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Analysis of student's mathematical problem solving ability based on responsibility learning with themed problem based learning model

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Abstract

The purposes of this research are to examine the differences in problem solving abilities of seventh grade students in quadrilateral material with Themed Problem Based Learning and Problem Based Learning model and to examine the effect of students' responsibility towards the students problem solving abilities in quadrilateral material with Themed Problem Based Learning. This research uses a quantitative method. The population is the seventh grade students in one of junior high school in Bekasi in amount of 198 students. The selected samples are students grade VII-9 as an experimental group and students grade VII-8 as a control group. The methods of collecting data in this study are method of test and questionnaire. Data analysis uses t test and regression analysis test. The results of this research show that the average of problem solving abilities of students on Themed Problem Based Learning is over than the model of Problem Based Learning and the responsibility of the student's learning give an impact to the problem solving abilities of students on Themed Problem Based Learning model.

1. Introduction

According to Regulation number 20 year 2003 about National Education System, education is a conscious and deliberate effort to create an atmosphere of learning and the learning process so that students actively develop their potency to have the spiritual power of religion, self-control, personality, intelligence, noble character, and skills that they need, society, nation and state. According to Alba, et al (2013: 132), education is a container or a place that serves to prepare the human resources (HR) has competence in carrying out the functions of life. It shows that through education to produce the next dignitive, excellent, and competitive generation.

According to Regulation number 20 year 2003 section 13 subsection 1 about the National Education System, there are educational paths consist of formal education, non-formal and informal. Formal education is a structured educational paths and tiered consisting of primary, secondary, and higher. In the formal education includes some of the subjects that must be taken by students. Mathematics is one of the subjects to be taken by students in education from elementary school to high school. Permendikbud No. 58 of 2014 concerning the curriculum in 2013 SMP / MTs stated that mathematics is a universal science that can be used in everyday life and also the basis for the development of modern technology and the promotion of human intellect. According Ramadhani (2016: 116), mathematics is one of the basic sciences that have important and beneficial role in the development of science and technology. In addition, according Triastuti, et al (2013: 181), mathematics is part of science that also contributed significantly to the development of science and human resource development. Based on these descriptions, mathematics is the discipline that plays an important role in the development of science and technology and daily activities. Therefore, it is

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one of the many important reasons for students to learning mathematics in elementary and secondary education.

Everybody will face the problems in their daily activities, so it is very important for them, including the students to learn problem-solving. The importance of solving math problems highlighted in the National Council of Teachers of Mathematics (2000: 52) states that any solution is an integral part of the learning of mathematics, so it should not be removed from the study of mathematics. In line with the statement, according to Sulastri, et al (2015: 26), the goal of learning mathematics for students is give a chance for them to train their skill, ability, and competence of problem solving, that's means for them to hone their careful, logical, critical, and creative reasoning. Therefore, solving the problem is important for students to practice their ability in purpose of be possessed in life.

But in reality, the results of student exams in one of junior high school in Bekasi are less than the optimal average. Based on data from the National Exam in the year 2014/2015, the average value of the National Exam mathematics in one of junior high school in Bekasi are 52.37 (Puspendik, 2015). The average was lower than the average value of mathematics examination at the district level, provincial and national levels in a row that the amount of 53.83; 52.72; and 56.59.

The materials were tested in mathematics National Exam SMP, namely (1) The number operations; (2) The algebra operations; (3) geometry; and (4) stastistika and opportunities. According to data from Puspendik (2015) that the absorption of the material geometry on students in one of junior high school in Bekasi been modest compared to other materials tested in the National Exam. Absorption capacity of the material geometry on the students of one of junior high school in Bekasi lower than the absorption capacity of the material geometry at the municipal, provincial, and national level. The following table is the data based on the material on absorption of material tested in National Exam in one of junior high school in Bekasi, in academic year 2014/2015 can be seen in Table 1.

Table 1. Percentage Absorption Materials on the Problem Based in one of junior high school in Bekasi in Academic Year 2014/2015

No	Ability Tested	School	City/District	Province	National
1	Number Operations	55.02	58.86	55.03	60.64
2	Algebra Operations	51.38	54.57	53.25	57.28
3	Build of Geometry	50.17	51.79	50.39	52.04
4	Statistics and Opportunities	57.88	60.51	56.65	60.78

Concerned the ability in problem solving of students in one of junior high school in Bekasi, they are still have difficulties in problem solving geometry on two dimentional figure. Here is the absorptive capacity of data based on a matter of Graduate Competency Standards in one of junior high school in Bekasi in academic year 2014/2015 can be seen in Table 2.

Table 2. Percentage Absorption Based Competency Standards of Problem in one of junior high school in Bekasi in Academic Year 2014/2015

No	Ability Tested	School	City/District	Province	National
3	Understand the concepts of congruence, properties and elements of flat building, as well as the concept of inter-angle and / or line relationships, and use them in problem solving.	49.81	51.72	49.95	52.44

One of the material taught in seventh grade of the semester is a quadrilateral. The data from in one of junior high school in Bekasi academic year 2014/2015 showed that the absorption of students in one of junior high school in Bekasi on items with lattice resolve problems relating to resolve issues related to area and perimeter two dimentional figure is still relatively low. National Exam absorptive capacity of students in 2014/2015 school year for grating resolve problems related to the two dimentional figure wake is 42.36 and resolve issues related to the flat wake circumference is 56.16. But the result was relatively low when compared with other items such as to resolve issues related to the operation plus, minus, multiply, or for the number amounted to 69.27; to resolve issues related to the co-operative banking or social in simple arithmetic amounted to 61.00; to determine factoring the algebra amounted to 60.69; and to determine the size concentration or use them in problem solving daily activities amounted to 63.34. The data obtained from the results of the National Exam -year report 2014/2015 issued by Puspendik (2015).

In addition, based on interviews with teachers of mathematics in seventh grade states that there are difficulties experienced by students in understanding the issues especially quadrilateral material with sub material rectangle and square, some students have not been used to solve the problem with a coherent step

by step and rarely include images to make it easier to solve the problem is given, and most students are only able to work on the problem with solutions that rely only formula. Based on these descriptions, problem-solving ability of students in one of junior high school in Bekasi is not maximum especially on quadrilateral material with sub material rectangular and square.

Besides the students' problem-solving abilities, another important aspect which is the focus of attention in learning mathematics is the behavior or character of students. According to the Ministry of National Education (2010: 93), the national education goals is to develop students' potential to become a man of faith and pious of God Almighty, noble, healthy, knowledgeable, skilled, creative, independent, and become a democratic and responsible citizens. In addition, Regulation number 21 year 2016 about content standards states that one of mathematical competence at the junior level is indicating a logical attitude, critical, analytical, meticulous, responsible, responsive, and do not give up solving the problem. One of the intended characters is responsible. Therefore, the student's characters of learning responsibility can be formed and trained through the learning process of mathematics.

In line with observations in one of junior high school in Bekasi, it is obtained by the fact that the learning responsibility of students is still not optimal so that the result is not maximal. This is shown by some students who do not pay attention to the lesson well, do not do their jobs, only a few students who participated in the execution of the task group, and students are less brave in presenting ideas to the class as well as a discussion session.

Recognizing the problem solving ability of students and the responsibility of the students learning in one of junior high school in Bekasi is not optimal, it would require the use of cooperative learning model that can help students to cope with the problem solving and learning responsibility. Problem Based Learning is one model of student-centered learning in a way that exposes students to a variety of problems encountered in life (Saleh, 2013: 203). According to Duch, as quoted by Shoimin (2013: 130), a model of Problem Based Learning is a learning model that is characterized by real-world problems as a context for students to learn critical thinking and problem-solving skills as well as gaining knowledge. Model Problem Based Learning requires students to actively conduct investigations in solving real problems assigned by the teacher, so that learning Problem Based Learning model can optimize students' problem-solving abilities.

According to Eggen & Kauchak (2012: 307), there are three characteristics, namely the model of Problem Based Learning (1) Classes focus on problem solving, where activity in this model stems from a problem and solving it; (2) The responsibility for solving the problem rests on the student, where the student is responsible for formulating strategies and solve problems in their respective groups; and (3) Master supports the current process of students working on a problem, where the teacher leads the efforts of students to ask questions and provide other teaching support when students try to solve the problem. Problem Based Learning Model progressively requires students to be responsible for their own learning process (Hmelo-Silver, 2006: 24). Therefore, learning Problem Based Learning model can also optimize student learning responsibility. Indicator responsibility of learning used in this study are as follows: (1) to learn the routine without prompting; (2) do the tasks without coercion; (3) can explain the reasons for learning to do (dare to bear the consequences); (4) able to determine the choice of several alternative learning activities; (5) controls in the study; (6) can concentrate on learning; (7) has an interest in learning; and (8) be fair in learning.

Problem Based Learning Model still has several shortcomings including in terms of attracting the attention of students to be attracted to a problem given by the teacher. Sometimes a study is also less attractive because students do not yet have an idea, experience or a matter that relates to the lesson. This can be overcome by giving the theme in any activity on the learning model Problem Based Learning, because according to Min KC, et al (2012: 273), use the theme in learning to create an active learning, interesting, and meaningful. In addition, according to Yahya (2015: 119), with the theme of learning has a very important role in increasing attention, learning activities, and the students' understanding of the material learned. In line with this statement, the results Abrantes (1991), Julie (1983) and Kaiser-Messmer (1989) in Handal, et al (2004: 6), the interest of students to the classroom atmosphere and the subject matter can be increased by the provision of the themes in accordance with certain learning context. Therefore, the provision of the theme encourages imagination and fascination of students to the problems in Problem Based Learning and students can apply the appropriate theme events in real life and to improve students' understanding of the material being studied. Based on the description of the model Problem Based Learning and the theme, in order to increase problem-solving ability and learning responsibility can be maximal so that this study applied learning Themed Problem Based Learning model.

It can be said that the problem-solving ability and responsibility is important in the study of mathematics. From these explanations, formulate the formulation of the problem as follows: (1) Does the

average ability of seventh grade students problem solving material with sub-materials quadrilateral rectangle and a square on the model of Problem Based Learning Themed is more than average ability students who received problem-solving model learning Problem Based Learning and (2) Are responsibilities positively affects students' problem-solving skills class VII material with sub-materials quadrilateral rectangle and a square on the model of Problem Based Learning Themed.

2. Methods

This research is a quantitative method. The design used in this study is True Experimental Design with shapes Posttest-Only Control Design. The picture of the study design can be seen in Table 3.

Table 3. Research Design Posttest-Only Control Design

	Treatment	***posttest***
Experiment group	X_1	T
Control group	X_2	T

information:
X_1: Learning Themed Problem Based Learning model;
X_2: Learning model Problem Based Learning; and
T: Test students' problem solving ability after treatment.

The population in this study were students of class VII in one of junior high school in Bekasi second semester of academic year 2017/2018 as many as 198 students. The samples in this study were students of class VII-9 as an experimental group of 39 students and students of class VII-8 as a control group of 39 students. In the experimental group subjected to learning Problem Based Learning Theme and subject to the control group learning Problem Based Learning. The samples in this study using simple random sampling technique.

Data collection methods used in this study is the method of test and questionnaire. Before the issue is used, about the test and questionnaire tested first and then analyzed validity, reliability, level of difficulty, and distinguishing for about tests while the validity and reliability of the questionnaire.

The results of students' problem solving ability test were analyzed to test the hypothesis of the study. To test the hypothesis, testing should be performed normality and homogeneity as a prerequisite. Normality test used in this study is the Kolmogorov-Smirnov test with SPSS 16.0. Homogeneity test used in this study is the Levene test with SPSS 16.0. Furthermore, the average difference test right side and regression analysis test.

3. Results and Discussions

The research was conducted in class VII in one of junior high school in Bekasi. Themed Problem Based Learning Model used in class VII-9 as an experimental group and Problem Based Learning model used in class VII-8 as a control group.

From this study showed posttest problem solving ability of students is presented in Table 4.

Table 4. Problem Solving Ability Students

Test	**Group**	**n**	**Average**
Postests	Themed Problem Based Learning Model	39	79.2
	Problem Based Learning Model	39	67.5

Based on analysis of these data showed that the experimental and control groups derived from normal distributed population and has a homogeneous variance.

Based on the average difference test shows that $t = 4{,}642$ while $t_{tabel} = t_{(0{,}95;76)} = 1{,}6673$. It shows that $t > t_{tabel}$. Thus H_0 is rejected, which means an average of problem-solving abilities of students of class VII quadrilateral material in the model of Problem Based Learning Themed is more than average ability to problem-solving class VII quadrilateral material in the model Problem Based Learning.

The results also showed that the average problem solving ability class VII quadrilateral material in the model of Problem Based Learning Themed is more than average ability to problem-solving class VII quadrilateral material in Problem Based Learning model. The average scores of students in the experimental group was 79,2 while the average test scores of students in the control group was 67,5. This is consistent with research Istikomah, et al (2017: 347), the learning model Problem Based Learning Themed present any problems in mathematics have certain themes, so that students can imagine the events based on the theme in everyday life and can be applied to life daily. Moreover, it is in line with that proposed by Saputro D. A, et al (2007: 241), which indicates that the theme lends itself to imaginative problem that encourage student interest in the problems contained in the learning model Problem Based Learning Themed.

Obtaining these results are also due in the model of Problem Based Learning Themed there is a syntax or learning steps, namely (1) the orienting of students on the issue; (2) organizing the students to learn; (3) guiding the investigation of individual or group; (4) developing and presenting work; and (5) analyzing and evaluating the problem solving process. During the first step, the students are given a problem and there is a problem solving activity on teaching materials themed, themed worksheets, and LTS themed. Furthermore, students in groups to work on the issues contained in teaching materials themed, themed worksheets, and LTS themed. At the time of learning teachers act as facilitators to steer and emphasize problem-solving process. Furthermore, the third step, Students collect information to understand the problem and devise a plan of settlement, then apply the problem-solving plan, and recheck the results of troubleshooting. Then in the fourth step, students presented or conveyed solving results of group discussion and respond, refute, gave advice on the outcome of the discussion presented another group. In the final step, students and teachers evaluation the problem-solving process is done and repair if there are errors and analyzes that have been studied. Based on these explanations, learning Problem Based Learning Themed model train students in active learning through problem-solving, social interaction through group discussions, and learn to use the experience or prior knowledge to acquire new knowledge. This is consistent with learning theory proposed by Piaget as quoted by Rifa'i & Anni (2012: 170), there are three main principles of learning: (1) active learning; (2) learn through interaction; and (3) learn through experience alone. Therefore, the model of Problem Based Learning Theme emphasizes the involvement of the students in finding and resolving troubleshooting to gain new knowledge through discussion.

Regression analysis was performed a series of tests that includes the determination of the regression equation, regression significance test, regression linearity test, and a significance test of correlation coefficient and determination of the coefficient of determination.

Based on the regression equation determination test shows that the shape of the regression equation $\hat{Y} = 8{,}494 + 1{,}221X$. It shows that the constant (a) value 8,494 means that if the responsibility for student learning (X) is 0, then the problem solving ability of students (Y) shall be equal 8,494. In addition, the known value of regression coefficient (b) be equal 1,221, which means that if the responsibility for student learning valuable then the score 1 $(X = 1)$ will $\hat{Y}$ rise by 1,221 unit. In other words, the regression equation shows that the average value of problem solving ability of students increased 1,221 to increase the score responsibility for student learning. Therefore b is positive, it means that the responsibility for student learning positively affects students' problem solving ability in the model of Problem Based Learning Themed.

Based on the significance test of regression is $F = 62{,}480$ that while $F_{tabel} = F_{(0,95);(1,37)} = 4{,}105$. It shows that $F > F_{tabel}$. Thus H_0 rejected, which means significant regression coefficient direction.

Based on regression linearity test is obtained that $F = 1{,}886$ while $F_{tabel} = F_{0,95(17,20)} = 2{,}165$. It shows that $F < F_{tabel}$. So H_0 is accepted, which means linear of regression between X and Y form a linear line.

Based on the correlation coefficient significance test shows that $t = 7{,}904$ while $t_{tabel} = t_{(0,95;37)} = 1{,}686$. It shows that $t > t_{(1-\alpha)(n-2)}$. Thus H_0 is rejected, which means the correlation coefficient means.

Furthermore, to determine the influence of the responsibility of learning on students' problem-solving skills can be seen from the value R^2. Based on the results of test calculations regression analysis $R^2 = 0{,}628$. This value indicates that the test scores of students problem-solving ability is affected by the responsibility for student learning 62,8% through a regression equation $\hat{Y} = 8{,}494 + 1{,}221X$. The rest is 37,2% influenced by other factors such as the social environment of students, student motivation, or their intelligence level of students.

Based on a series of analysis conducted, the research concluded that the responsibility of the student's learning positively affects the ability of VII grade students solving quadrilateral material in Problem Based Learning Themed Model.

4. Conclusion

Based on the results of research and discussion can be drawn conclusions that average problem solving ability class VII quadrilateral material in the model of Problem Based Learning Themed more than average ability to problem solving class VII quadrilateral material in the model Problem based Learning and the responsibility of the student's learning positively affects the ability of problem-solving class VII quadrilateral material in Themed Problem Based Learning Model.

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