teacher when students are not able to do the tasks provided without assistance. Assistance provided by educators (teachers) can be in the form of instructions, warnings, encouragement, describing problems in other forms that allow students to be independent. "

In accordance line with this, Vonna et al. (2015: 229) states that: "Providing assistance must be adjusted to the Zone Proximal of Development (ZPD) of students. Scaffolding is a practice based on Vgyotsky's concept of ZPD which can be interpreted as the Closest Development Area. "

The researcher also changed the shape of the group based on the results of TKPM I, where students whose grades were not high enough were grouped with students whose grades were high with the aim that the student would help his group mates to understand the subject matter to be implemented. The researcher appoints one person in each group to be the group leader and assigns the task to the group leader to lead the group discussion. There were 8 groups formed with each group consisting of 4 students.

In cycle II students were more active than cycle I and they were able to work faster, there were no passive group members, and many began to dare to ask the teacher when they were having difficulties and it was even apparent that all groups wanted to present it. Students also have more mastery of procedures or steps in problem solving. The teacher guides many students so that finally each group can complete their investigation, and the results are satisfying.

After learning in the second cycle ends, the researcher gives TKPM II to students who work individually to see the students' problem solving abilities. Percentage of student test results on indicators understanding the problem 95.83% (very high), indicators planning problem solving 83.68% (high), implementing the problem solving plan 79.51% (moderate), re-examining the solutions obtained 78.125% (moderate), and students who have reached 28 students out of 32 students. From the test results it can be seen an increase in students' mathematical problem solving abilities. Success criteria in this study have also been reached, so that the cycle is not continued.

In line with learning theories expressed by experts and based on the results of research it can be proven that the problem-based learning model can be applied to improve students' mathematical problem solving abilities. This was also strengthened by the results of research conducted by Ifut Riati (2015) with the title "Efforts to Improve Mathematical Problem Solving Capabilities with Problem Based Learning Models for Class VIII Students of SMP IT Syuhada Mosque" showed that the application of Problem Based Learning (PBM) test results the mathematical problem solving ability of the first cycle was 76.40 then the value of the test results increased to 82.71 in the second cycle. So the average value of students has increased by 8.11.

This corroborates the researchers 'findings that by applying a problem-based learning model can improve students' problem solving abilities in the material patterns of grade VIII students of SMP Negeri 37 Medan T.A 2019/2020.

CONCLUSION

Based on the research results discussion, it was concluded that the application of problem-based learning models can improve the ability of students to solve math problems in class VIII SMP Negeri 37 Medan T.A. 2019/2020 on material number patterns. Improvement of students' mathematical problem solving abilities can be seen from the results of tests of mathematical problem solving abilities provided in the first cycle obtained by students who completed 21 students from 32 students (65.625%) with an average of 68.22 and have not yet reached classical completeness, in cycle II students who have completed increased to 28 students from 32 students (87.5%) with an average of 80.82 and have reached the classical completeness criteria because ≥ 85% of the number of students taking the test have reached completeness study.

SUGGESTIONS

Based on the conclusion above, the researcher gives suggestion to:

1. The mathematics teacher, in teaching the material about numerical patterns or other suitable topics, it is better to use the Problem Based Learning model (PBM) in accordance with cycle II actions. The application of the PBM model requires quite a long time so the teacher must be more careful in managing time.
2. The researchers for those who are interested in conducting research with the application of the same model as this research, it is recommended to develop this research better so that in the future it is expected that the results will be even better.

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