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STUDENTS' MATHEMATICS CONCEPTUAL UNDERSTANDING IN PROBLEM POSING LEARNING BASED ON GEOGEBRA APPLICATION

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Abstract

The aim of the research is to analyze the effect of problem posing learning based on Geogebra application toward the students' mathematics conceptual understanding. The research was conducted on the subject of trigonometric function plots material for X grade students of academic year 2017/2018. The type of the research used Pre-Experimental Design method with One Group Pretest-Posttest Design type. The sample in this research was 39 students. The sample taken by using cluster random sampling method. The students were given treatment in the form of problem posing learning with Geogebra application. The instruments used in this research are the pretest-posttest and student activity observation sheet. The data were analyzed for normality test, N-gain test and t-paired test using parametric analysis method with SPSS 20 applications. The results of the study show significant effect toward conceptual understanding ability. The student's activity observation indicates active student activity during problem posing learning with Geogebra application.

Keywords: *problem posing, conceptual understanding, Geogebra application.*

INTRODUCTION

There are lot of things for students to be able to successfully learn mathematics. The factors are from the inside and the outside of the students. The outside factors such as the teacher, the curriculum, environment/class and the inside factors such as the motivation and the phsycology of the students. These factors to succesfully learn mathematics called mathematical proficiency. According to Kilpatrick (2001), mathematical proficiency cosists of (1) conceptual understanding; (2) procedural fluency (procedural fluency); (3) strategic competence; (4) adaptive reasoning (adaptive reasoning); and (5) productive disposition.

Conceptual understanding is the ability for students to understand concepts operations and relations in mathematics (Kilpatrick, 2001: 116). According to the Law of Ministry of National Education (2006), the mathematics subjects aims to make students understanding matematical concepts, explaining the relationship between concepts and applying concepts or algorithms, flexibly, accurately, efficiently and precisely, in problem solving. In accordance with that mathematics learning objectives, after the learning process students are expected to be able to understand a mathematical concept and to use the ability in dealing mathematical problem in their real life.

The curriculum in Indonesia is using 2013 curriculum that applies student-oriented active learning. This means in learing process the students is more active during the learning to achieve the learning objective while the teacher only as facilitator. The taecher helps facilitate student learning, as a manager who is able to design and carry out meaningful learning activities, and manage the learning resources needed. Then teacher need to choose the best method to achieve the learning objective. Arsyad (2013) described in learning process there are two important factors, the teaching method and learning media. According to the Law of Ministry of National Education (2014) the learning model is the conceptual and operational of learning that has names, characteristics, logical sequences, settings, and culture. One example of a learning model that can be used is learning ist problem posing learning. Problem posing learning is learning that includes the activities of students in constructing problems and finding solutions. For this reason the learning can facilitate the students more active during the learning process and improve their ability.

Problem posing lerning according to Silver (Priest, 2009) refers to one of three mathematical activities. The

mathematical activities are Pre-solution Posing, Within-solution Posing, dan Post-Solution Posing. In Post-Solution Posing, the teacher provide problems to be solved by students. Then students solve the problem and after that the students constructs new problems. In this reasearch used the Post-Solution Posing, which is the students are given questions by teacher to be solved individually and students are asked to create new questions. The choice of Post-Solution Posing type problem is due to the students who have been able to solve a given problem first will find it easier to create new questions about the same material.

Learning process will be more interesting if combined with appropriate learning media. This accordance with one of the learning principles stated in the Copy of the Law Ministery of Education and Culture Regulation (2016) concerning Basic and Secondary Education Process Standards which states that classroom learning should utilize information and communication technology to improve learning efficiency and effectiveness. Problem posing learning can be combined with application-based learning media, for example the Geogebra application. Geogebra is an open source mathematical software that can be obtained for free. Geogebra was developed by Markus Hohenwarter and international programming team (Hamzah, 2011).

Geogebra combines geometry, algebra, statistics, and calculus (Stols, 2009), so it is suitable to be used as a medium for learning mathematics. The use of Geogebra application-based learning media can be used as a tools for delivering material, providing interesting illustrations for students, and providing solutions to various mathematical problems because the use of Geogebra can help teacher easily illustrate points, lines, graphs, curves, and two-dimensional constructs.

Geogebra has actually been widely known by teachers and students in schools, this is based on surveys that before conducting research. The results of the survey found that mathematics teachers had known the Geogebra application and the use of the Geogebra application media contained in learning resources, such as student textbooks. But in fact in the learning process educators rarely use the Geogebra application as a learning media and draw graphics or two-dimensional objects manually so that it takes a long time. Therefore in this study the material chosen was a graph of trigonometric functions in grade X. In the material, the role of Geogebra application can be used as an illustration media to draw graphs of trigonometric functions more quickly and easily understood by students.

. Based on an explanation of the problems described above, it was concluded that understanding mathematical concepts is an important components in solving a mathematical problem for students. While problem posing learning with Geogebra applications is expected to have an impact on student's mathematical conceptual understanding.

METHODS

The type of research conducted in this study is quantitative-descriptive. The method used is the experimental method with the form of Pre-Experimental Design. This study aims to explore the effect of Problem posing learning based on Geogebra application toward students' conceptual understanding. The form of the research is One Group Pretest-Posttest Design. One Group Pretest-Posttest Design means there is only one group treated and observed the results, before the treatment conducted there is a pretest to determine initial condition and compared to the posttest that conducted after the treatment.

The research design "One Group Pretest-Posttest" as follows:

$$O_1 \quad X \quad O_2$$

O_1 : Pre-test
X : Treatment
O_2 : Post-test

This research was conducted by class determination using Cluster Random Sampling technique, which is random sampling from existing population groups taken as a research sample. Sampling was carried out by researchers with teachers in schools so that one class was selected from seven classes at SMAN 1 Kedungwaru. The study was conducted with a sample of 39 students of class X-7 MIPA in the even semester 2017/2018 academic year with subject material graphs of trigonometric functions.

Data collection techniques conducted by researchers include observation methods and test methods.The observation method was carried out by an observer by using observation sheets to obtain data about student activities during the problem posing learning in the experimental class. The test method is used to measure the initial and final abilities of students mathematics conceptual understanding. Tests are given twice, namely pretest and posttest. The data were analyzed using normality test, N-gain test, and t-paired test. The data analyzed by using parametric analysis method with SPSS 20 applications.The hypothesis in this study is:

H_o = Problem posing learning based on Geogebra applications has no effects toward students' conceptual understanding.

H_1 = Problem posing learning based on Geogebra applications has significant effects toward students' conceptual understanding.

RESULT AND DISCUSSIONS

This study aims to explore the effect of Problem posing learning based on Geogebra application toward students' conceptual understanding. This research was conducted with a sample of 39 students on 10th grade (X-7 MIPA) at SMAN 1 Kedungwaru in the even semester 2017/2018 academic year with subject material graphs of trigonometric functions.

Students' mathematics conceptual understanding

After the research using problem posing learning based on Geogebra aplication is complete, the results of pretest and posttest are obtained. The following table shows the score of conceptual understanding of pretest and posttest:

Table 1. Pretest and Postest Score

Test	Min	Max	SD	Mean
Pretest	25	90	17.98	62.95
Posttest	50	100	12.40	85.51

From table 1 above shows that the value of ability on the results of pretest and posttest changes. The mean of conceptual understanding from pretest (62.95) increased to the pretest (85.51).

To find out whether there is an effect of problem posing learning based on Geogebra applications in the form of N-gain. The following table shows the N-gain score of conceptual understanding of pretest and posttest:

Table 2. N-gain Score

	Min	Max	SD	Mean
N-gain	0.00	1.00	0.267	0.648

From the table 2 above shows the mean of N-gain is 0.648.

The normality test conducted to analyze whether the n-gain data is normal distribution or not. The normality test results showed by the following table:

Table 3. Normality Test

	Asymp. Sig. (2-tailed)	Explanation
Conceptual Understanding	0.458	Normal

From the table 3, obtained the value of Asymp. Sig. is 0.458. Then the n-gain of conceptual understanding is normal distribution since $0.458 > 0.05$.

Since the n-gain of conceptual understanding is normal the test will continued to t-paired test parametric analysis method with SPSS 20 applications. The result obtained the value of Sig. (2-tailed) is 0.000. The value of Sig. (2-tailed) < 0.05 therefore that H_o is rejected and H_1 is accepted which means there is a significant difference between the average pre-test value and the average post-test score during the problem posing learning based on Geogebra application.

The possitve result of the test indicated the effect is an improvement in students' conceptual understanding. In line with Siswono (2018) state that problem posing stimulates an improvement in students' mathematical abilities. The other research by Asmara (2013) which revealed that the application of problem posing learning improves students' mathematical skills. The improvement can also be showed by the score of N-gain of conceptual understanding 0.648 and categorized as medium.

Factors that cause learning with problem posing shows the results better because it has two stages cognitive activities that support students to active learning. The Post-Solution Posing type problem in this research helps students to solve a given problem and to create new questions about the same material make the learning process more active and interesting.

Results of Student' Activity Observations

Researchers used student observation sheets to find out the activities of students during the problem posing learning bsed on Geogebra application. Data collected by researcher and observers using an observation sheet. Based on the observations, data on student' activity obtained as follows:

Table 4. Recapitulation of Student Observation Results

Aspect that observed	Percentage
Ask an opinion to the teacher or to another students	55.13%
Respond to teacher's questions or instructions	53.85%
Discuss or participate in groups	82.05%
Do the student's worksheet	61.54%
Participate in the stage of formulate problem	74.36%
Use existing learning resources	85.90%

Based on the table the students' activities during the problem posing learning based on Geogebra application are categorized on active. The results is in line with the Noviaanggraeni (2017) that using Geogebra on Problem posing learning improved student' activities in learning mathematics. In learning process the student very interested by the Geogebra application since it help them to solve mathematics problem and easy to operate. The student can use Geogebra by their laptop or smartphone easily. The problem posing learning also make students experience new learning, because it helps students understand the concept by solving and create their own problem.

CONCLUSIONS

Based on the results of the research and discussion above about the effect of problem posing learning based on Geogebra application toward students' conceptual understanding can be concluded that:

1. Problem posing learning based on Geogebra application effects the students' conceptual understanding.
2. The students' activities during the problem posing learning based on Geogebra application are categorized on active.

Based on the results of research , the researchers gave the suggestions that for further research with Problem posing learning based on Geogebra application, to pay attention to the time allocation and prepare LCDs and laptops for learning media, to add more than one observer to help researcher observe the student activities. For the better result the population of the research can be add so the conclusion is more generalized. The results of this study are expected to be an idea for other researches to carry out advanced research that has the potential to improve students's conceptual understanding, in mathematics learning.

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