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Learning Effectiveness Based on the Problem of Solving Problems in SMP Negeri 8 Tanjungbalai

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Abstract
This study aims to determine whether there is the effectiveness of problem-based learning on students' mathematical problem solving abilities. This research is semi experimental research, this study population is VII students of SMP Negeri 8 Tanjungbalai who accredited B. Then randomly selected two classes. The experimental class is treated by the problem-based learning model and the control class is treated by the usual learning model. The instrument used is the test of mathematical problem solving ability. Data analysis was performed by covariance analysis. The results showed that the effectiveness of problem-based learning on students' mathematical problem solving abilities. It can be seen from the result of covariance analysis for Fhitung = 4,25> Ftabel = 3,99. The regression equation constant for problem based learning model is 58,74 is bigger than ordinary learning model that is 56,60.
Keywords: Effectiveness, Problem Based Learning, and Problem Solving Ability

1. Introduction

The right education is education that prepares students to be qualified and reliable human resources to be critical, logical and innovative in dealing with and solving every problem that it faces and can form a good human character of Indonesia, and is expected to be a man who believes and pious , noble character, personality, advanced, intelligent, creative, skilled, disciplined, professional, responsible, productive, healthy physically and spiritually.

Education is also useful for the development of students in order to become a human resource that can lead Indonesia to a leading position, at least parallel to other countries, both in economic development, politics, and socio-culture. This can happen because education provides an enabling environment for students to develop their abilities optimally, so that they can be useful for their own needs as well as the needs of the surrounding community (Hamid, 2007).

Conditions like these are challenges that educated people have to face and have the ability to acquire, select, manage, and follow up the information to use in a dynamic, challenging, and competitive life. This all demands that we have critical, creative, logical, and systematic thinking skills.

National Research Council (NCTM, 2000), stated "*Mathematics is the key to oppurtunity*." Mathematics is born out of human need. Mathematics is a tool that can clarify and simplify an abstract situation or situation into concrete through language and mathematical ideas and generalizations, to facilitate problem solving, because the way of thinking developed in mathematics uses consistent and accurate reasoning rules so that math can be used as a very effective thinking tool to look at various problems including outside mathematics itself.

So far, math learning has not been impressed with the substance of problem solving. Teachers generally tend to present the learning process by using teacher-centered ordinary learning. Because teacher-centered learning activities, such a learning system is a one-way learning system that makes learning activities monotonous. Furthermore, students also become bored so it is not surprising that many students who do not understand in completing the task and understand the material. Students tend to be directed to memorize mathematical concepts so that the ability of students in solving problems is very less.

This can be seen from the results of Trends in International Math and Science survey in 2007 conducted by the Global Institute shows only 5% of Indonesian students who are able to do the question of categorizing high; whereas Korean learners can reach 71 percent. In contrast, 78 percent of Indonesian students can work on low-caliber memorabilia, while Korean students are 10 percent. Other data disclosed by Programme for International Student Assessment (PISA), the results of his study in 2009 put Indonesia at the bottom of the top 10, from 65 countries participating in PISA, in this framework the need for curriculum change and development, beginning with the arrangement of the four elements of national standards, namely the graduation competency standard, content standards, process standards, and assessment standards.

Trianto (2007), the main problem in learning in formal education today is still low absorption of learners. This is evident from the average learning outcomes of students who are always very concerned. This achievement is certainly the result of learning conditions that are still conventional and do not touch the realm of the learner's dimension itself, that is how to actually learn it. Conventional learning results in a tended classroom atmosphere *teacher-centered* so students become passive.

Based on this, the teacher focuses on the mathematics learning efforts to pour the knowledge of math as much as possible to students. Given the above weaknesses, it appears that mathematics learning during this time

seems less meaningful and less provide the independence of learning to students to be directly involved in the formation of mathematical knowledge so they are more dependent on the teacher. Whereas the desired is an independent Indonesian able to generate creative ideas and ideas and can use mathematics and mathematical thinking patterns in everyday life and in studying various science in accordance with the objectives of mathematics education for primary and secondary education.

To obtain learning outcomes in accordance with the objectives of learning requires the ability to choose the appropriate learning approach, because the learning approach is an important thing that must be considered in a teaching and learning process.

The low results achieved in this national evaluation of mathematics suggests that the quality of students' understanding in mathematics is relatively low. Understanding in mathematics has long been an important issue. Not a few studies and studies in learning mathematics concentrate and trying to reach understanding, but it is believed by most that to achieve understanding and math interpretation is not as easy as turning the palm of the hand. One of the causes of the poor quality of students in mathematics junior school and high school is because because in the process of learning mathematics teachers are generally too concentrated on the practice of solving problems that are more procedural and mechanistic than understanding. In the learning activity the teacher usually explains the concept informatively, gives examples of questions, and gives practice questions.

Ordinary mathematical learning is characterized as: teacher-centered, teacher explains math through *chalk-and-talk*, passive students, questions from students rarely appear, berorientasi on one correct answer, and the activity of the class that is often done just to record or copy. Such learning activities do not accommodate students' ability development in problem solving, reasoning, connections, and mathematical communication. As a result, the students' high cognitive abilities are poor because the usual learning activities are only encouraging students to think at a low level of governance.

This condition is clearly shown by the results of international surveys *The Third International Mathematics and Science Study (TIMSS)* that the ability of junior secondary students in Indonesia to solve non-routine problems (mathematical problems) is very weak, but relatively good in solving problems about facts and procedures. This proves that the mathematical problems that demand high-mindedness of Indonesian junior high students are far below the international average, even with some of the neighboring countries, such as Malaysia, Singapore and Thailand. In view of these circumstances, efforts to improve the quality of learning especially in the development of students' high-order thinking skills are essential and essential.

Addressing the problems that arise in learning mathematics in schools, one alternative solution is to improve the quality of learning through problem-based learning. The main focus in improving the quality of this learning is to position the role of teachers as designers and learning organizers so that students have the opportunity to understand and interpret mathematics through learning activities.

Learning with a problem-based learning model is one of student-centered learning and a teacher as a facilitator. Problem-based learning is teaching that uses real-world problems as a context for students to learn critical thinking and problem-solving skills, and to acquire knowledge and concepts that are essentially from the subject matter. The problem is to motivate the students, to arouse students' learning arousal, to increase student learning activities, to focus on solving problems so that students are interested to learn, find concepts that are appropriate to the subject matter, and with the interaction of knowledge sharing between students and students with teachers, as well as students with the environment students are invited to be active in learning.

One of the main characteristics of the problem-based learning model is that it focuses on interdisciplinary linkages, with the intent of the problems presented in problem-based learning may be centered on a particular subject but the student can review the issue from many facets or associate with other disciplines to solve it. With the teaching of the problem-based learning model encourages students to learn actively, passionately and students will be more open to mathematics, and will realize the benefits of mathematics because it is not just focused on a particular topic being studied.

Problem solving is the highest type of learning compared to other types of learning. According to Slameto (2003), problem solving is seen as a process to determine the combination of a number of rules that can be applied in an effort to cope with the new situation. Problem solving skills are very important for students and their future. The learning scholars agree that problem-solving abilities within certain limits can be established through the field of study and the discipline that is taught. So it can be concluded that the ability to solve mathematical problems is the ability that must be owned by students to be able to understand the problem, plan the solution, solve the problem, and re-examine the results of a given mathematics.

In solving the problem required readiness-readiness, creativity, knowledge and abilities and applications in everyday life. Problem solving as an activity to solve story problems, solve problems that are not routine, apply math in everyday life or other circumstances, and prove or create or test conjecture. Problem solving is one type of intellectual skill as said by Gagne et al., Higher in degree and more complex than other types of intellectual skills. Gagne et al. Pointed out that in solving problem solving requires complex rules or high-level rules, and high-level rules can be achieved after mastering defined rules or concepts. Likewise, defined rules and concepts

can be achieved if supported by a concrete understanding of concepts. After that to understand concrete concepts are also required skills in distinguishing problem solving.

Therefore, problem solving can be seen from various senses, that is as an effort to find the way out which is done in reaching a goal. In addition, problem solving is a problem that has not been known or known, and contains understanding as a process of thinking high and important in the process of learning mathematics.

Problem solving is a fundamental progress that must be mastered by learners. Even this is reflected in the concept of competency-based curriculum. The demand for problem-solving skills is also emphasized in the curriculum, namely as basic competencies that must be developed and integrated into a number of appropriate materials.

Russefendi (2012), problem-solving skills are essential in mathematics, not only for those who later will study or study mathematics, but also for those who will apply them in other fields of study in everyday life. Based on some of the above opinions, problem-solving abilities must be possessed by students to train in order to be familiar with problems, math problems, problems in other fields of study, or problems in more complex daily life.

Students trained with problem solving will be skilled in selecting relevant information, then analyzing it and finally researching the results. The skills will also generate intellectual satisfaction in students, increase students' intellectual potential, and train students how to search through discovery.

The low value of students' mathematics should be reviewed from the five aspects of general mathematics learning formulated by the National Council of Teachers of Mathematics (NCTM, 2000), outlining learners to learn math through understanding and actively building on prior knowledge. To achieve this, the learning of mathematics formulated five general objectives are: first, learn to communicate; second, learn to reason; third learn to solve problems; fourth, learn to associate ideas; and fifth, the formation of a positive attitude toward mathematics.

Math lessons have been less concerned with the development of communication skills and mathematical problem solving. In fact, these two capabilities are very important, because in everyday life everyone is always faced with a variety of problems that must be solved and demands the communication skills of students to find solutions to the problems encountered. Communicating and problem solving skills enable us to overcome life challenges.

To develop problem-solving skills in mathematics learning, teachers should seek and use appropriate learning models that can provide opportunities and encourage students to train and develop problem-solving skills.

2. Research Methods

Accreditation rating of SMP Negeri 8 Tanjungbalai based on school evaluation that can be seen in Table 2.1 below:

Table 2.1.
Results Evaluation of SMP Negeri 8 Tanjungbalai

No	Rated Aspect	Value
1	Curriculum and learning	71,25
2	School administration and management	62,00
3	Organization and school institutions	94,00
4	School facilities and infrastructure	72,00
5	Manpower	72,00
6	Financing and funding	66,00
7	Learners	79,00
8	Community participation	88,00
9	School environment and culture	68,00
	Total	**72,35**

(Source: Data of Accreditation Board of North Sumatera Province School/Madrasah, 2010)

Criteria:

$85 \leq$ value ≤ 100 : A (very good)

$70 \leq$ value < 85 : B (good)

$56 \leq$ value < 70 : C (enough)

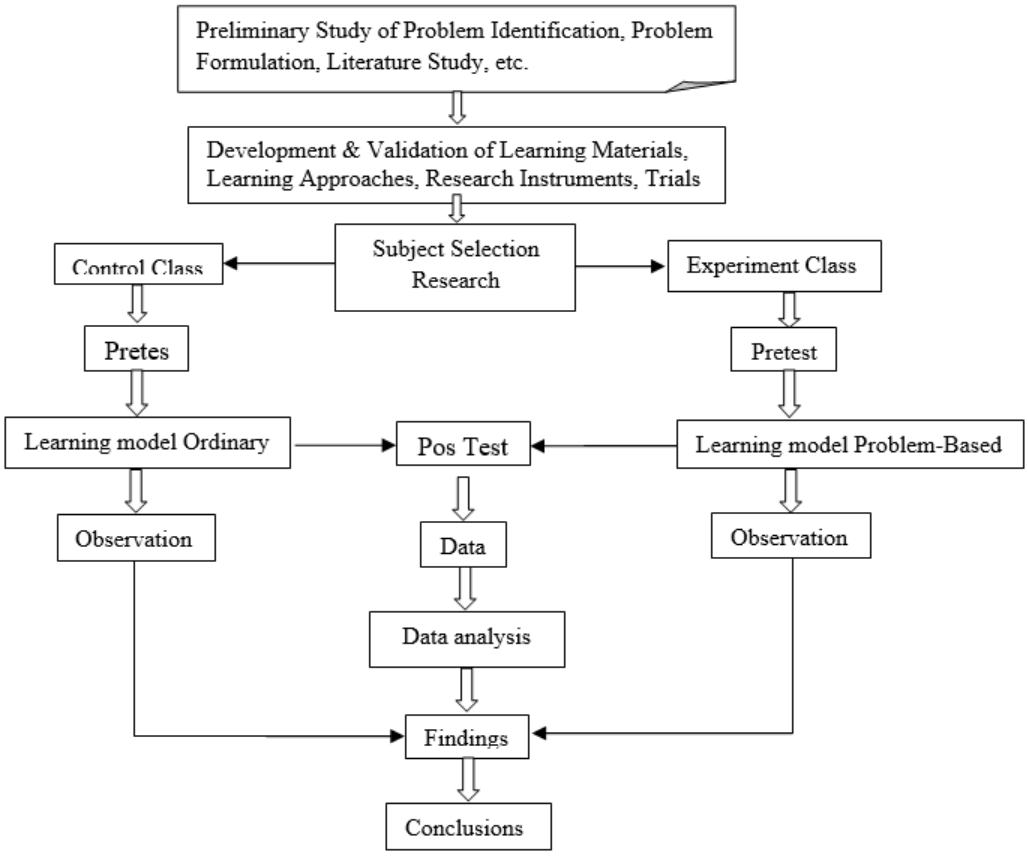

Figure 2.1. Flowchart of research implementation

3. Results and Analysis

Descriptive Analysis of Problem Solving Ability

The problem solving test is done twice, the first and the final test with different problems. Preliminary and final test followed 66 students so that in the data analysis subject to this research is 66 people who are taking the initial test and the final test. The following descriptive statistical analysis.

Initial Ability Test Results Problem Solving Student

Quantitatively, the initial ability level of problem solving can be seen in Table 3.1 below:

Table 3.1

Early Mathematical Problem Solving Ability of Students Quantitative Model Classroom Learning

No	Value Interval	The number of students	Percentage (%)	Assessment Category
1	$0 \leq$ SPMM < 45	12	36,36	Very less
2	$45 \leq$ SPMM < 65	16	48,48	Less
3	$65 \leq$ SPMM < 75	5	15,15	Enough
4	$75 \leq$ SPMM < 90	0	0	Good
5	$90 \leq$ SPMM ≤ 100	0	0	Very good

From Table 3.1, the initial problem-solving abilities in the usual learning model class found that, the number of students who got the score was less as much as 12 people (36.36%), which had less category as many as 16 people (48.48%), enough as many as 5 people (15.15%), good and excellent as much as 0 people (0%). For more details can be seen in Figure 3.1

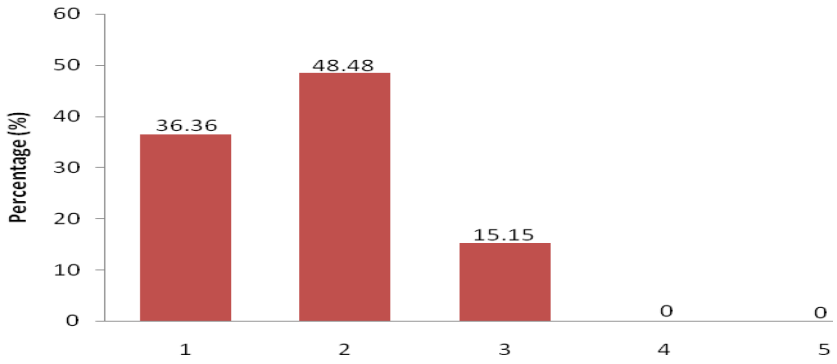

Fig. 3.1. Initial Ability Level of Mathematical Problem Solving Students in the Class of Ordinary Learning Model

Table 3.2
Early Mathematical Problem Solving Problem Model Class
Quantitative Problem Based Learning

No	Value Interval	The number of students	Percentage (%)	Assessment Category
1	0 ≤ SPMM < 45	11	33,33	Very less
2	45 ≤ SPMM < 65	15	45,45	Less
3	65 ≤ SPMM < 75	7	21,21	Enough
4	75 ≤ SPMM < 90	0	0	Good
5	90 ≤ SPMM ≤ 100	0	0	Very good

From Table 3.2, the initial problem-solving abilities of the problem-based learning model class found that the number of students who scored less than 11 people (33.33%), who had less than 15 (45.45%) has sufficient category value as many as 7 people (21,21%), which have good category value as much as 0 person (0%), which has very good category 0 0 (0%). For more details can be seen in Fig. 3.2.

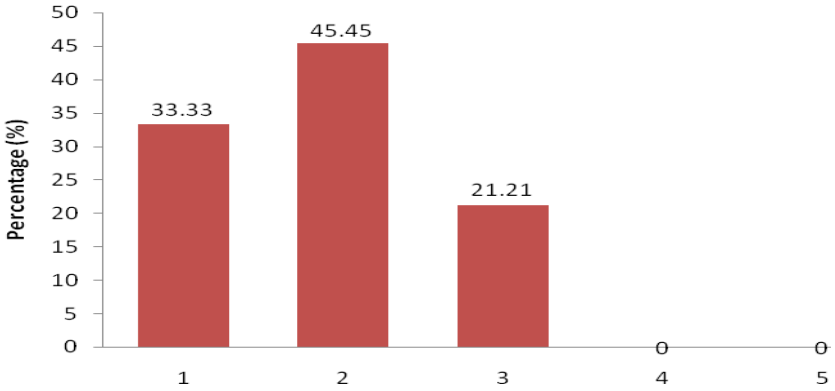

Fig. 3.2. Initial Ability Level of Mathematical Problem Solving for Students in Problem-Based Model Class

Results of Student Problem Solving End Test

Quantitatively, the final level of problem solving can be seen in Table 3.3 below:

Table 3.3
End Ability of Mathematical Problem Solving for Class Students
Ordinary Learning Model Quantitatively

No	Value Interval	The number of students	Percentage (%)	Assessment Category
1	0 ≤ SPMM < 45	0	0	Very less
2	45 ≤ SPMM < 65	8	24,24	Less
3	65 ≤ SPMM < 75	10	30,30	Enough
4	75 ≤ SPMM < 90	15	45,45	Good
5	90 ≤ SPMM ≤ 100	0	0	Very good

From Table 3.3 problem-solving abilities in the normal learning model class, it is found that the number of students who get the score is less than 0 people (0%), which has less category as many as 8 people (24.24%),

which has enough category value of 10 people (30.30%), which has a good category category of 15 people (45.54%), which has a very good category 0 people (0%). For more details can be observed Fig. 3.3.

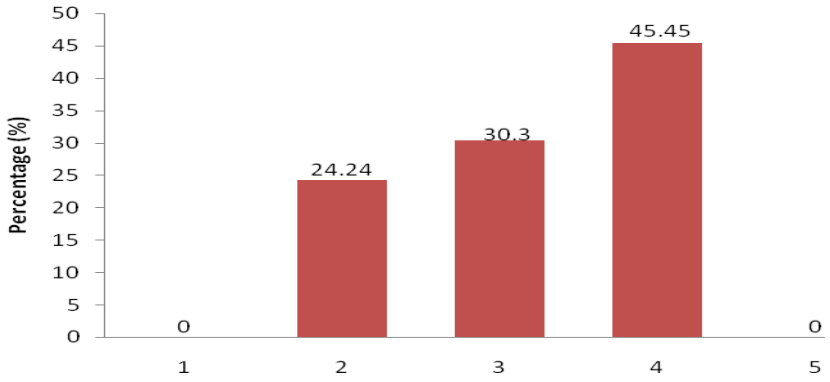

Fig. 3.3. Level Ability of the Student Mathematical Problem Solving Test in the Class of Ordinary Learning Model

Table 3.4.
Final Ability of Mathematical Problem Solving Classes of Quantitative Models Problem Based Learning

No	Value Interval	The number of students	Percentage (%)	Assessment Category
1	0 ≤ SPMM < 45	0	0	Very less
2	45 ≤ SPMM < 65	4	12,12	Less
3	65 ≤ SPMM < 75	8	24,24	Enough
4	75 ≤ SPMM < 90	21	63,63	Good
5	90 ≤ SPMM ≤ 100	0	0	Very good

From Table 3.4 final problem-solving abilities in the problem-based model learning class, it is found that the number of students who get the score is less than 0 people (0%), which has less category as many as 4 people (12.12%), which has enough category value as many as 8 people (24.24%), which has a good category score of 21 people (63.63%), which has a very good category 0 people (0%).

The classical level of final problem solving abilities Mathematics in the class of problem-based learning model obtained by 87.87%. When reviewed from the final test level of problem-solving skills in the class of ordinary learning model only amounted to 75.75%. While the level of problem-solving ability that is planned in classical is ≥ 80% of the number of students who take the test has a minimum value of sufficient category. By looking at these results then the results of research on the class of problem-based learning model increased. For more details can be seen in Fig. 3.4.

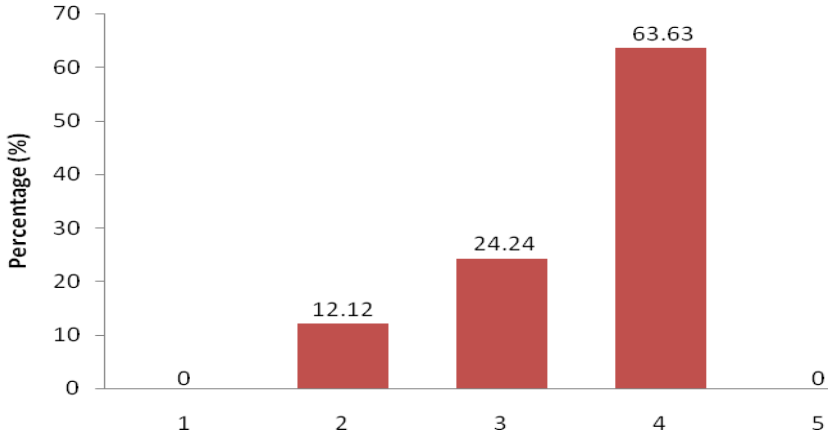

Fig. 3.4. Student Mathematical Problem Solving Ability Level in Problem-Based Model Class

Based on the final test data in the regular and problem-based learning model, where the students in the class of ordinary learning model many can not solve the problem well. This is seen from the achievement of students to the minimum learning mastery criteria that is 80% in classical. It can be seen that the achievement in the regular learning model class is that for the interval value of 65 ≤ SPMM < 75 there are 10 students, there are 15 students at the interval value of 75 ≤ SPMM <90, and no students at 90 ≤ SPMM ≤ 100 interval this means only 75,55% of students who passed KKM, while for achievement in class of problem-based learning model that is at

interval value 65 ≤ SPMM < 75 there are 8 students, at interval value 75 ≤ SPMM < 90 there are 21 students, and no students at interval 90 ≤ SPMM ≤ 100 means 87.87% of students who pass the KKM, so it can be said that the class of problem-based learning model has graduated classically, and seen improvement of problem solving abilities Mathematically higher student in class of problem-based learning model than ordinary learning model class.

The description of improvement of problem solving abilities of Mathematical students in class of problem-based learning model and commonly presented in Fig. 3.5 follows:

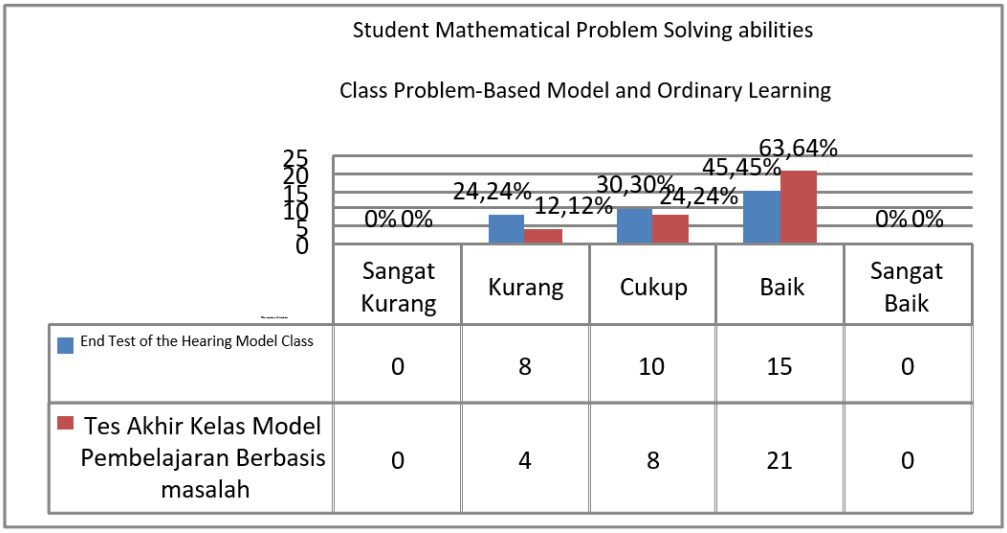

Fig. 3.5. Diagram of Final Test Result of Student Mathematical Problem Solving in Class of Problem-Based and Ordinary Learning Model

Based on the diagram in Figure 3.5 it is seen in the final test in the class of problem-based learning model and there is usually a good and sufficient increase in both grades and an increase in the higher experimental class with the control class. In accordance with the KKM, the classroom model of learning based on problem-solving classically is 86.87% or there are 29 students who have met the minimum criterion "enough", while in the usual class that is recommended by students not complete in the classical, students who meet the minimum criteria ' enough 'only 75.55% or as many as 25 students.

Average Score of Initial Test Result and Final Test of Mathematical Problem Solving

Mathematical problem solving test is done twice, the first test and the final test with different problems. Initial and final tests were followed by 66 students consisting of two classes. So in the data analysis that became the subject of this research is 66 people who follow the initial test and final test.

Average student scores on integer, angle, line and rectangle materials in the problem-based model learning class are summarized in Table 3.5 below.

Table 3.5.
Complete Recapitulation of Initial Test Results and Final Test Mathematical Problem Solving Abilities

Type of Test	No	Aspect	Group	
			Model of Ordinary Learning	Model of Problem-Based Learning
Solution to problem	1	Proportion of initial test score	47,72	51,12
	2	Proportion of final test score	71,12	76,42
	3	Number of completed students	25	29
	4	Completeness (%)	75,75	87,87

In Table 3.5 it can be seen, for average problem solving ability the proportion of preliminary test scores and the final test of the students of the regular learning model class are 47.72 and 51.12. When the average proportion of the final test score score is increased, the average proportion of score is 3.40. While the group of problem-based learning model that is 51,12 and 76,42 happened the average increase of score proportion equal to 25,3. The difference in the proportion of preliminary and late-group tests of problem-based learning models is greater than the difference in the proportion of preliminary and final test scores for the ordinary model learning classes. This suggests that a problem-based learning model can improve the achievement of problem-solving skills rather than ordinary learning models.

According to the data in Table 3.5, based on learning completeness criteria for problem-solving abilities that the number of students of ordinary learning model classes that complete the study only 25 people from 33

students or 75.75% of the number of students. The number of students who completed for the class of problem-based learning model is 29 people from 33 students or 87.88% of the number of students. The difference of percentage of students' mastery of the problem-based learning model class is much greater than the percentage of mastery of the average learning model class with 12.12%.

These results indicate that the problem-based learning model supported by learning tools developed by researchers can increase the number of students who complete learning for rectangular material. In accordance with the criteria of classical completeness that a learning is considered complete if there are 80% of students who have scored 65% of the maximum score. Thus classically the model class problem-based learning meets the learning completeness criteria but the regular learning model class does not meet the learning completeness criteria. Because of the completeness of learning outcomes with problem-based learning model is better than the completeness of learning outcomes of ordinary learning model, it indicates that the problem-based learning model is well applied in Mathematical learning on the subject of rectangles.

4. Conclusion

Based on the results and discussion it can be concluded that: Improved problem solving skills of students who are taught with a realistic mathematics approach is better than students who are taught with ordinary learning.

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