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THE IMPACT OF DISCOVERY LEARNING ON THE MATHEMATICAL COMMUNICATION ABILITY ON TRIGONOMETRIC MATERIALS

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Abstract:

Mathematical communication ability in Indonesia are still relatively low due to students'lack of mastery of concepts and lack of teacher attention. This is evidenced by the fact that students cannot capture, master, and explain questions in their own words. The purpose of this study was to determine the effect of the Discovery Learning model on the mathematical communication abilities of class X students in trigonometric material. This research is a quantitativeresearch. This research was conducted on class X students of SMA Negeri 1 Mantup, with a sample of 66 students selected using a purposive sampling technique. Data collection techniques obtained from observation and tests. Data were tested using n-gain, normality test, homogeneity test and hypothesis testing using the t test. The results showed that after being given treatment the average posttest score of the experimental class was higher than that of the control class. In addition, based on the results of the hypothesis test, the value of *sig (2-tailed)*is less than 0,005 (0,000<0,05) then it is accepted. So it can be concluded that there is a significant influence of the Discovery Learning model on the mathematical communication abilities of class X students in trigonometry material.

Keywords: *Discovery Leaning, Mathematical Communication Skills, Trigonometry.*

INTRODUCTION

Education is a basic human interest, because basically education is a way to support humans to grow personally so they can make the right changes and develop their thinking and abilities (Etia, et al., 2019). One of the goals of education in general is to develop individuals both physically and mentally so that they can improve their lives and themselves, their families and society (Anggoro, 2015). To achieve these educational goals, learning activities are carried out through various sciences. One of the fields of science that is a factor in education is mathematics.

Mathematics is a science that must exist at every school level from elementary to high school (Linda &Afriansyah, 2022). In mathematics learning, there are 5 competency standards that must be achieved, as stated by Nasir (2018) and Febriyanti (2019), namely mathematical problemsolving abilities, mathematical reasoning abilities, mathematical connection abilities, mathematical communication abilities, and mathematical representation abilities. Based on these competency standards, there is a benchmark for abilities that students should master, namely mathematical communication skills (Kufa &Susilowaty, 2022). In the mathematics learning process at school, it is not just students' numeracy skills that must be improved, but also students' abilities in communicating problems orally and in writing (Asmara &Afriansyah, 2018).

Communication is the conveying of messages from one human to another, the aim of which is to inform and change someone's behavior verbally or in writing.

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Communication is a special factor in the mathematics learning process, because from communication (1) mathematical ideas can be used from various possibilities; (2) students' thinking techniques can be sharpened; (3) understand that progress is being measured; (4) students' ideas can be consolidated and organized; (5) building insight and improving students' mathematics cases; (6) students' thinking abilities increase; and (7) student communication was successfully established (Ariawan&Nufus, 2017).

Mathematical communication skills are the ability to learn concepts, provide mathematical ideas verbally or in writing in the form of diagrams, pictures, symbols and mathematical objects. Students' mathematical communication skills are successfully obtained through information, knowledge and students' life experiences, so that students who have mathematical communication find it easier to absorb the material and are able to improve students' learning outcomes (Bugis, 2021).

There are facts that state that mathematical communication skills in Indonesia are still considered weak due to students' lack of mastery of concepts and lack of teacher attention (Arina &Nuraeni, 2022). This is proven by students not being able to understand, master and explain questions in their own words. Meanwhile, the lack of attention from teachers is because teachers focus more on material that is in accordance with procedures such as teacher-focused learning, perceptions of mathematics are often given by explanation, and students are only taught to do questions without intensive knowledge, resulting in students' mathematical communication skills decreasing.

Based on the PLP experience that researchers have conducted at SMA Negeri 1 Mantup in class X, the lack of students' mathematical communication skills regarding learning makes students view mathematics as a subject that is not easy. Most students have difficulty interpreting question descriptions into mathematical models and many are confused in interpreting questions. Meanwhile, verbally students lack the courage to convey mathematical ideas using appropriate mathematical language.

Seeing these conditions, an effort is needed to improve students' mathematical communication skills. Students should explain perceptions through constructing appropriate sentences, have the opportunity to create techniques using symbols, model mathematical problems accurately, and describe images through mathematical ideas (Etia, et al., 2019). In developing mathematical communication, a learning process is needed that trains students to build their own understanding and know how to guide students in communicating, so that students are able to understand the perceptions being taught and can convey their mathematical ideas. One learning model that can be used to improve students' mathematical communication skills is by using the Discovery Learning model.

The Discovery Learningmodel is a learning where students participate to discover problems in order to develop insight and skills (Yuliana, 2018). In the Discovery Learning model, students are invited to discover for themselves what has been taught, after that constructing understanding by reading the meaning and the facilitator is the teacher (Fajri, 2019). Using the Discovery Learning model can help improve students' mathematical communication skills, because it involves students being able to communicate in learning activities, so that a conducive classroom situation is created and learning becomes meaningful, and relationships become

optimal in the learning process so as to improve mathematical communication skills (Damanik, et al., 2020).

One of the mathematical materials that can be used to see students' mathematical communication skills is trigonometry. Researchers chose trigonometry material because it requires skills to find problems such as constructing equations, completing symbol manipulation, skills in adapting numbers, and the ability to use reasoning.

thoughts and connecting the corners and sides of a triangle. Therefore, the existence of trigonometry material can be used to understand how students use mathematical communication in writing and expressing their findings in trigonometry material (Setyayudha, et al., 2019).

Based on the background above, the main topic of discussion in this research is to find out how the Discovery Learning model influences students' mathematical communication skills related to trigonometry material. Therefore, based on this, researchers are interested in taking the research title "The Impact of Discovery Learning on The Mathematical Communication Ability on Trigonometric Materials".

RESEARCH METHODS

This research is quantitative research using quasi experimental design in the Non equivalent Pretest-Posttest Control Group Design section. This research was conductedat SMA Negeri 1 Mantupwith a population of all students in class X and the samplesused were class X4 consistingof 33 students as the control class and X7 consistingof 33 students as the experimental class. The sampling techniqueused in this research is Purposive Sampling.

The instruments used in this research consistof main instruments and supporting instruments. The main instrumentis in the for moftest questions (pretest and posttest) in the form of descriptions covering 5 questions. The questions used are based on indicator sofmathematical communication skills. The testused in this research meet sall the requirements for validity, reliability, level of difficultyand distinguishing power. Meanwhile, the supporting instruments are in the for mofteaching modules. This research data wasobtained from observations and tests. The data analysis techniques used are n-gain, normality test, homogeneity test and hypothesis testing using the t test in the *Independent Sample T-Test*section.

RESULTS AND DISCUSSION

In this research, class X4 is the control class and class X7 is the experimental class. The treatment in the experimental class was the application of the Discovery Learning model, while the treatment in the control class was the application of the conventional learning model.

Table 1. Pretest Scores for Control Class and Experimental Class

Class	Average
X4	54
X7	55

Based on Table 1 above, class X4 has an average of 54. Meanwhile, class X7 has an average of 55.

Table 2. Posttest Scores for Control Class and Experimental Class

Class	Average
X4	83
X7	90

Based on Table 2 above, class X4 has an average of 83. Meanwhile, the X7 class has an average of 90.

Based on the tables 1 and tables 2 above, the average increase in the mathematical communication ability test scores for the experimental class was higher compared to the average increase in the mathematical communication ability test scores for the control class. Therefore, the scores obtained by students in learning using the conventional model are lower than using the Discovery Learning model.

Treatment in the experimental class with trigonometry material was carried out during 2 meetings. Before conducting the research, a trial of pretest and posttest questions was carried out first in class X6, which consisted of 28 students. The mathematical communication ability test questions consist of 5 items that are valid, reliable, meet the difficult and medium criteria and have very good differential power. After carrying out the instrument trial analysis, it was continued with data analysis using n-gain, normality test, homogeneity test and hypothesis testing using the t test in the *Independent Sample T-Test* section.

Table 3. N-Gain Results for Control Class and Experimental Class

Class	N-Gain	Criteria
Control	0,64	Medium
Experimental	0,77	High

Table4. Normality Test of Data from Pretest Results for Control and Experiment Class Students

Kolmogorov-Smirnov	ControlClass	ExperimentalClass
Statistic	0,088	0,135
Df	33	33
Sig.	0,200	0,130

Table5. Normality Test of Data from Posttest Results for Control and Experiment Class Students

Kolmogorov-Smirnov	ControlClass	ExperimentalClass
Statistic	0,137	0,117
Df	33	33
Sig.	0,120	0,200

Based on the normality test of the data from the pretest and posttest results of control and experimental class students using Kolmogorov-Smirnov, a significance value of more than 0.05 was obtained, so the data was normally distributed.

Table6. Student Data Homogeneity Test

LeveneStatistic	Df1	df2	Sig.
2,791	1	64	0,100

Based on the homogeneity test of student data it is greater than 0.05 (0.100>0.05). Thus, the data studied is a homogeneous sample.

Table7. Hypothesis Test *Independent Sample T-Test*

	T	df	$Sig.(2-tailed)$
Equalvariancesassumed	36,722	64	0,000
Equalvariances not assumed	36,722	63,615	0,000

Based on the results of the Independent Sample T-Test hypothesis testing which sig(2-tailed) is less 0,005 (0,000<0,05) than the hypothesis is accepted. So it can be concluded that there is a significant influence of the Discovery Learning model on the mathematical communication skills of class X students in trigonometry material.

The results of the research show that there are significant differences in the results of the mathematical communication ability test using the two learning models. The average score in the experimental class was higher than the control class. Thus, the most suitable model to use to measure students' mathematical communication skills is the Discovery Learning model. This is in accordance with the results of research conducted by Tri Adiyanti (2018) which states that there is an influence of the Discovery Learning model on students' mathematical communication skills. By using the Discovery Learning model, students can participate in finding problems, constructing knowledge by understanding its meaning. This is in line with the opinion expressed by Fajri (2019) who states that in the Discovery Learning model, students are invited to discover for themselves what has been taught, after that constructing understanding by reading the meaning and the facilitator is the teacher. Meanwhile, the learning process that uses conventional learning models makes students passive and students are also not taught a learning model that can understand how to learn about various materials, think and motivate themselves. This is in line with the opinion expressed by Arina &Nuraeni (2022) who stated that teachers focus more on material that is in accordance with procedures such as teacher-focused learning, perceptions are often given by explanation, and students are only taught to do questions without intensive knowledge, thus resulting in students' mathematical communication skills decreasing.

The results of this research show that the mathematical communication skills of students taught using the Discovery Learning model are better than students taught using the conventional learning model. This can be seen from the average N-Gain score obtained by students in the experimental class which is higher than that of students in the control class. In the experimental class the average N-Gain was of a value which 0,77 mean that in the learning process results increased in the high category, while in the control class the average N-Gain was of a value which 0,64 mean that in the learning process the results increased in the medium category.

The difference that results from learning with the Discovery Learning model is that it focuses on improving five indicators of students' mathematical communication skills, namely connecting real objects, pictures or diagrams to mathematical ideas in trigonometry material, using mathematical terms, notations and symbols in presenting mathematical ideas in trigonometry material, expressing everyday events in language or mathematical symbols in trigonometry material, interpreting ideas for mathematical problems in trigonometry material in your own language, and finally drawing conclusions from statements in trigonometry material. The question instrument in the mathematical communication ability test is based on these five indicators. So that the increase in students' mathematical communication skills using the Discovery Learning model can be seen from the analysis of the posttest results for the two classes which shows that the answer scores of the experimental class students are better than the control class.

REFERENSCES

Based on the results of data analysis and discussion in this research, it can beconcluded that students taught using the Discovery Learning model are betterthanstudentstaughtusingtheconventionallearning model. This can beproven from the average post test score for the experimental class whichis higher, namely 90, than the average post test scorefor the control class, whichis 83. Thisis in line with the average n-gain score in the experimental clas swhich produces 0.77 high criteria, while the average n-gain value in the control class produces 0.64 medium criteria. Apart from that, based on the result softhehypothesistest, thesig (2-tailed) value is lessthan 0.05 (0.000<0.05), soitis accepted. Soit can beconcluded that the reisan influence of the Discovery Learning model onclass X students' mathematical communication skills in trigonometry material. Other researchers canhighlightseveral other factors that influence students' mathematical communication skills, other learning model sapplied, and the learning tool sused and the learning materials to be studied.

CONCLUSION

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