EFFECTIVENESS OF PROBLEM POSING APPROACH IN REGARDS TO PROBLEM SOLVING ABILITY OF THE SENIOR HIGH SCHOOL STUDENTS IN LEARNING MATHEMATICS

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Abstract

This research aimed to find out the effectiveness of problem posing approach in regards to problem solving ability on high school students of class X in learning mathematics. This research was quasi experiment with pre-test post-test group design. The subjects of this study were students grade X in SMA Negeri Imogiri, where the samples were class X4. The samples were given the treatment of problem posing. The research instruments are problem solving ability test and observation sheet. The validity of the instruments was determined through content validity. The results of data analyze showed that learning by problem posing approach is effective to increase problem solving ability on high school students of class X SMA Negeri Imogiri in learning mathematics.

Key words: effectiveness, problem posing, problem based learning, problem solving ability

INTRODUCTION

Mathematics is one of the subjects learned in school because it is a basic science that has envolved both material and its use therefore it regard to development and position of mathematics (Suherman, 2003: 55). One of the objectives of learning mathematics based on KTSP (Depdiknas, 2006) is students have problem solving ability which involve the ability to understand problems, design mathematics models, solve models and interpret the solutions. This is in line with the statement of the National Council of Teachers of Mathematics (NCTM, 2000: 29) which sets the standard of mathematical ability that must be possessed by students, one of which is the problem solving ability. Problem solving ability is the skills or potentials of a person or student in solving problems and adapting in everyday life (Gunantara, Suarjana & Riastini, 2014: 5).

Based on these, the ability of problem solving is important and should be posessed by students. O'Connell (2007:1) states that problem solving is the main focus of the learning mathematics. In addition, there is the essence of problem solving that is performing a procedural action sequences, step by step systematically, as a novice certainly do problem solving steps to solve a problem (Wena, 2011:52). Students should be able to build new knowledge in mathematics through problem solving, solve problems that arose in mathematics and other context, use a various of appropriate strategies to solve the problem, and reflect on the process of mathematical problem solving.

More detailed, Polya (1985:6-19) explains there are four steps in problem

solving, namely: 1) understanding the problem, students can show it is given, asked, and can make a picture to clarify illustrated problems; 2) devising the plan, students know what should seek to find things unknown then needed relevant knowledge of mathematical knowledge ever obtained; 3) carrying out the plan, the students perform the calculation to find the answers and students ensure the truth every step, 4) looking back, students reconsider and review results, moreover, students could infer the results obtained and relate it to the things that are asked. These fourth steps are the indication of problem solving ability as a guide scoring students in solving problems.

In the problem solving ability of the student, students are expected to develop its ability to find answers to the problems encountered in everyday life. However, the reality shows that the problem solving ability is still low.

The students ability inSMA Negeri Imogiri to solving a problem that requires problem solving ability is still low. The following data absorption grade XII in SMA Negeri Imogiri to complete the national exam questions that require problem solving ability.

Table1. Absorption ofProblem Solving Ability in Lesson Math National Examination of the Students Grade XII SMA Negeri Imogiri

Competency	Percentage of Material Mastery
Academic Year 2014/2015	
Solve daily problems related to linear equations system of three variables	60,76 %
Solve daily problems related to linear program	49,37 %
Solve daily problems related to arithmetica sequencces and series and geometry	50,64 %
Determine the trigonometric ratio of angle between 2 planes in the solid geometry	34,18 %
Determine other elements using sine or cosine rules with the presented rectangular and some elements	24,05 %
Academic Year 2015/2016	
Determine the surface area of the triangular prism by using sine or cosines rules	17,81 %
Complete the question of reasoning related to statistics	23,29 %
Solve daily problems related to trigonometry	31,51 %
Solve daily problems related to linear program	32,88 %
Solve daily problems related to calculus	41,10 %
Solve daily problems related to combination	56,16 %
Solve daily problems related to linear equation system of two variables	84,93 %

Data Source:

Year Academic 2014/2015: National Examination 2014/2015 Report (BSNP, 2015)

Year Academic 2015/2016: National Examination 2015/2016 Report (BSNP, 2016)

Based on the data in Table 1, it can be seen that the ability of problem solving in math in the national examination of the students grade XII in SMA Negeri Imogiri is still low. Percentage trigonometry achievement are the lowest one compared to other materials.

Responding to the low ability of problem solving students then the teacher should apply a learning approach in accordance with the learning objectives to be achieved in learning mathematics in school. The learning approach that is able to involve students directly will result in more effective learning so that it can achieve the learning objectives (Sanjaya, 2016: 185). One of learning approach that is expected to provide an opportunity for students to develop their abilities in solving math problems is problem posing approach.

Learning with problem posing approach is a learning where students are asked to pose problems based on certain situations (Lestari &Yudhanegara, 2017: 66). More detailed, Silver (1994: 19) states that "problem posing refers to both the generation of new problems and the re-formulation, of given problems. Thus, posing can occur before, during, or after the solution of a problem ".

Associated with problem posing approach, Xia, Lü, & Wang (2008: 155) stated that the basic purpose of problem posing is to train students ability in making problems and improve students' ability to coordinate knowledge, problem understanding, and problem solving from a mathematical point of view. Arikan & Unal (2015: 23) stated about goal problem posing approach is "problem posing activity makes a sensation; enables autonomous learning; diverse and flexible thinking; prevents misunderstanding and preconceptions; Helps to deplete anxiety about mathematics learning by means of interactive learning environment". In addition, according to Lin &Leng (2008: 3), the process of creating problems and finding solutions provide opportunities for students to encourage having different thoughts and can exchange ideas.

According to Mahmudi (2008: 8) there is a link between problem solving ability and problem posing, when students create a problem, the first step in solving the problem, students are required to understand the problem properly. Considering the question of which created by the student should be solved, certainly students try to devising the plan in the form of the creation of mathematical models to

solve them. This is in line with the statement Silver (1994:23) that the problem posing help analyze problems through creating problems by students themselves thus this will improve students problemsolving ability. Therefore, learning with problem posing approach can help students in improving their problem solving skills so that this approach is effective in terms of problem solving ability.

Previous research conducted by Prihantini (2015) obtained the result that the problem posing approach effective to increase problem solving and confidence ability applied in grade X SMA N 1 Kasihan on geometry material. Problem posing approach according to Prihantini (2015) is the activity of questioning by the students themselves, the students are given the opportunity to make the question based on the given situation after the teacher delivered the material then the students solve the problems that have been made by themselves so that students feel encouraged and trained in formulating math questions and then determine solution. Based on the theory by the researcher, according to Brown & Walter (2005: 23-24) that the problem posing approach is oriented learning that reinforces the concept of mathematics through the making of problems that can be solved based on the given situation. Based on the description above, there is a difference about the

problem posing approach, according to Prihantini, students make the problem after the teacher delivering the material while based on the theory, students make a problem so that students have the reinforcement of mathematical concepts. In this case, we need to know whether learning with problem posing approach is effective in terms of problem solving ability.

This research will examine whether problem posing approach helps students in understanding the mathematical concepts to. Based on the above explanation, it is necessary to test the effectiveness of the problem posing approach regards to problem solving abilities of high school students of grade X.

RESEARCH METHODS

Types of Research

This research was a quasi experiment.

Time and Location of Research

This research was carried out in SMA Negeri Imogiri on February 6, 2017 until March 1, 2017. The schedule of mathematics subject in experiment class as follows.

Table 2. Learning Schedule in Experiment Class

No.	Date	Time	Material
1	Monday, 6/2/2017	3-4	Pre-testproblem solving ability
2	Wednesday,	5-6	Trigonometric

	8/2 2017		ratio of right triangle
3	Monday, 13/2/2017	3-4	Trigonometric ratio of special angle
4	Monday, 20/2/2017	3-4	Trigonometric ratio of related angel (quadrant I and II)
5	Wednesday, 22/2/2017	5-6	Trigonometric ratio of related angel (quadrant III and IV)
6	Monday, 27/2/2017	3-4	Trigonometric ratio of related angel (negative angle and more than 360°)
7	Wednesday, 1/3/ 2017	5-6	Post-test problem solving ability

Subjects of Research

The subject of this research are all of the students grade X in SMA Negeri Imogiri consisting of 7 classes. The sample were obtained by means of a lottery to take one class. The sample were obtained class X4 who were given the treatment with problem posingapproach.

Procedure

In the implementation, the experiment class is treated with problem posing approach. Mathematics subject is scheduled for two meetings each week with a time allocation of 2×45 minutes of each meeting. The first meeting begins with pre-test problem solving ability consists of 4 questions with trigonometry material. The data of the pre-test used to test the similarities of students' initial ability. The second meeting until the sixth meeting was conducted with problem posing approach and learning about trigonometry material. The last meeting of the seventh meeting held post-test problem solving ability. The post-test question consists of 4 questions about trigonometry material. The data of the post-test used to determine the problem solving ability of students after being treated the problem posing approach so that it can be used to test the effectiveness of problem posing approch.

The design of this study is pre-test and post-test experimental group design. The description of the research design of pre-test and post-test experimental group design shown below.

Table 3. Pre-test dan Post-test Experimental Group Design

Class	Pre-test	Treatment	Post-test
E_1	O_1	X_1	O_2

Note :

E_1 : Experiment class

O_1 : Pre-test of problem solving ability

O_2 : Posttestof problem solving ability

X_1 : Treatment of Problem Posing Approach

Data, Instrument, dan Collecting Data Technique

Learning sets used in this study are lesson plan and the student worksheet. Lesson plan and the student worksheet used in this study developed based on problem posing approach. The data collection tool used are problem solving ability test consists of pre-test and post-test. Data collection techniques in research this is test. The test consists of pret-est and post-test used to measure the ability of problem solving. In addition, the use of observation to know implementation of the learning related to the activites of the teachers and students in the learning process.

Data Analysis Technique

The data analysis conducted using descriptive analysis to carrying on the mean, variance, and standard deviation. Furthermore, the test assumptions werethe normality test. The significance level used in this test is 0.05.

Hypothesis test to determine the effectiveness of the problem posing approach, this hypothesis was tested using one-sample t-test with the help of IDM SPSS Statistics 2.1. First effectiveness criterion in this hypothesis test if student get value more than or equal to KKM that is 75. Statistically, hypothesis can be symbolized as follows. Statistcally, the hypothesis can be symbolized as follows:

$$H_0: \mu_2 \leq 74,99$$
$$H_1: \mu_2 > 74,99$$

The decision criterion H_0 is rejected if the significance value is less than 0.05. Second, the problem posing approach is effective if at least 75% of the students in the first experimental class get the value more than or equal to the KKM.

RESULT AND DISCUSSION

Data Description

In the implementation, the teaching and learning carried out in accordance with the lesson plans made by researchers. An observer is a student of mathematics education, observe the learning activities in the class. The following shows the percentage data of learning implementation.

Table 4. Percentage of Learning Implementation in Experiment Class

Meeting	Learning Implementation
	Experiment Class
2	94,44 %
3	94,44%
4	100%
5	97,22%
6	94,44%
Mean	96,10%

Based on the observation sheet of learning implementation, the percentage of learning activity in the experiment class using problem posing approach reaches 96.10%.

In this research obtained data through pre-test and post-test in the experiment class to determine students problem solving abilities. The following shows the results of the pre-test and post-test of the experiment class.

Table 5. Pre-test dan Post-test Result in Experiment Class

Data Description	Experiment Class	
	Pre-test	Post-test
Mean	41,59	78,93
Variance	43,23	54,98
Standard Deviation	6,57	7,41
Min	25,00	64,58
Max	54,17	93,75

Based on Table 5 it can be seen that the average post-test value is higher than the pre-test value. The variance of the data is almost the same also the standard deviation.

In addition to the pre-test and post-test values, there are also student achievement data in each of the problem solving steps. The following shows the average achievement results on each of the problem solving steps.

Table 6. Data Percentage of Each Problem Solvng Steps

Problem Solving Steps	Experiment Class	
	Pre-test	Post-test
Understanding the problem	57,05%	86,86%
Devising the plan	47,12%	82,05%
Carrying out the plan	36,54%	75,32%
Looking back and conclude	26,54%	71,47%

Based on Table 7 it can be seen that the percentage of students problem solving ability from pre-test to post-test increases at each step. However, there is a decrease of understanding the problem until looking back. This decrease is due to an error in the student's answer in solving the problem. In addition, the improvement of students' ability to looking back and conclude is quite high because when working on the pre-test, the conclusions made by the students do not answer about the pre-test. When students get learning with problem posing approach, students ability to looking back and conclude is better than pre-test and when students do post-test questions, students' ability to looking back and conclude has answered the post-test.

Data analysis begins by testing the assumption of normality test and homogeneity test. The following shows the results of the experiment class.

Table7. The Normality Test Result

Data	Sig.	Decision	Result
Pre-test	0,865	H_0 diterima	Normal
Post-test	0,984	H_0 diterima	Normal

Based on the Table 7, the normality test using one-sample Kolmogorov-Smirnov with significance level $\alpha = 0.05$, it can be concluded that the value of pre-test and post-test in the experimental class

derives from the normal distributed population.

Hypothesis test is done to know the effectiveness of learning with problem posing approach regards to problem solving ability. The first criterion of effectiveness is that learning is said to be effective if the average student's post-test score is more than or equal to the KKM score of 75. This hypothesis test is determine with one sample t-test with the help of IBM SPSS Statistic 21. One sample t-test is used to test the hypothesis of the effectiveness of the problem posing approach regards to problem-solving ability because in this study in class X4 obtained a treatment that is the problem posing with sample $n \leq 30$.

Table 8. Effectiveness Test Result of Learning with Problem Posing Approach Regards to Problem Solving Ability

Variable	Class	T	df	Sig.
Problem Posing	Experiment	2,707	25	0,012

Table 8 shows that the significance value in the first experimental class with the problem posing approach regards to problem solving ability is 0.012. The value of this significance is less than 0.05 then H_0 is rejected means learning with the problem posing approach regards to problem solving abilities is effective.

The second effectiveness test is the problem posing approach is effective if at least 75% of the students in the class get the value of more than or equal to KKM obtained the result that the percentage of students in the experiment class treated with problem posing obtaining value more than or equal to KKM is 80.77% .

Based on these tests, learning with problem posing approach is effective regards to problem solving ability. The results of this study are supported by Prihantini (2015) previous research, the result of which is that the effective problem posing approach is applied in grade X SMA 1 Kasihan to increase problem solving and confidence ability. This is in line with Silver (1994: 23) which states that problems posing positively affect students' learning of their knowledge and problem solving further so that problem posing is a means to increase students problem solving ability.

SUMMARY AND SUGGESTION

Summary

Learning by problem posing approach is effective to increase problem solving ability on high school students of grade X in learning mathematics.

Suggestion

Based on this research, teachers are suggested to apply learning with problem

posing approach, where the approach is effective regrds to problem solving ability. Suggestions for schools, schools should provide more supportive facilities for learning activities with problem posing approaches in the classroom, such as boards used to stick answers to student discussions to make presentations work smoothly. Suggestions for future researchers, are expected to conduct further research using different learning approaches from this research and reviewed from problem-solving ability or doing further research using problem posing for other materials and reviewed from the ability that must be possessed by students in math lesson**.**

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