Improving Students Mathematical Communication Ability Through Guided Discovery Learning Method Assisted By Autograph

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***Abstract*--- This research is aimed to find out: (1) Whether the improvement of students' mathematical communication taught by guided discovery learning methods and Autograph higher than the students who were given guided discovery methods without Autograph, (2) Is there an interaction between learning with early mathematical ability of students towards increasing the ability of understanding mathematical concepts. This study was a quasi-experimental study. The population of this study were all fourth semester mathematics education study program classes, amounting to approximately 120 peoples. The first experimental given an autograph with discovery method and autograph and the second experimental class was given a guided discovery method without autograph. The instrument used was a description test. Data analyzed was performed by analyzed of two-way variance (ANAVA). The results showed (1) the increasing of students' mathematical communication ability through guided discovery learning methods assisted by autograph was better than the students who were given guided discovery learning methods without autograph. (2) There was no Interaction between learning mathematics and early mathematical ability.**

Keywords: Mathematical Communication Ability, Guided Discovery Learning, Autograph

I. INTRODUCTION

Mathematics is queen of the science and very important for our life. A review of literature shows that some students perceive mathematics as difficult and complicated (e.g., Markovits & Forgasz, 2017), and other students find mathematics important (e.g., Markovits & Forgasz, 2017), 216 Hatisaru & Murphy useful, relevant, or worthwhile (Stiles, Adkisson, Sebben, & Tamashiro, 2008) but did not enjoy learning it much (Markovits & Forgasz, 2017) or describe mathematics as boring (Stiles et al., 2008). Some of peoples like mathematics so much but another is dislike. Although some peoples like mathematics, but some of topic in mathematics can't understood and communicate by them. This phenomena is always found on school and university. In accordance with the qualification of mathematics education study program, it was stated that graduates of mathematics education should be able to become educators and educate and also learn mathematics at elementary and secondary education levels. But unfortunately there are still many students who do not master the material in the subject of education, and can't communicate or explain the lesson.

Whereas according to Baroody A.J.(1993) states that there are at least two important reasons why mathematical communication skills need to be improved. First, mathematics as language. Second, mathematics learning as social activity. So that Teachers need to increasing their knowledge. (Ceja's-León, Navío-Gámez, & Barroso-Osuna, 2016).

One of solution to improving mathematics communication is applied guided discovery learning method. It needs to be designed for an informative and creative learning application so that it is exciting and easy to learn (J. Simarmata: 2018). Guided discovery learning is one part of discovery that involves many students in teaching and learning activities. According to Suryosubroto, B. (1993: 193), discovery is part of inquiry, and inquiry is an expansion of the discovery process that is used more deeply. Discovery is a mental proses. The mental process for example observing, classifying, making conclusions and so on. With this learning students will be guided deeply to solve the problem in mathematics and to communicate it direcly or indirectly.

However, the current development Information Communication Technologies or revolution industry 4.0, the teacher must be using technology to teach the lesson. Technology can make students to learn mathematics become joyful and at the same time can improve their mathematical communication skills. One of ICT that applied in this learning is autograph. Karnasih (2008) explain that autograph help student get more creativity in doing mathematics both 2D and 3D. Autograph can help lecturers to explain the topic quickly and pleasantly especially in drawing graphs of functions and finding area under some of the curve. Based on the problems, as well as several solutions mentioned earlier, the researchers tried to combine guided discovery learning with computer technology (Autograph), to improving the ability of students' mathematic communication.

III. METHOD

The population of this study was 120 peoples. from, two classes selected, first class given an *autograph* plus discovery learning and the second just gave discovery learning without *software mathematics*. The data analysis performed by t-test and analysis of Anova, we used t test:

$H_0 : \mu_x = \mu_y$

$H_a : \mu_x \neq \mu_y$

μ_x = Improving students mathematic communicat ion taught by guide discovery learning assisted by autograph

μ_y = Improving students' mathematic communicat ion taught by guide discovery learning without autograph

The second hypothesis we used ANOVA

$H_0 : \mu_{11} - \mu_{12} = \mu_{21} - \mu_{22} = \mu_{31} - \mu_{32}$

H_a : There is at least one difference in the average ability to mathematics communication ability that are different from the others

μ_{11} = Low group of students mathematic al abilities taught by discovery learning methods assisted by autograph to improving students' mathematic communicat ion ability

μ_{12} = Low group of students mathematic al abilities taught by discovery learning methods without Autograph to improving students mathematic communicat ion ability

IV. RESULT AND DISCUSSION

The Results of first hypothesis

Table 1 shows us the results data in first hypothesis using t test below:

Table 1. Independent Samples Test of Mathematical Communication

		Levine's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mathematical Communication	Equal variances assumed	.158	.72	2.32	58	.009	.016	.032	.023	.163
	Equal variances not assumed			2.32	37.931	.009	.016	.032	.02300	.16300

Table 1 shows us at significance level , obtained t count of 2.32 with a significance value of 0.009 while t table is 2.32. Because t count 2.32 > t table 2.00 and significance 0.009 < α 0.05, so H0 is rejected. So it can be concluded that the improving students' mathematical communication with software is better than the improving students' mathematical communication ability through guided discovery learning methods without autograph. These findings are accordance with research conducted by Muhammad, I. (2017), which explained that students who get guided discovery learning methods assisted by Autograph software more effectiveness than students who get conventional learning. Lestari (2010: 134) also conclude that problem based learning method

assisted by autograph able to increasing student's mathematical understanding concept.

Table 2. Tests of Between-Subjects Effects

Dependent Variable: Gain

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	.652[a]	5	.124	14.515	.000
Intercept	24.943	1	25.964	2.804E3	.000
Learning	.221	1	.221	12.087	.001
Early Ability of students	.517	2	.258	28.912	.000
Learning* Early Math	.010	2	.005	.512	.628
Error	.500	54	.009		
Total	30.265	60			
Corrected Total	1.232	59			

a. R Squared = ,534 (Adjusted R Squared = ,512)

Table 2 shows us sig. value for Learning and Early math is 0,628. This value higher than . So that H0 is accepted. Therefore we can conclude that there isn't interaction about learning and early ability to improving students' critical thinking skills. So, the improving student's critical thinking ability is caused by differences in learning used not because of students' early mathematical abilities. In other words, there is no influence together given by learning and early math ability. These findings are accordance with research conducted by Annajmi (2015) conclude that there is no interaction between learning model and early math ability to improving students' Mathematical understanding concept. Another findings was related to Batubara, I.H (2019) conclude that The improving of mathematic critical thinking plus software is better than without software.

V. CONCLUSION

Based on the information above, there are some conclusions which are the answer of problem's formulation, including: The improving of mathematic communication students with guided discovery learning by Autograph is higher than the students without Autograph. Second there was no interaction between learning and early capability of student mathematical result. The last, to improving student learning outcomes, educators can use guided discovery learning methods with Autograph software as an alternative.

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