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IMPLEMENTATION OF SCIENTIFIC APPROACH TO INCREASING JUNIOR HIGH SCHOOL STUDENTS' MATHEMATICAL PROBLEM SOLVING ABILITY

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ABSTRACT

This research aims to analyze the learning of class VIII students at Nur Al Rahman Middle School in Cimahi City on linear equations of two variables system material using a scientific approach. In learning mathematics using a scientific approach, especially in linear equations of two variables system material, it is hoped that students can play an active, creative, skilled, and noble character, find and solve problems. The research method used was classroom action research with the subjects studied being 15 class VIII students. This research was conducted for 2 cycles with data collection techniques, namely observation, documentation, and tests in the form of essays that match the indicators of mathematical problem-solving ability. The increase in students' mathematical problem-solving abilities can be seen from the achievement of the percentage of test questions on the problem-solving abilities of the 2 cycles carried out. The instrument used in the research results found that the problem-solving ability skills in linear equations of two variables system material were 33% for cycle I, then 80% in cycle II. This means that learning mathematics in linear equations of two variables system material using a scientific approach has a better influence on students' mathematical problem-solving.

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INTRODUCTION

Education is an effort to form human resources that can improve the quality of life. Therefore, improving the quality of education is something that must be done irrationally. In the process of learning science, mathematics is considered the queen or mother of knowledge, namely the

source of other knowledge. In other words, many sciences whose discoveries and developments depend on mathematics (Aisyah, Yuliani, & Rohaeti, 2018).

In Indonesia, education is given top priority. This is marked by the government's efforts to provide an education budget of 20% of the State Revenue and Expenditure Budget (APBN). This refers to the 1945 Constitution article 31 paragraph 1 which states that every citizen has the right to education. Mathematics is used by every human element, be it housewives, employees, traders and others, mathematics is part of education and is made one of the compulsory subjects in schools. This is in line with the statement (Aripin, 2015) that mathematics is a human activity. Everyone carries out mathematical activities, starting from housewives, traders, employees, students, mathematicians, etc., according to their individual needs. In mathematics subjects students must be able to master related subject concepts, so that students can understand a subject matter in mathematics to be able to understand and think creatively in solving the problems they face (Aripin & Purwasih, 2017). One of the objectives of learning mathematics in Kurtilas and KTSP 2006 includes understanding mathematical concepts and their relationships and applying them in various problem solving precisely and thoroughly (Hendriana, 2017). One of the abilities in mathematics is the ability to solve problems (Hidayat & Sariningsih, 2018).

Problem solving ability is one of the objectives of learning mathematics that must be achieved by students. In everyday life, consciously or unconsciously, every day we are faced with various problems that require problem-solving skills. By solving problems students will learn to devise appropriate strategies to solve the problems they face. problem solving is considered as the heart of learning mathematics in line with Burchartz & Stein's statement (Yazgan, 2015) problem solving always plays an important role, because all mathematical creative activities require problem solving actions.

To find out students' mathematical problem solving abilities, they must be faced with mathematical problems (mathematics questions). By facing math problems, students will try to solve problems using all the schemes that are in them. Problem solving involves interaction between schemas (knowledge) possessed by students and application processes that use cognitive and affective factors in solving problems (Webb, 1979).

The system of two-variable linear equations is one of the mathematics subject matter studied at the junior high school level, especially in class VIII. The system of two-variable linear equations is material that students must understand, because SPLDV material will be prerequisite material for material to be studied later, but the results of Rahayu Ningsih and Qahar's research show that students' ability to solve problems related to SPLDV, especially questions that are in the form of the story is classified as less than expected (Indriani, 2018). Therefore, an appropriate approach is needed that can increase student motivation and learning outcomes in SPLDV material.

The researcher conducted interviews at SMP IT Nur Al Rahman in Cimahi City and interviewed the mathematics teacher who taught there, the results of the interviews obtained by the teacher had complaints that during the learning process the teacher gave teaching that was not focused on students so that students had difficulty understanding the material that had been explained by the teacher . In SPLDV material students are required to try to independently solve problems, be it problems in contextual form or mathematical models, because when solving SPLDV problems students must be able to construct themselves in order to be able to choose the right method to use for a given problem. The learning model applied by the teacher is a lecture model, so students are less active during class learning. In order to achieve the goals of learning mathematics, one of which is the ability to solve mathematical problems, it is necessary to provide new innovations to LKPD which aim to construct students' knowledge. The innovation

carried out in the LKPD is in the form of using a learning model or strategy which is used as the basis for developing LKPD. LKPD will be more optimal if it is based on one of the learning models or strategies that have the aim of increasing students' problem-solving abilities and teaching how to solve a problem. One model or learning strategy that can be used to achieve this goal is through a scientific approach (Zulfah et al., 2018). According to Polya (Lismaya, 2019), the model used in learning mathematics and which is very important in developing mathematical abilities is a scientific approach.

According to Hosan (Septiety & Wijayanti, 2020) revealed that the scientific approach means one of the stages specifically made to make students active in learning by constructing. Meanwhile, according to Daryanto (Najmul & Wadi Hairil, 2020) the scientific approach has several objectives which include (1) assessing students' intellectual abilities (2) directing students to be able to solve mathematical problems (3) instilling the importance of learning in students (4) learning outcomes that can maximized (5) train students' self-confidence (6) develop student character.

Based on the purpose of the scientific approach, namely solving mathematical problems, it can be said that the scientific approach is used to assist students in understanding the material of the system of two-variable linear equations (SPLDV). This is in accordance with the results of research (Azzahro, Dian, & Sujiran, 2019) which revealed that a scientific approach can make it easier for students to construct understanding in solving mathematical problems, especially the material of the two-variable linear equation system (SPLDV).

Polya in (Marlina, 2011) defines four steps that can be taken so that students are more focused in solving mathematical problems, namely understanding the problem, devising plan, carrying out the plan, and looking back which is defined as understanding the problem, making plans, implementing plans, and look back at the results obtained. According to (Sukayasa, 2012) with Polya's steps students will get used to working on questions that do not only rely on good memory, but students are expected to be able to relate them to real situations they have experienced or have thought about. Students can also have traits that can appreciate the usefulness of mathematics in life, namely having curiosity, attention and interest in learning as well as being tenacious and confident in problem solving. According to (Sukayasa, 2012) problem solving phases according to Polya are more popularly used in solving mathematical problems than the others. Perhaps this is caused by several things, including: (1) the phases in the problem solving process that Polya proposed were quite simple; (2) the activities in each phase stated by Polya are quite clear and; (3) the phases of problem solving according to Polya are commonly used in solving mathematical problems.

Based on the background of the problems above, the formulation of the problem in this research activity is obtained, namely, can a scientific approach improve the mathematical problem solving skills of IT junior high school students in Cimahi on SPLDV material? From the formulation of the problem, there is a goal of this research, which is to find out whether a scientific approach can improve the mathematical problem solving skills of SMP IT students in Cimahi City on SPLDV material.

METHOD

This research is a Class Action Research (PTK) or Class Action Research (CAR). This research is used to provide the right strategy in delivering material that will be used in learning so as to motivate students to continue to be active when learning takes place. The model used in Classroom Action Research (CAR) is the spiral model. Kemmis & Taggart (Arikunto, 2006) explains that the spiral model consists of four stages, namely planning, implementing actions, observing or observing and reflecting.

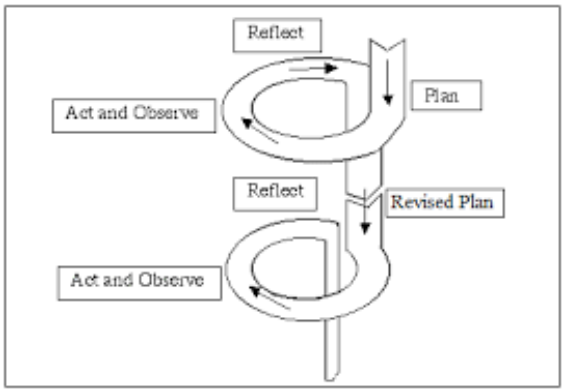

Figure 1. Research Spiral Model from Kemmis & Taggart

This type of research is descriptive qualitative which is to analyze students' abilities in solving problem solving questions aimed at obtaining an overview of students' mathematical problem solving abilities. The subjects in this study were class VIII students at SMP IT Nur Al-Rahman Cimahi consisting of 15 students. The time for carrying out this research is in November in semester I of the 2022/2023 Academic Year. The research instrument used consisted of tests in this study to measure students' skills in solving word problems. (1) The test in the researcher contains questions in the form of descriptions which have been checked for validity, reliability and distinguishing power. The form of description questions was chosen to collect data regarding students' problem-solving abilities, (2) anget used was a mathematical disposition questionnaire (3) The observation method was carried out by researchers during the learning process which aims to observe the process of implementing mathematics learning.

Student answers were analyzed through four indicators, namely (1). Indicators of understanding the problem include: (a) knowing what is known and asked about the problem and (b) explaining the problem according to their own words. (2). Indicators of making plans include: (a) simplifying problems, (b) being able to make experiments and simulations, (c) being able to find sub-objectives (things that need to be looked for before solving problems), (d) sorting information. (3). The indicators of carrying out the plan include: (a) interpreting the problems given in the form of mathematical sentences, and (b) implementing strategies during the process and calculations. (4). Indicators of looking back include: (a) checking all the information and calculations involved, (b) considering whether the solution is logical, (c) looking at other alternative solutions, (d) reading the questions again, (e) asking yourself whether the questions already answered.

The stages that must be achieved by students in each indicator, including:

1. The stage of understanding the problem. This stage has the goal of knowing the students' ability to understand the problem of collecting information on the problem and then converting it into a mathematical model to determine the value.
2. Stage of planning completion. This stage has the goal of knowing the ability of students to choose a strategic plan in solving the appropriate problem and then develop procedures for solving the problem.
3. The stage of implementing the plan. This stage has the goal of knowing the ability of students to carry out the plans that have been compiled to get the right results.
4. Check back stage. Then at this last stage the aim is to find out the ability of students to identify problems, collect all information, and conclude solutions to problems.

The instruments used in the test are as follows:

Problem 1: Bayu was told by his mother to go to the market to buy two types of fish, single and tuna, his mother only gave Rp. 30,000 and all of them had to be

bought for both types of fish. At a fish selling place, Bayu found the following prices:
The price for 6 single fish and 3 tuna is Rp. 24,000
The price for 8 single fish and 2 tuna is Rp. 20,000
If each type of fish is the same size, how many fish of both types can Bayu buy?

Problem 2: A trader sells all the skipjack tuna and mangrove crabs he gets for IDR 600,000. The price of 2 mud crabs is IDR 12,000 and the price of 3 skipjack tuna is IDR 60,000. If he only sells 2/5 of the mangrove crabs and 1/3 of the skipjack tuna, then he can collect as much as IDR 110,000. How many each of skipjack tuna and mangrove crabs did the trader sell?

Problem 3: The number of women compared to the number of men who attend the launching ceremony for a motorboat is 2 : 5. If 6 of the men present leave the event before it is finished, then the ratio of the number of women and men present will be 1 : 2. How many people attend attend the ceremony before anyone left the event?

This problem-solving ability research sheet was prepared by researchers adapted from the TPMM scoring referring to problem-solving indicators from Polya (Marlina, 2011). The data analysis technique was carried out through 3 (three) stages, namely checking the results of student answers, presenting test data, and drawing conclusions from the research. To find out the percentage of each type of answer error, use the formula:

$$P = \frac{n}{N} x100\%$$

Information :
Q: Percentage
n : Total Score
N : Maximum Score

RESULTS AND DISCUSSION

Results

This study used classroom action research which consisted of 2 cycles, where each cycle consisted of the stages of planning, implementing the action, observing the results of the action and reflecting. At the planning stage of cycle I, a field survey was carried out to see what material was being studied with the model used by the teacher, the results obtained from the field survey were the material being studied, namely the Two-Variable Linear Equation System (SPLDV) material. After that, the class action was carried out by teaching SPLDV material with a scientific approach and also carrying out tests in the form of essays in accordance with the indicators of mathematical problem solving ability. The next stage was to observe class action by examining student answers. reflection. The following table shows the percentage of students in the problem-solving ability level based on the Polya model.

Table 1. Ability Level of Cycle I Students

NO	POLYA MODEL STAGES	STUDENT ABILITY LEVEL					
		High		Medium		Low	
		N	%	N	%	N	%
1	Understanding Problems	5	33,33%	4	26,66%	6	40,00%
2	Create a settlement plan	2	13,33%	3	20,00%	10	66,66%
3	Execute the settlement plan	0	00,00%	5	33,33%	10	66,66%
4	Check again	1	6,66%	2	13,33%	12	80,00%

Based on the results of the analysis carried out, it can be seen in table 1 that the highest percentage tends to be at a low ability level, the stage of understanding problems in students at a relatively low ability level is 40.00%, because students answer tend to be direct in solving problems without writing down anything understood first. In making a settlement plan, students who belong to the lower abilities are higher, namely 66.66%. This shows that students have not been able to develop plans that will be used in solving problems. The percentage of students in the problem-solving ability level at the stage of carrying out the settlement plan is also at a low level, namely 66.66% and there are no students who are in high ability. And for the percentage of students in checking again is very large at a low level of 80.00%. The following is one of the test results on students in cycle I who are at a low ability level.

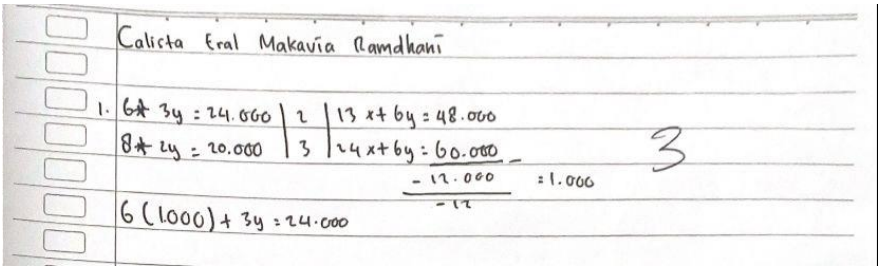

Figure 2. Results of cycle I student answers

In figure 2, the results in cycle I were still not satisfactory, students still could not solve the problems on the test questions given. It can be seen that students can only achieve indicators of understanding the problem but cannot continue with answers, so other indicators of solving mathematical problems are not achieved. Students who are classified as having high abilities reveal that at the stage of carrying out the settlement plan, high accuracy is needed. Because if you do just a little wrong it will make all the answers wrong. While students with moderate abilities revealed that at the stage of carrying out the completion plan there were many steps that had to be taken from eg, changing into a mathematical model, eliminating, and substituting. Even if it is wrong to change from a verbal sentence to a mathematical model, then the end result can be all wrong. Then do the reflection by doing the second cycle in order to get satisfactory results. So that researchers can see how far the problem-solving abilities of students are by using this scientific approach in the matter of the Two-Variable Linear Equation System (SPLDV).

In the second cycle, the researcher gave LKPD with completion steps using a scientific approach to the SPLDV material. In learning students are asked to work in groups, when working on the LKPD students are assisted by researchers in the learning process. After doing the learning, the students took the test again in the form of an essay in accordance with the indicators of mathematical problem-solving ability and the results of the students were obtained in the second cycle. The following is a table of student percentages in the level of problem solving ability in cycle II with the Polya model.

Table 2. Ability Level of Cycle II Students

NO	POLYA MODEL STAGES	STUDENT ABILITY LEVEL					
		High		Medium		Low	
		N	%	N	%	N	%
1	Understanding Problems	12	80,00%	2	13,33%	1	6,66%
2	Create a settlement plan	8	53,33%	4	26,66%	3	20,00%
3	Execute the settlement plan	6	40,00%	4	26,66%	5	33,33%
4	Check again	4	26,66%	7	46,66%	4	26,66%

Based on table 2, we can see that students in the SPLDV learning evaluation test increased. Here it can be proven that these students experienced an increase in mathematical problem solving abilities according to the indicators given. The highest percentage tends to be at a high level of ability, the stage of understanding problems in students at a relatively high level of ability, namely 80.00%, because students are able to answer directly solving problems by writing down what they understand first. In making a settlement plan, students who are classified as high ability become 53.33%. This shows that students are able to develop plans that will be used in solving problems. The percentage of students in the problem-solving ability level at the stage of carrying out the settlement plan is also relatively higher at the high level, namely 66.66%, although there are still students who are at medium and low levels. And the percentage of students who checked again was at a moderate level, namely 46.66%. Here is one of the test results on students in cycle II.

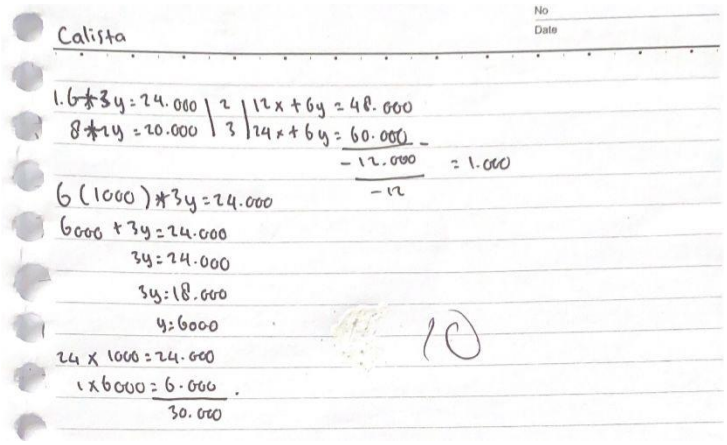

Figure 3. Results of cycle II student answers

In Figure 3 above there are the results of students' work on the Two Variable Linear Equation System (SPLDV) material. There it can be seen that students have been able to work on the questions in accordance with the indicators given so that there is an increase in students working on these questions compared to the results in cycle I. cycle I, then this research is sufficient until cycle II.

Discussions

From the data shown above the results of observations made to students of IT Nur Al Rahman Middle School on student learning outcomes, it was found that there were many students with high, medium and low ability levels and it can be seen from the percentages in the table above, this shows that learning using a scientific approach in SPLDV material carried out in the first cycle was unsatisfactory because it did not match the desired expectations, namely students with low ability levels were more than students who had high ability levels.

In the next stage, after carrying out learning in the first cycle, the results of which were unsatisfactory, the researcher reflected, namely the researcher evaluated the learning in cycle I, the researcher concluded that there were weaknesses in cycle I and there were still many students who had low ability levels. From the results of the tests that have been given to students which show the percentage of students who have not achieved completeness in accordance with the problem solving indicators, so the researchers added an approach to the learning process, namely a scientific approach. Then all the deficiencies that existed in cycle I can then be determined in cycle II.

This was done because the researchers felt that in the learning process in cycle I, many students were at a low level of ability and also many did not have the motivation to learn and felt bored

with the learning approach that they were used to getting from math class teachers, so that learning outcomes The results obtained for achieving problem-solving skills in cycle I were unsatisfactory, as seen from the percentage of students who were still at a low level of ability. Therefore, researchers felt the need for improvement in cycle II to eliminate the boredom experienced by students and to increase students' motivation towards learning. In mathematics SPLDV material, the goal is to get better student learning outcomes in the two-variable linear equation system material, so further action is needed to achieve the expected final result, namely achieving an increase in problem-solving skills on student learning outcomes in SPLDV material in the form of word problems.

Based on reflection on the actions of cycle I and through discussions with the teacher who taught them, the researcher and the teacher concluded that grade VIII IT Nur Al-Rahman Middle School students actually had an understanding of this material, but the teacher said that the lack of seriousness of students' interest in learning caused the results to be lacking. satisfactory, from that rationale researchers and teachers agree that there must be the right approach so that students' interest in learning increases. The researcher took the initiative to add an approach to learning, namely a scientific approach. So that the learning outcomes that were not as expected in the previous cycle were better, the researchers finally took the initiative to add learning videos to complement the scientific approach that had been applied to learning in the first cycle.

The test results show several completion plans written by students in solving the problems given. From the test results, the average student solves problems with strategies for making mathematical models, eliminating, and substituting. Problem solving strategies and steps based on the Polya model were not previously taught to students so that students did not follow the four stages of problem solving according to Polya. Students tend to directly plan problem solving and carry out problem solving without writing down what is understood in the problem, while some students do not write down how to plan the solution first. Overall students can solve problems using the Polya model. Solving problems with the Polya model makes it easier for students to solve problems. This is relevant to research conducted by (Komariah, 2011) as a whole student activities during learning activities through the application of problem solving the Polya model are in the good category.

Based on the data from the analysis of answers to written tests and interviews, it was shown that in general, students of all levels of mathematical ability were able to understand the problem very well, both students with high (T), medium (S) and low (R) abilities were able to meet the ability indicators problem solving, namely understanding the problem very well, being able to identify the elements that are known, the elements that are asked, and the adequacy of the elements needed to solve mathematical problems in SPLDV material. So as to be able to mention what is known, and what is asked. This is relevant to research conducted by (Rahmawati, 2017) on the application of the Polya model and is in a very good category.

Student test results also show several settlement plans written by students in solving the problems given. From the test results, the average student solves problems with strategies for making mathematical models, eliminating, and substituting. Problem solving strategies and steps based on the Polya model were not previously taught to students so that students did not follow the four stages of problem solving according to Polya. Students tend to directly plan problem solving and carry out problem solving without writing down what is understood in the problem, while some students do not write down how to plan the solution first. Overall students can solve problems using the Polya model. Solving problems with the Polya model makes it easier for students to solve problems. This is relevant to research conducted by (Najmul & Wadi Hairil, 2020) overall student activity during learning activities through the application of problem solving the Polya model is in the good category.

Based on the results of the researcher's analysis, when viewed from the learning process and student learning outcomes using a scientific approach has increased, the low ability of students' mathematical problem solving in SPLDV material is caused by the way the teacher provides teaching that is not focused on students so that students find it difficult to understand the material that has been explained by the teacher . In SPLDV material students are required to try to independently solve problems, be it problems in contextual form or mathematical models, because when solving SPLDV problems students must be able to construct themselves in order to be able to choose the right method to use for a given problem. We can see from Tables 1 and 2 that there is an increase in students' abilities obtained in solving SPLDV problems.

CONCLUSION

Based on the results of the research and discussion that has been carried out on the actions of the two cycles, we can see that the scientific approach can improve students' mathematical problem solving abilities. This can be proven in the percentage of cycle I on all indicators at a low level, while in cycle II there is an increase in all indicators to a high level.

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