

THE USE OF GEOGEBRA IN LEARNING LINEAR EQUATION FOR UT STUDENTS

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Abstract

Students should have ability to use computer software in the era of technology and information nowadays. This ability could be gotten by using computer in all learnings, including Mathematics. This research aims to describe the usage of Geogebra software in Linear Equation, in Mathematics Learning for UT students. The subjects of this research is mathematics students from UPBJJ-UT Jember in 2015-2016 academic year. The research instruments are a tutorial kit, an initial problem, final problem, student's activity observation sheet and questionnaire. The tutorial kit consist of tutorial activity plan, tutorial activity unit, student worksheet with Geogebra assisted. The initial problem and final problem are continuously given to the students before and after implementing Geogebra assisted tutorial. From this research, it is found that there is a significant improvement in student's ability to solve mathematical problem, especially in Linear Equation. The students were actively asking questions, answering the questions and using Geogebra software. The students also pleased with the discussion and the usage of Geogebra in tutorial. Furthermore, the students felt that the usage of Geogebra can help them to understand the concept of Linear Equation. This happens because the software gave visual interactive experience towards Linear Equation concept.

Keywords : geogebra software, Straight Line Equation, Tutorial, Mathematics problem.

BACKGROUND

Currently the development of computers is very advanced and has touched on all aspects of life including the study of mathematics. National Council of Teachers of Mathematics (2000) states that students should be able to access and use computers in learning. This is important because people who master the computer will be able to face the challenges of the times in the era of technology and information. Moreover, some experts claimed that learning with a computer can create active, creative, innovative and fun learning (Rusman, 2012). Computers can visualize mathematical concepts in a dynamic, interesting and interactive ways. On the matter of straight line equation, the computer can visualize the lines with different gradients with an interesting and interactive ways. In geogebra program, students only need to sliding the specific points to vary the gradient. Geogebra will visualize the line directly with the corresponding gradient. This process will assist students in finding the meaning of the gradient and the constant of straight line equation.

Computers can also be used by the student to explore in depth concept (Mairing, 2013). The exploration can help students to discover and construct knowledge significantly. Skemp (1982) and Hudojo (2005) stated that the concept constructed through discovery will be more meaningful and last a long time in the minds of students. Students who have such knowledge would be able to resolve the problems of mathematics (Sutawidjaja & Afgani, 2011). Students who are capable of solving mathematical problems will have high-level thinking skills (Prastiti, et al; 2009; Siswono, 2008). Such capabilities are critical and creative thinking (Kruilik, Rudnick, & Milou, 2003; Prastiti, et al; 2009).

In line with the above, Hamalik (2008) and Jennah (2009) stated that the use of computers in learning process can generate desire and interest in the new , motivational and stimulation of learning activities, and even brought psychological influences toward students. Instead, learning with only using blackboard can cause less interest and boring feeling for students during the learning activities. As the

result, students have difficulty in understanding mathematical concepts. Difficulties can result in low learning outcomes (Prastiti, et al; 2011).

One of the computer program that can be used in teaching geometry materials is geogebra. Geogebra is dynamic mathematics software that combines geometry, algebra, and calculus contents. The program was developed for teaching and learning mathematics. Furthermore, geogebra is a dynamic geometry system (Tamimuddin, 2010). The advantages of geogebra is : (a) the application of GeoGebra can be accessed free of charge. (b) it can be used on various operating computer systems (Windows, MacOS, Linux), (c) supported by more than 40 languages, Indonesian included therein, and (d) easy to use; each switches and steps on geogebra always accompanied with instructions and user help.

One of the material on the subject of mathematics at UT PGSD program is a straight line equation. In this matter, the student learns the meaning of the gradient, determining the gradient, the gradient of the lines that are parallel or perpendicular, to determine straight line equation, and resolve issues related to the gradient and straight line equation.. Students should be able resolve issues on this matter in college since this material has actually been studied by junior and senior high school students. However, the results of initial tests on straight line equation material given in the month of February 2016 towards UT students at UPPBJ Jember shows that the average value is 45.43 (scale 0-100).

These conditions need to be improved in order to improve student results. Such improvements can be made by combining constructivist learning with media that can visualize the concepts of straight line equation in an interesting, dynamic and interactive ways. One of the medium that can be used for such purposes is the geogebra program.

Based on deduction explanation above, researcher conducted a research with formulation of the problem as follows: "Is geogebra program can improve learning outcomes of students at UPPBJ UT Jember on the 2015/2016 school year on Straight Line Equations matter?". The results of this research can be used by mathematics tutors or other mathematics education as an alternative mathematics tutorial activities : geometry in particular. Furthermore, the results of this study are also useful to supplement studies related to the use of computers in mathematics, specifically for distance learning based university students.

RESEARCH METHODOLOGY

This research utilized a quantitative approach with experimental research type. Experimental research is a research used to find a specific treatment effect against the other in controlled conditions. The independent variable is the tutorial using geogebra program. The dependent variable is student learning outcomes in straight line equation materials. Furthermore, the research design of this research was the before and after design (Sugiyono, 2010). In this design, there was one group that was selected randomly. Researchers gave initial matter before the treatment results which was symbolized by Y_0 . Subsequently, researchers gave the treatment in the form of learning to use geogebra computer programme (X). Researchers gave the final outcome after treatment which was

The population of this research were of three classes students at UT Jember UPPBJ on 2016.1 school year who registered courses in Mathematics. The total number of the students was 125 students. The sample was selected using clustered random sampling. Class A students were selected as a sample for given geogebra for learning.

The research instrument were Tutorial Activities Plan (TAP), Tutorial Activities Unit (TAU), Draft Evaluation (DE), and Students Worksheet (SW) aided geogebra for five tutorial meetings, student activities observation sheet , the questionnaire responses of students, the initial problem and the final problem . Both of these issues have been assessed by three experts: one expert in the field of mathematics education and two UPBJJ-UT jember mathematics lecturers. The result was both problems were valid and worthy issues to be used in the tutorial activities, especially on the straight line equation (Table 1) material.

Table 1. Problems and Issues Final Preliminary Research

No	Indicator	Initial Problem	Final Problem
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1	Students could find gradient from two point.	1. Find gradient line that passed through $A(2,3)$ and $B(4,9)$.	1. Find gradient line that passed through $A(9,2)$ and $B(3,8)$.
2	Students could find gradient of straight line equation	2. Specify gradient from line $y = -\frac{1}{2}x - 3$	2. Specify gradient from line $y = \frac{1}{2}x + 3$.
3	Students could determine point which located or not at one line	3. a. Specify two points that passed by $y = x - 1$. b. Specify two points that not passed by line $y = x - 1$	3. a. Specify two points that passed by $y = x + 1$. b. Specify two points that not passed by line $y = x + 1$
4	Students could find straight line equation or perpendicular with one known line.	4. a. Specify line equation that parallel with line $= x$! b. Is there another line which parallel with $y = x$? If there are, specify the line equation. Explain your answer!	4. a. Specify line equation that parallel with line $= x - 1$! b. Is there another line which parallel with $y = x - 1$? If there are, specify the line equation. Explain your answer!
5	Students could finish issues related to straight line equation.	5. a. Specify line equation which perpendicular with line $= x$! b. Is there other line which is perpendicular with $y = x$? If there are, specify the line equation. Explain your answer!	5. a. Specify line equation which perpendicular with line $= x - 1$! b. Is there other line which is perpendicular with $y = x - 1$? If there are, specify the line equation. Explain your answer!

Data collection techniques in this study were the observation, and the provision of questionnaire, the initial problem and the final problem. The results were presented in tabular form and summarized using certain statistics. Subsequently, researchers conducted a test of Statistics to draw conclusions and answer the problem formulation in this study. Conclusion withdrawal based on research hypotheses :

$$: H_0: \bar{D} = 0$$

$$H_1: \bar{D} > 0$$

with \bar{D} = average of students mathematic learning outcomes at the final problem reduced by initial problem. If the test data result are encouraging to reject the null hypothesis (H_0), then learning using geogebra program can improve student results on the material straight line equation significantly.

Testing the hypothesis using t-test , Previously, researchers had examined whether the assumptions of the test are met or not. The assumption is that the normality excess data were tested using Kolomogorov-Smirnov test. These tests was conducted using Minitab 17 program

RESULTS AND DISCUSSIONS

RESULTS

Researchers allot three initial questions that have been developed prior to treatment. The three initial questions distributed on 35 students UPPBJ UT Jember who is the sample. The average value was 45.43 (scale 0-100). The minimum value of 30, while the maximum value of 55. Next, the researchers applied learning straight line equation material using geogebra in four times tutorial.

In the first tutorial, students are expected to be able to provide examples and non example of a straight line equation, can draw a straight line graph of the equation, and can provide examples of points that lie and do not lie on the graph of straight line equation.

In the second tutorial, students learn how to determine the point of intersection between the straight line graph of the equation by-axis $-x$ and-axis $-y$, and learning how to determine gradients and constants of an equation of a line $y = mx + c$,

In the third tutorial, students learn to determine the gradient of the line if the two points of its path are known, and learning to determine gradient of the two lines are parallel or perpendicular. In the fourth tutorial, students learn to solve mathematical problems related to straight-line equation.

In the fourth tutorial, students use geogebra integrated with tutorial activities. Geogebra is not only used at the beginning or at the end of the tutorial, but used for tutorial activities. Geogebra also not being used only to seek answers from the questions, or check whether or not the answers are correct. However, students explore the visual concepts of line equation using geogebra. The purpose of this exploration is the student can construct the concepts of straight line equation significantly.

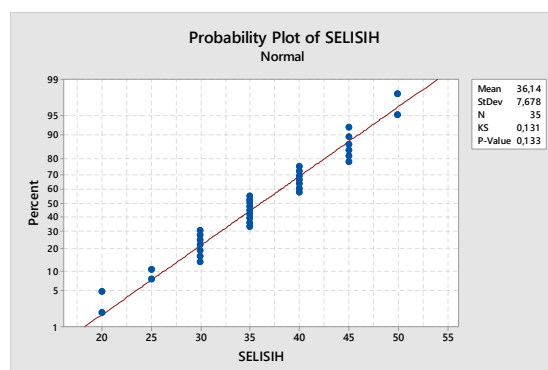
Furthermore, **researchers using geogebra in a tutorial-based understanding of constructivism. At the beginning of the learning**, researchers express purpose of learning, motivate students and associate the material with the concepts students have learned previously.

In core activities, students discussed in groups of 4-5 people. The discussion activity directed towards discovering the concepts of straight line equation using geogebra. Students presented the results of discussions in front of the class.

The researchers facilitate a class discussion aimed to help students in order to have a deep understanding. At the end of the lesson, students create individual conclusions and take the quiz. The individual quiz results are used by tutor for team recognition. There are three recognition namely a good team, a great team and superb team. This recognition is intended to enable the positive dependence among students (Slavin, 1995; Djamarah 2006; Widyantini 2006; Isjoni, 2009).

In the fifth tutorial, researchers distributed about the final questions. The average value of 71, 57 (scale 0-100). The minimum value of 60, while the maximum value of 80.

Furthermore, researchers carried out Statistics test to draw conclusions that used to answer formulation of the problem. Previously, researchers calculated the difference between primary values and final values for each student. The average difference of 36.14. The difference data is checked normality using the Kolmogorov-Smirnov test. Results using Minitab 17 is $p\text{-value} = 0.133 > 0.05 = \square$ (Figure 1). The conclusion was that the excess data is a normal distribution with a confidence level of 95%.



Gambar 1. Hasil Uji Kenormalan Data Menggunakan Kolmogorov-Smirnov

Next, researcher tested the hypotheses using uji-t. The results using Minitab-17 is :

One-Sample T: SELISIH

Test of $\mu = 0$ vs > 0

Variable	N	Mean	StDev	SE Mean	95% Lower Bound	T	P
SELISIH	35	36,14	7,68	1,30	33,95 27,85	0,000	

Analysis uji-t obtained p-value = $0 < 0,05 = \alpha$. The conclusion was the supporting data for refusing H_0 with 95% confidence level. This means learning using geogebra can significantly increase student learning result in UPPBJ UT Jember school year 2016.1 on straight line equation materials.

DISCUSSION

The results of this study indicate that geogebra assisted learning can improve student results on the material a straight line equation. Such results occur because a good learning process. Slameto (2003), Hudojo (2005), and Dimiyati and Mu j lono (2009) states that a good learning process can encourage good learning outcomes . The process is well demonstrated by the student role and be actively involved in tutorial activities. Active students, when asked, give feedback / answers to friend, answered questions in LKS, exploring the concept of using geogebra or presenting the answer in front of the class. The observation of student activity in this study showed that 72% of students do the mentioned activities. .

The above study results also occur because students responded positively to the tutorial using geogebra program. Students who have a positive response will be motivated in learning. Students will thus have the results of a high-learning results (Slameto, 2003; Sudjana, 2005; Suwangsih & Tiurlina, 2010). The results of the questionnaire showed that 94% of students were delighted with geogebra aided tutorial activities, and 88% of students said that they could understood material straight line equation using geogebra program.

This result is complementary towards research results regarding the use of computers in mathematics. Apriyani research results (2012) and Sukasih (2013) shows that results for students who learn using geogebra are better than without using the geogebra in geometry application materials. Something similar is shown by the results of research Mahmudi (2008) to class X SMAN 2 Yogyakarta second semester of the 2007/2008 academic year which shows that learning by using geogebra can improve student learning outcomes in geometry materials. Likewise, the results of research Mustikamaya (2013) showed that students class X Catholic High School St. Peter Canisius Palangkaraya become motivated and active in group discussions by learning to use a computer. Liveliness of student learning is supported by a positive response towards this case. Questionnaire results showed that the average student with a positive response by 98.57%. Average values of final test of 79.31. These results indicate that the application program computer in mathematics materials have a positive impact on the activity, res pons and student learning outcomes.

CONCLUSION.

The results showed that the application of computer aided tutorials geogebra can improve student results on the straight line equation materials. Results of preliminary tests showed that the average student results at 45.43 with a minimum value of 30 and a maximum value of 55. Next, researchers given tutorial using the geogebra program in four meetings. Final test results showed that the average student results at 71.57 with a minimum value of 60 and a maximum value of 80. Subsequently, researchers conducted a statistic test to draw conclusions regarding the formulation of research problems. The results show that the tutorial using geogebra can improve student learning outcomes for UPPBJ UT Jember on the material equations straight line with a confidence level of 95%.

These results be caused by active students constructing their knowledge, and have a positive response to the tutorial activity using geogebra. The results showed that 72% of students do activities that the tutor asks, give feedback / answers to his friend, answered questions in LKS, exploring the concept of using geogebra or presenting the answer in front of the class in tutorial activities. Furthermore, the results of questionnaire responses showed that 94% of students are pleased with using geogebra tutorial activities, and 88% of students claim to understand the material using the straight-line equation geogebra program.

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