Daya Matematis : Jurnal Inovasi Pendidikan Matematika
Volume, 10 Nomor 2 July 2022 Hal. 114- 121
p-ISSN:2541-4232 dan e-ISSN: 2354-7146

DIFFERENCES IN MATHEMATICAL COMMUNICATION ABILITY USING DISCOVERY LEARNING AND CONVENTIONAL LEARNING MODELS

Widyanti Astari[1] , Slamet Soro[2]
[1] Muhammadiyah University Prof.Dr.Hamka
Email: widyanti.astari@uhamka.ac.id
[2] Muhammadiyah University Prof.Dr.Hamka
Email: 0103.slamet@gmail.com

***(Received**:12-4-2022; **Reviewed:** 16-4-2022; **Revised:** 24-05-2022; **Accepted:** 22-06-2022; **Published:** 29-07-2022)*

Abstract
The aims of this research to see the differences in mathematical communication ablility using discovery learning models and conventional learning models and see whether the use of discovery learning models and conventional learning models affects students ' mathematical communication abilities. The sample of this research was 70 learners from two different classes who were randomly selected with purposive sampling techniques. The selected class is used as an experimental class using the discovery learning model and other classes as a control class using a conventional learning model. The data in this research were obtained from the results of the initial test and the final test of mathematical communication ability carried out before and after learning. The data will be analyzed using homogeneity test, normality test, independent sample T-test and paired T-test. The research conducted shows that : (1) The learning model applied to each class can have an influence on mathematical communication abilities. This is evidenced by the increase in the final test results given after learning (2) a learning model that allows students to actively participate in learning activities is not necessarily better than conventional learning models. This is shown by the similarity between the final test scores of the experimental class and the control class.

Keywords: Communication Mathematics Ability ; Discovery Learning; Conventional Learning

INTRODUCTION

For high school students, math skills need to be improved. Mathematical skills play a very important role in life and work in the 21st century (Firdiani et al., 2020) . Mathematical communication skills are one of the many mathematical skills that play an important role in learning. Through communication, students can express, explain, and deepen their understanding in the process of learning mathematics. Mathematics has abstract concepts and ideas. By communicating, these ideas can be expressed, clarified, discussed, and further developed. The communication process also helps deepen understanding, develop ideas, and express problems. Communication itself can also be described as a means to exchange ideas and clarify understanding (Khairunnisa et al., 2020) . Communication is a major requirement in the teaching, assessment and learning of mathematics (Tiffany et al., 2017) . In learning, communication skills have an influence because it is a form of reciprocity from students when obtaining information in class. This will have a positive impact on the mathematical interaction between educators and students.

Different levels of intelligence and ways of thinking make a big difference in students' mathematical communication skills. The number of students with low mathematical communication skills can have an impact on the quality and quality of education. Facts like this can be seen from student learning scores that are not so good. This is because learning focuses

on educators while students are not actively involved (Daulay et al., 2019) . Another cause is that students lack confidence in answering the teacher's questions during the discussion in class. Students are also embarrassed to ask questions when they do not understand the material being explained. Therefore, educators need to provide a relaxed and fun learning environment to stimulate their thinking skills and make them active in learning (Triana et al., 2019) . With that, it is expected that students' mathematical communication skills will increase.

In this context, it is necessary to develop a model in innovative learning so that it can be accepted by students, such as the discovery learning model. According to (Persada, 2016) the use of discovery learning models makes students actively involved in learning because students are given the freedom to investigate and draw conclusions from existing problems. As a facilitator, what educators must do is provide instructions for every idea and idea that students have to find new knowledge. Discovery learning model isn't it something new in education. This model has been known for a long time, when Jerome Bruner, an American psychologist, developed a theory for the field of education. In this theory, Bruner states that education has two objectives, namely school subjects and understanding.

Based on this opinion, education does not only aim to prepare students in completing school assignments, but also guides and facilitates students in finding understanding and knowledge of what is being learned so that students can implement their understanding in everyday life (Kharismawati et al., 2020). . However , in practice, educators in Indonesia are not used to using discovery learning models in learning mathematics . This statement is reinforced by research (Friani et al., 2017) that one of the obstacles for educators in teaching is choosing a learning model so that students are actively involved in this case is the discovery model. Most educators in Indonesia teach with conventional learning models because of the easier way of teaching. The conventional learning model itself is a model in learning that has many methods such as lectures, questions, and answers, and giving assignments. This model is very commonly used in Indonesia (Peranginangin et al., 2020) . But unfortunately, the use of these methods makes the mindset of students less developed. This is certainly a challenge for educators in determining the learning model that will be applied in the classroom.

Research on the discovery learning model and problem solving skills and mathematical communication skills conducted by (Jarwan, 2018) aims to determine the effect of the application of the discovery model on students' mathematical problem solving and communication skills. The sample of this study was obtained from all students of class VIII.1 SMPN Pitumpanua using the pretest and posttest methods. The data obtained from this study are the results of the problem-solving and mathematical communication skills tests in the form of essays. The results of the research conducted are that the discovery model has an effect on problem solving and mathematical communication skills.

While research by (Maulida et al., 2018) uses mathematical communication skills as well as learning activities as variables in his research. The aim is to see the effect of the use of discovery learning models on mathematical communication skills and learning activities at the junior high school level. The results of this study found that there was an influence from the application of discovery learning models in developing mathematical communication skills and being able to increase the activeness of students in learning mathematics at the junior high school level.

In contrast to research (Jarwan, 2018) and (Maulida et al., 2018) which used two ability variables, (Asmara & Afriansyah, 2018) used two learning models, namely activity initiation, I used discovery learning. model. The two learning models were chosen as a solution to overcome

the low mathematical communication skills of students. The purpose of this research is to see an increase in students' mathematical communication skills through the applied learning model. The samples in this study were two class X MIPA SMAN 15 Garut. The research data are the results of the pre-test and post-test results of mathematical communication skills in the form of description tests and non-test instruments in the form of questionnaires. From the research conducted, it is proven that the increase in students' mathematical communication skills is classified as moderate in the activity model class and low in the discovery model class.

From several studies that have been mentioned, it can be seen that the results of research on mathematical communication and discovery learning models have different results. The limitation of the first research conducted by (Jarwan, 2018) and research by (Maulida et al., 2018) is that this study only focuses on the effect of using the discovery learning model on the two research variables. Meanwhile, the research conducted by (Asmara & Afriansyah, 2018) does not only focus on the discovery model in increasing mathematical communication skills in students but also on other learning models. Due to the limitations of previous studies, the GAP in this study is that the three studies only looked at the effect and increase of the dependent variable so that the researcher intended to bring up novelty by focusing on the influence of the two independent variables in this context, namely the discovery model and the discovery model. conventional model to increase the dependent variable, namely the ability of mathematical communication and see the difference in the application of learning models in each class.

METHODS

The methodology of this research is quasi-experimental, meaning that this research only focuses on controlling the most important variables. The point is that research with this model has a control class but the class does not completely control external variables that can affect the results of the research conducted (Untari, 2018) . A total of 70 students of class VII SMP in Jakarta spread over two different classes became the sample in this study. The sample was taken randomly using purposive sampling technique. The selected class will be used as an experimental class and given a discovery learning model, while the other classes will be used as a control class and given a conventional learning model. Homogeneity testing is a test used to see whether or not a sample of the research population is the same. The homogeneity test is usually used as a requirement when analyzing the sample t-test and ANOVA and can only be done when the data is normally distributed. Before comparing two or more groups, it is necessary to do a variance similarity test to see if the differences are not caused by the basic data. The homogeneity test can show that the difference in the parametric statistical tests performed (t test, ANOVA) occurs due to differences between groups (Usmadi, 2020) .

Normality testing is used to determine what type of statistics will be used by researchers. In normal data, data conclusion is drawn using parameter statistics, while non-normal data uses non-parameter statistics. Usually in quantitative research, drawing conclusions makes the average parameter as a measure of research success because these parameters are unstable so that normal data are needed in the analysis. If in the study there are values that are much different from the values of most groups, then drawing conclusions with the average parameter can be said to be not the same as the actual situation in the field. This can make the data not normally distributed (Nasrum, 2018) .Hypothesis testing is a way to test whether or not the statistical hypothesis of the research population is valid by using the sample data of the population (Nuryadi et al., 2017) . Hypothesis testing conducted in this study is the paired test (t-test). The paired test itself is a method that is carried out with the aim of testing paired data. The characteristic of this test is to use two different treatments to the object in the study, where later the researcher will obtain two kinds of data from the treatment.

RESULT AND DISCUSSION

Table 1. Descriptive Analysis of Mathematical Communication Ability Test Results

		Experiment Pretest	Final Test of Experiment	Pretest Control	Final Test Control
N	Valid	35	35	35	35
	Missing	1	1	1	1
mean		21,275	54,291	30,363	54,654
Std. Error of Mean		1.9110	2.3832	1.7781	2.1781
median		20,800	50,000	29,200	54,200
Mode		12.5	45.8	37.5	41.7
Std. Deviation		11.3056	14.0992	10.5195	12.8860
Variance		127,816	198,788	110,660	166,050
Range		47.1	50.0	41.7	45.8
Minimum		2.9	41.7	8.3	41.7
Maximum		50.0	91.7	50.0	87.5
Sum		744.6	1900.2	1062.7	1912.9

The table shows that the initial test in the experimental class with the discovery learning model achieved the highest score of 50 and the lowest score of 2.9. The average count is 21,275 with a mode of 12.5 and a median of 20,800. While the final test results from the experimental class got the highest score of 91.7 and the lowest score of 41.7 with a mode of 45.8 and a median of 50,000. In the control class, the conventional model applied the highest score of 50 in the initial test and 87.5 in the final test with a median and mode of 29,200 and 37.5 in the initial test and 54,200 and 41.7 in the final test.

Table 2. Homogeneity Test

		LeveneStatistic	df1	df2	Sig.
Communication Skills Test	BasedOnMean	.233	1	68	.631
	BasedOnMedian	.000	1	68	.997
	BasedOnMedian and WithAdjusted df	.000	1	64,034	.997
	BasedOnTrimmedMean	.107	1	68	.745

The calculation of the variance similarity test can be done with SPSS software. A data is said to be homogeneous if the sig value is based on the mean $> 0{,}05$ and a data is said to be inhomogeneous if the significant value is based on the mean $< 0{,}05$ (Setyawan, 2021) . Based on Levene's test, it can be seen in the table that the value on the significance based on the mean of the two classes is 0.631 and is greater than 0.05 and it is stated that the data is homogeneous.

Table 3 . Experimental and Control Class Normality Testing

One-SampleKolmogorov-SmirnovTest			
			Unstandardized Residual
N			140
NormalParameters [a,b]	mean		.0000000
	StdDeviation		17.07648832
MostExtremeDifferences	Absolute		.104
	Positive		.104
	negative		-.059
TestStatistic			.104
Asymp.Sig.(2-tailed)			.001 [c]
MonteCarloSig. (2-tailed)	Sig.		.090 [d]
	99%ConfidenceInterval	LowBound	.083
		UppBound	.097

Calculations on normality testing can use SPSS software. A data is called normal if the value is significant $> 0{,}05$ (Setyawan, 2021) . Based on the Kolmogorov-Smirnov test, the significance value was 0.090 and greater than 0.05. This shows that the existing data is normal data.

Table 4. Different Tests in Experimental and Control Classes

IndependentSamplesTest

		Levene'sTest ForEqualityOf Variances		t-test forEquality ofMeans						
									95% Confidence IntervalOfTheDifference	
		F	Sig.	t	df	Sig.(2-tailed)	Mean Difference	Std.Error Difference	Low	Upp
TestsCommunicationAbilityMathematics	Equal variances assumed	.233	.631	-.112	68	.911	-.3629	3.2286	-6.8055	6.0797
	Equal variances not assumed			-.112	67,457	.911	-.3629	3.2286	-6.8064	6.0807

According to (Nuryadi et al., 2017) , the Independent sample Test is a test that is carried out to see the average difference in the unpaired data population. The basis for drawing conclusions in this test are:

1.If the value is significant (2-tailed) $< 0{,}05$, it is H_0rejected and $H_\alpha$accepted
2.If the value is significant (2-tailed) $> 0{,}05$, it is H_0accepted and $H_\alpha$rejected
So that the hypothesis can be made from the research as follows:
H_0: There is no difference in mathematical communication skills in the classroom that applies the discovery model and the conventional model
H_α: There are differences in mathematical communication skills in classes that apply discovery learning models and conventional models
Or it can be written:
$H_0 : \mu_1 = \mu_2$
$H_0 : \mu_1 \neq \mu_2$
In the Independent Test table, the 2-tailed significant value is 0.911. The significant value above is more than 0.05 which means H_0it can be accepted and $H_\alpha$rejected. From these results it can be concluded that there is no significant difference in students' mathematical communication skills by applying the discovery model and the conventional model.

Table 5. Paired T-Test Test of Mathematical Communication Ability

PairedSamplesTest

		PairedDifferences							
					95%ConfidenceIntervalOfTheDifference				
		mean	Std. Deviation	Std.ErrorMean	Low	Upp	t	df	Sig.(2-tailed)
Pair 1	Initial TestExperiment - EndTestExperimer	-33.016(	14.2251	2.4045	-37.9031	-28.1301	-13,731	34	.000
Pair 2	TestInitialControl - FinalTestControl	-24.2914	8.1270	1.3737	-27.0832	-21.4997	-17.683	34	.000

(Nuryadi et al., 2017) in his research explained that the Paired T-test is a way to test paired data. Paired data referred to in this study is data from the two tests that have been carried out in both classes. The basis for drawing conclusions in this test are:
1.If the value is significant (2-tailed) $< 0{,}05$, it is H_0rejected and $H_\alpha$accepted
2.If the value is significant (2-tailed) $> 0{,}05$, it is H_0accepted and $H_\alpha$rejected
With research hypotheses as follows:
H_0: There is no difference in the average score of the initial and final tests, it means that there is no influence from the implementation of the given learning model on mathematical communication skills
H_α: There is a difference in the average score between the initial and final tests, it means the effect of the application of the given learning model on mathematical communication skills.
Or it can be written:
$H_0 = \mu_1 - \mu_2 = 0\ atau\ \mu_1 = \mu_2$

$H_\alpha = \mu_1 - \mu_2 \neq 0\ atau\ \mu_1 \neq \mu_2$

From the results of the paired sample test, it can be seen in table l above, the significance value of pair 1 and pair 2 in the experimental and control classes is 0.000. The significant value is smaller than 0.05 which means that it is H_0 rejected and H_α accepted. From the results above, it can be concluded that there is an influence from the application of the given learning model, namely the discovery model and the conventional model on students' mathematical communication skill

Discussion

From the research that has been done, the test value data is tested for homogeneity of variance before other analytical tests are carried out. This is intended to indicate that the samples in this study have the same type. The improvement of mathematical communication skills can be seen in the results of the Paired Sample Test while the difference between the two learning models can be seen in the results of the Independent Sample Test. By looking at the results of the tests carried out for the experimental class and the control class, it can be concluded that the initial test scores of the two classes both increased in the final test given. However, the final test scores in the experimental class were not much different from the final test scores in the control class. Things like this mean that the application of learning models in each class has an influence on students' mathematical communication skills but the increase in mathematical communication skills itself does not make a difference to students who are given the discovery model and the conventional model (Nuryadi et al., 2017)

CONCLUSIONS AND SUGGESTIONS

Based on the results and discussions, two conclusions can be drawn, namely:

1. The learning model applied to each class can have an influence on mathematical communication skills. This is evidenced by the increase in the results of the final test given after learning.
2. A learning model that allows students to actively participate in learning activities is not necessarily better than conventional learning models. This is indicated by the similarity between the final test scores of the experimental and control classes.

From the overall results of the research conducted, each educator should study the characteristics of students first before applying the learning model. The goal is to get an overview of the abilities of the students themselves in order to achieve maximum learning outcomes

REFFERENCE

Asmara, R., & Afriansyah, EA (2018). Differences in Students' Mathematical Communication Ability Improvement between Eliciting Activities and Discovery Learning Models. *Suska Journal of Mathematics Education* , *4* (2), 78. https://doi.org/10.24014/sjme.v4i2.5714

Daulay, LA, Hakim, H., & Sartikawati, LD (2019). THE IMPROVEMENT OF STUDENT'S MATHEMATICAL COMMUNICATION ABILITY BY USING COOPERATIVE LEARNING: COURSE REVIEW HORAY. *Journal of Tarbiyah* , *26* (1), 185–204. https://doi.org/10.30829/tar.v26i1.376

Firdiani, NH, Herman, T., & Hasanah, A. (2020). Gender and mathematical communication abilities. *Journal of Physics: Conference Series* , *1521* (032095), 1–5. https://doi.org/10.1088/1742-6596/1521/3/032095

Friani, IF, Sulaiman, & Mislinawati. (2017). Teacher Constraints in Applying Learning Models to Thematic Learning based on the 2013 Curriculum at SD Negeri 2 Banda Aceh City. *Scientific Journal of Elementary School Teacher Education FKIP Unsyiah* , *2* (1), 88–97.

Ikhsan, F., Pramudya, I., & Subanti, S. (2020). AN ANALYSIS OF MATHEMATICAL COMMUNICATION SKILLS. *International Online Journal of Education and Teaching*

(IOJET) , *7* (4), 1300–1307.

Jarwan. (2018). The Effect of Discovery Learning on Students' Problem Solving and Mathematical Communication Ability. *Proximal* , *1* (2), 77–89.

Khairunnisa, GF, Malang, UI, Maulyda, MA, & Hijriani, L. (2020). Mathematics Communication : Translation of Elementary Students' Idea. *Numerical: Journal of Mathematics and Mathematics Education* , *4* (2), 77–86. https://doi.org/10.25217/numerical.v4i2.781

Kharismawati, LRS, Nirwansyah, Fauziah, S., Puspita, RA, Gasalba, RA, & Rabbani, TAS (2020). *HOTS-Oriented Module: Discovery Learning* (1st ed.). SEAMEO QITEP in Language.

Maulida, AH, Ningsih, MF, & Bastian, T. (2018). The Influence of Discovery Learning Model on Mathematical Communication Ability and Learning Activity of Junior High School Students. *Delta: Scientific Journal of Mathematics Education* , *6* (1), 47. https://doi.org/10.31941/delta.v6i1.649

Nasrum, A. (2018). DATA NORMALITY TEST FOR RESEARCH. In *Jayapangus Press* (pp. 1–117).

Nuryadi, Astuti, TD, Utami, ES, & M. Budiantara. (2017). *Fundamentals of Research Statistics* (1st ed.). SIBUKU MEDIA. http://lppm.mercubuana-yogya.ac.id/wp-content/uploads/2017/05/Buku-Ajar_Dasar-Dasar-Statistik-Penelitian.pdf

Warinangin, A., Barus, H., & Gulo, R. (2020). Differences in Student Learning Outcomes Who Are Taught With Elaboration Learning Models With Conventional Learning Models. *Journal of Research Physicists* , *3* (1), 43–50. http://jurnal.darmaagung.ac.id/index.php/jurnalpenelitianfisiawan/article/view/452

Persada, AR (2016). THE INFLUENCE OF DISCOVERY LEARNING MODEL ON STUDENT'S MATHEMATICS CONNECTION ABILITY. *EduMa* , *5* (2), 23–33.

Setyawan, DA (2021). Practical Instructions for Normality Test & Data Homogeneity Test with SPSS. In *Paper Knowledge . Toward a Media History of Documents* (1st ed.). Media Group's throne.

Tiffany, F., Surya, E., Panjaitan, A., & Syahputra, E. (2017). ANALYSIS OF MATHEMATICAL COMMUNICATION SKILLS STUDENT AT THE GRADE IX JUNIOR HIGH SCHOOL. *Ijariie* , *3* (2), 2160–2164. http://usnsj.com/index.php/JME/article/view/2.2.45-51%0D

Triana, M., Zubainur, CM, & Bahrun, B. (2019). Students' Mathematical Communication Ability through the Brain-Based Learning Approach using Autograph. *JRAMathEdu (Journal of Research and Advances in Mathematics Education)* , *4* (1), 1–10. https://doi.org/10.23917/jramathedu.v4i1.6972

Untari, DDT (2018). *Research Methodology* (I). CV. Editor's Persada Pen.

Usmadi. (2020). Testing Requirements Analysis (Test of Homogeneity and Test of Normality). *Educational Innovation* , *7* (1), 50–62.