Overcoming Student Difficulties in Completing Analytical Geometry Problems in Linear Equation Using Goegebra Scripting

Asep Ikin Sugandi[1], Martin Bernard[2], Masta Hutajulu[3], Siti Chotimah[4]
{asepikinsugandi@gmail.com[1], pamartin23rnard@gmail.com[2], masthahutajulu@yahoo.com[3], Chotimah019@gmail.com[4]}

IKIP Siliwangi, Bandung Indonesia

Abstract. The aims of this study are examine and identify the difficulties experienced by students in solving field analytic geometry problems on linear equation before and after using Geogebra Scripting. The subject of this study was the second-semester mathematics education student of IKIP Siliwangi. The method in this study was using descriptive with a qualitative approach. The instrument of research was a set of test about linear equation. The results of this study Concluded that students using Geogebra Scripting can reduce students' difficulties in solving analytic geometry problems in linear equation.

Keywords: Analytical Geometry, Geogebra Scripting

1 Introduction

Mathematics is an important science to be mastered and studied by each because mathematics is a science that has characteristics as a science that has an abstract nature, has a pattern in thought, is axiomatic, deductive and also based on truth. With these characteristics, mathematics is useful in developing hard and soft skills (the ability and shape of students' personal). Mathematics as a basic science as well as a servant of knowledge is needed to achieve high-quality success in other sciences. Therefore mathematics is taught at all levels of school, from elementary to tertiary level. Besides that mathematics is also a science that can be applied to solving problems in everyday life. One branch of mathematics is geometry. James [1] says that geometry is the science that deals with the shape and size of objects. Whereas according to [1] geometry is an axiomatic system and a collection of generalizations, models, and evidence about the forms of plane objects and space.

Analytical Geometry is a part of mathematics which is a combination of algebra and geometry. By making correspondence between mathematical equations algebraically and geometrically the point of position is obtained a more clear and firm geometry problem-solving method. Geometry problems will be solved analytically (solved algebraically). Instead, the use of images often provides a clearer understanding of the meaning of algebraic results. In this case, also allows students to solve algebraic problems in geometry, but the model of geometry is far more important than just a solution, especially if numbers are associated with the main concepts of geomatics. Geometry is a subject that must be taken by the Mathematics Education Study Program students of IKIP Siliwangi. In the curriculum structure of the IKIP Siliwangi

ICSTI 2018, October 19-20, Malaysia

DOI 10.4108/eai.19-10-2018.2281360

Mathematics Education Study Program, geometry courses are divided into 2, namely, analytical geometry courses, and

Euclid geometry. Analytic geometry is a basic course of geometry that studies flat planes. This course aims to develop the ability of students to understand the equation of geometry in a flat plane (lines and conic sections) in the form of a vector, canonical, and parameter equations, the position of the lines against other lines and the position of the lines on the cone slices. Until now geometry is still a difficult subject, this is evident from the low value of analytic geometry.

Student learning outcomes that do not meet expectations indicate problems. This is a low value and information from some third-semester mathematics students in the 2016/2017 academic year at IKIP Siliwangi, who experienced difficulties when spelling out geometric questions. Students reveal that in the teaching and learning process in basic calculus courses, students experience difficulties in drawing graphs of a student's functions and difficulties in proving the theorems that exist in the subject of reflection.

One effort to overcome this is to use mathematics learning media. Learning media in mathematics is a tool to help students so that students can understand how to apply various problems related to mathematics. Mathematics is not a matter of numbers or mathematical symbols, but mathematics can help in solving problems. In line with the purpose of learning media in mathematics is to provide students with success in mastering mathematical concepts [2]

Characteristics of a good media are media can facilitate students' understanding, students find a concept that is initially considered difficult for students to understand. learning mathematics, using media students can be more skilled at solving problems [3], [4]. In addition, a good media can make students understand how to take steps to get the right results; and the following good media characteristics, creating students to understand mathematics and become more active in problem-solving [5], [6]. In making media it is necessary to consider the time, conditions and place so that the media used is more effective and meaningful for students. Through the use of technology that is widely found, one of them utilizes ICT [7], [8]. Is a consideration of effectiveness in the use of learning media [9]. With the existence of ICT, work becomes easier including in the field of mathematics education. The use of ICTs has a lot to do with functions in mathematics, especially in mathematical logic. ICT is a medium that can improve the quality of teachers by creating a student-centered mathematics learning atmosphere [10]. ICT is effective in learning mathematics so that it makes work easier.

One of the most appropriate ICTs for the mathematics media industry is Geogebra 5. According to [11], Geogebra is a computer program to teach students in mathematics, especially geometry and algebra. This program can be used freely and can be downloaded from www.geogebra.com. This GeoGebra program is very popular, so it is often visited and has been used by millions of people around the world, both by students, students, teachers, lecturers, and others who use it.

Some of the benefits of the Geogebra program in mathematics learning are as follows: a) Can produce geometric paintings quickly and accurately, even complicated ones. b) There are animation facilities and manipulation movements that can provide visual experience in understanding geometrical concepts. c) Can be used as feedback/evaluation to ensure that the geometric paintings that have been made are true. d) Make it easy to investigate or show the properties that apply to an object's geometry.

2 Research Method

The method used in this study was a descriptive method with a qualitative approach. The research method was not based on quantitative measurements but with a qualitative assessment tries to understand and interpret based on the observed difficulties in the ability of students' mathematical understanding before learning using Geogebra 5 and this observation ends after learning using GeoGebra 5. This study was conducted on IKIP Siliwangi students as many as 40 people.

3 Result and Discussion

The difficulty of students encountered when studying geometry has not been able to understand mathematical symbols, operating numbers and identify the right picture. this obstacle is because students have not mastered the basic concepts of mathematics or mathematical prerequisites well. many of them, the work is done is practical and fast, but because the process is successfully understood, many students are finally wrong.

Here the instrument in this research: Find out the linear equation through intersection two lines $2x - y = 1$ and $6x + 5y = 1$. The line perpendicular with $x + 2y + 5 + 0$.

In this section will be explained about the identification of types of errors made by students based on written answers and student interviews.

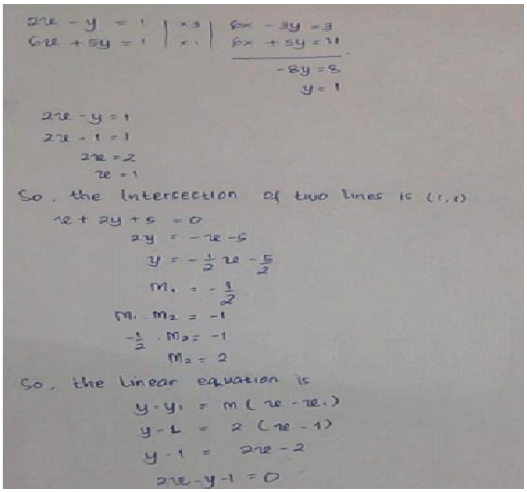

Fig. 1. Student A Completes Problem Number 1 Correctly.

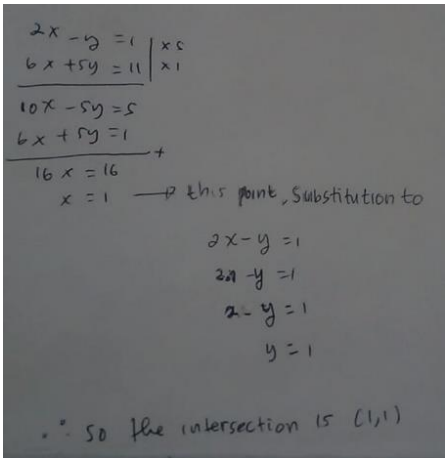

Fig. 2. Student B Completes Problem Number 2

From figure 2, student begin know to calculate the intersection of the two lines, so they do not understand the concept that must be used so that the work stops. This is due to the weak mastery of basic definitions and theorems in mathematics.

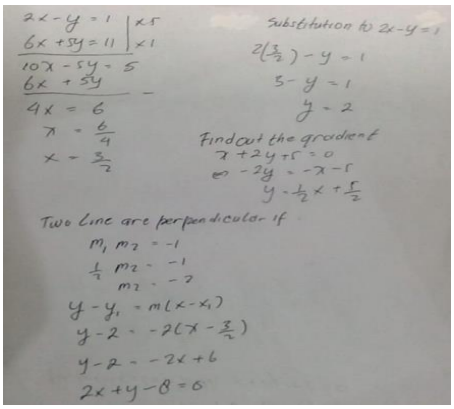

Fig. 3. Student C Completes Problem Number 3

Based on Figure 3, student have been able to do the process of calculating comparative values, but at the stage of the calculation process, students have difficulty understanding the nature of operating calculations such as sums and subtractions. Here the student's error in the process of subtraction is -5y-5y = 0 should be -5y + 5y = 0 so that 6x + 4x = 10x, so 10 x = 10 then x = 1 is then substituted to the 2x-1 equation = 0, obtained 2 (1) - y = 1 so that y = 1 is the point where the two lines are cut (1,1). Then the miscalculation in x + 2y + 5 = 0 is changed to 2y = -x - 5 so y = -½ x -5 / 2. So the gradient is m = -1/2.

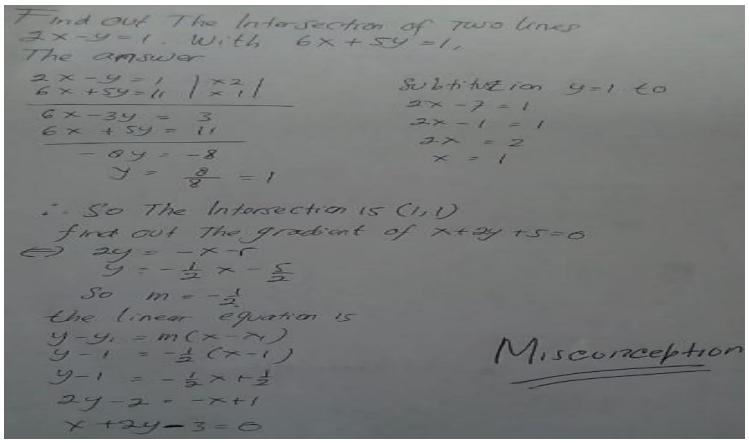

Fig. 4. Student D Completes Problem Number 3

Based on Figure 4, students have difficulty in connecting a concept with other concepts, for example, according to the argument if two lines are perpendicular to each other then the result of multiplying two gradients is equal to -1. From the results of data processing obtained results as in Table 1.

Table 1. Difficulties of students in completing Linear Equation before using GeoGebra Scripting.

Student Difficulties	Numbers of student	%
Mastery of the prerequisite definition and basic mathematical theorem	11	27,5
Error in calculation step	9	22,5
Linking concepts to other concepts	15	37

Some steps of students to master the problem of the ability to understand the understanding of linear equations by using GeoGebra scripting in GeoGebra software which is a picture of the media of mathematics learning. suppose students look for linear equations through the intersection of equation lines, and perpendicular. The making of the media is in accordance with the initial thinking process, which is determining the form of equations in GeoGebra with the help of GeoGebra scripting.

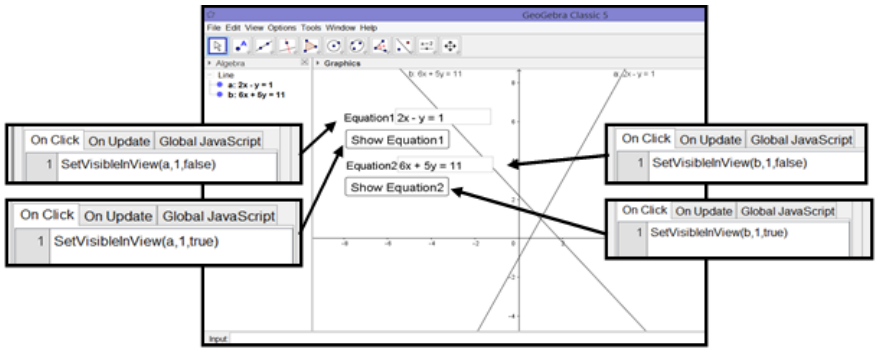

Fig. 5. Initial Steps to Make Linear Equations

Figure 5 shows how to display a picture of the equation of the line ordered in the Input Box with the command from SetVisibleInView's GeoGebra scripting (a, 1, false) meaning that when writing the linear equation a then enter the image will be hidden. And the Button with the GeoGebra scripting code SetVisibleView (a, 1, true) serves to bring up the equation a. Thus for equation 2 in Text Box 2 and Button 2. For the second step is to make a cut point from the two linear equations, namely the linear equation a and the linear equation b.

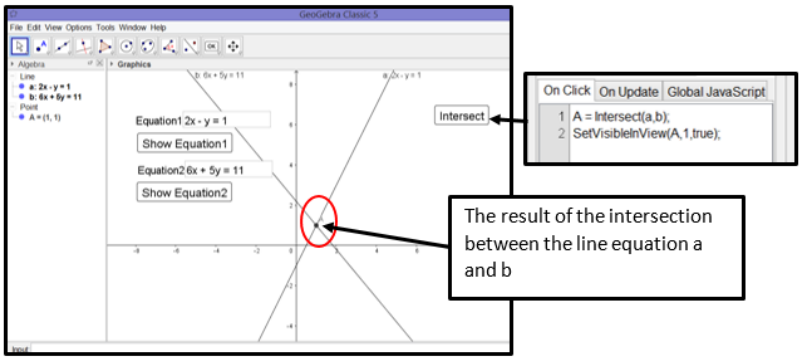

Fig. 6. The second step makes a cut point

Based on Figure 6 shows how to make a cut point between two linear equations, by entering a Button with the GeoGebra scripting code A = Intersect (a, b) which means that point A is the result of the intersection of the equation a and equation b. And SetVisibleInView (A, 1, true) functions to display the intersection point A. After that, the third step is to display the other linear equation.

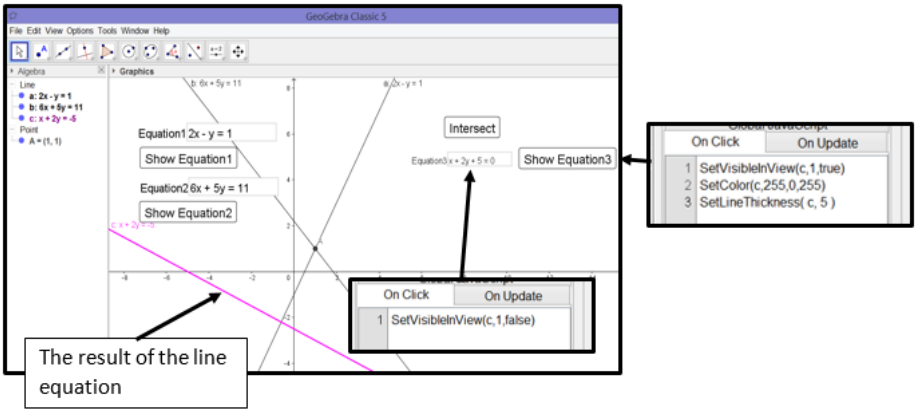

Fig. 7. The third step to make a linear equation

Figure 7 shows the third step to make a linear equation as a guide to determine the end line results, that is by entering the third Input Box as a linear equation c with the SetVisibleInView GeoGebra scripting code (c, 1, false) which is a function to hide the linear equation c. While the GeoGebra scripting for the Button is:

Display linear equation c

// SetVisibleInView (c, 1, true)

Gives a combination purple of red and blue

// SetColor (c, 255,0,255)

Give thickness to the linear equation c

// SetLineThickness (c, 5).

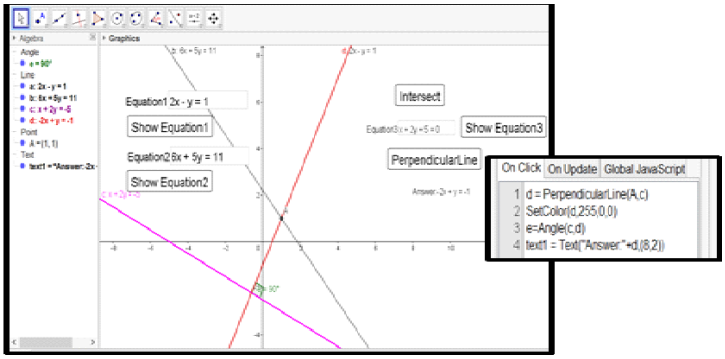

Fig. 8. The Final step to make a linear equation

Figure 8, shows the final results of the linear equation that is sought, using the Button. Make a perpendicular line from the linear equation c through point A by entering the GeoGebra scripting code as follows:

// d = PerpendicularLine (A, c)

.Give the color of the line with red
// SetColor (d, 255,0,0)
the angle between the two lines to see each other perpendicular
// e = Angle (c, d)
See the results of the straight-linear equation
// text1 = Text ("Answer:" + d, (8.2))
Students can try again to improve understanding of linear equations, so GeoGebra scripting can repeat again in the new linear equation problem and find the results of different linear equations.

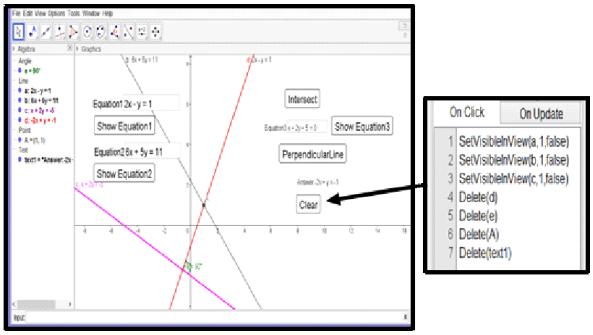

Fig. 9. Steps to delete and make problems

Figure 9 shows a Button command to delete and starts searching for the new linear equation by pressing the "Clear" button as a Button so that it displays the initial problem.

After being given mathematics learning using GeoGebra, the rest were given a test again, the problem was equivalent to the problem. then the results obtained are listed in Table 2 below.

Table 2 Difficulties of students in completing Linear equation after using GeoGebra Scripting

Student Difficulties	Number of student	%
Mastery of the prerequisite definition and basic mathematical theorem	2	5
Error in calculation step	3	7,5
Linking concepts to other concepts	2	5

Based on Table 2, We know that difficulties of students in completing Linear equation after using GeoGebra Scripting have reduced. The results of this study agree with [12] study which indicated there is a meaningful difference between experimental and control groups'. This difference is in favor of the experimental group which had lessons with GeoGebra. This generally agrees with many previous studies which indicated the effectiveness of using GeoGebra improving innovative thinking for ordinary and talented students. The results this study also agreed with [13]study that GeoGebra can benefit students Mathematics learning and diversifying learning in classrooms. The overflown of resources triggered students' interest to learn Mathematics however, the selection of software has to be properly planned. It also agreed with [14] study, assessed using GeoGebra during Coordinate Geometry for university students. The results of the study revealed that the use of GeoGebra enhanced the students' performance in learning Coordinate Geometry.

4 Conclusion

From the results of the study, that GeoGebra 5 uses GeoGebra scripting language as an alternative to overcome the difficulties of students in working on linear equations in analytical geometry courses on mastery of prerequisite mathematical basic definitions and theorems, errors in calculation steps, and linking another concept.

Acknowledgments. Thank you to the IKIP Siliwangi leader who has allowed us to conduct research and scientific publications on international journals held by UST Yogyakarta..

References

[1] E. T. Ruseffendi, *Pengantar kepada Membantu Guru Mengembangkan Kompetensinya dalam Pengajaran Matematika untuk Meningkatkan CBSA.* Bandung: Tarsito, 1990.

[2] A. Buchori and R. D. Setyawati, "Development Learning Model character education through-Comic in Elementary School.," *Int.J.Educ.Res*, vol. 3, no. 9, pp. 269–386, 2015.

[3] M. Benard, "Meningkatkan kemampuan komunikasi dan penalaran serta disposisi matematik siswa SMK dengan pendekatan Kontekstual melalui game adobe flash 4.0," *Infin. J.*, vol. 4, no. 2, pp. 197–220, 2015.

[4] J. Simarmata, et all, "Prototype Application Multimedia Learning for Teaching Basic English," *Int.. J. Elem. Educ*, vol. 1, no. 2, pp. 103–114, 2017.

[5] N. Nasrudin, I. Agustina, A. Akrim, A. S. Ahmar, and R. Rahim, "Multimedia educational game approach for psycholoconditional," *Int.J. Eng.Technol*, vol. 7, no. 2.9, pp. 78–81, 2018.

[6] I. M. Suarjana, N. P. N. Riastini, and I. G. N. Y. Pustika, "Penerapan Pendekatan Kontekstual Berbantuan Media Konkret untuk Meningkatkan Aktivitas dan Hasil Belajar," *Int.. J. Elem. Educ*, vol. 1, no. 2, pp. 103–114, 2017.

[7] E. Kartikadarma, T. Listyorini, and R. Rahim, "An Android mobile RC4 Simulation for education," *world Trans. Eng. Technol.Educ.*, vol. 16, pp. 75–79, 2018.

[8] D. Napitupulu, et all, "Analysis os Student Satisfaction Toward Quality of Service Facility," *J. Phys. Conf.Ser.*, vol. 954, no. 1, pp. 12–19, 2018.

[9] K. Adiyanto, D. Napitupulu, R. Rahim, D. Abdullah, and M. Stiawan, "Analysis of e-learning implementation readiness based on integrated our model," *J. Phys. Conf.Ser.*, vol. 1007, no. 1, pp. 12–41, 2018.

[10] S. Sriadhi, R. Rahim, and A. S. Ahmar, "RC Algorithm Visualization for Cryptography Education," *J. Phys. Conf.Ser.*, vol. 1028, no. 1, pp. 12–57, 2018.

[11] Hohenwarter. et all, "Teaching and Learning Calculus with Free Dynamic Mathematics Software GeoGebra." [Online]. Available: http://archive.geogebra.org/static/.

[12] Y. Zengin, H. Furkan, and T. Kutluca, "Social and The effect of dynamic mathematics software geogebra on student achievement in teaching of trigonometry," *Procedia - Soc. Behav. Sci.*, vol. 00, no. 2011, pp. 183–187, 2012.

[13] R. Abdul, A. Fauzi, M. Ayub, and R. Ahmad, "The Effects of GeoGebra on Mathematics Achievement : Enlightening Coordinate Geometry Learning," *Procedia - Soc. Behav. Sci.*, vol. 8, no. 5, pp. 686–693, 2010.

[14] N. Arbain and N. A. Shukor, "The effects of GeoGebra on students achievement," *Procedia - Soc. Behav. Sci.*, vol. 172, no. 2007, pp. 208–214, 2015.