

The Effect of Online Learning on Mathematical Communication Ability in 10th Grade Senior High School

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ABSTRACT

The current Covid-19 pandemic has disrupted the conventional learning process which had been done face-to-face. So a solution is needed to answer this problem. Online learning is one alternative that can overcome this problem. The purpose of this study was to determine the mathematical communication skills of students at State High School 3 Jombang, which during this pandemic had an online learning process. The subjects of this study were students of class 10th MAN 3 Jombang. The data were collected by giving a test in the form of 3 essay questions, giving a questionnaire and an interview. The analysis was carried out using the One Sample T-test technique and the results showed that the t-count values in the description test and questionnaire were 35,327 and 102,384, respectively, with a significance of 0.000. The significance value shows $0.000 < 0.05$, then H_0 is rejected and H_a is accepted, meaning that there is a significant effect of online learning on the mathematical communication skills of class 10th MAN 3 Jombang.

Keywords: *Online Learning, Mathematical Communication Skills, Composition Function.*

INTRODUCTION

The Indonesian government's policy to stop the spread of Covid-19 by carrying out physical distancing has had an impact on various fields, including the education sector (Hariono et al, 2020). The government finally made an online learning policy or in a network (online) to replace conventional face-to-face learning to ensure that students continue to get learning (Sadikin & Hamidah, 2020). The implementation of social distancing causes digital media and the internet to become the main way for teachers and students to carry out learning at home so that communication between teachers and students and between students continues (Gayati & Suryawan, 2020). Online learning (on the network) is one of the methods used in delivering material in the pandemic era so that students continue to study even at home, therefore students must remain active when online learning takes place (Rosyidah & Sholihah, 2021). Online learning requires students to be more independent and active in learning.

Mathematics is a science that plays an important role in the world of education. Mathematics is a branch of science that supports other sciences related to everyday life (Rahmawati et al, 2019). Mathematics as a branch of science is of course very necessary to communicate orally and in writing (Anderha & Maskar, 2020). Therefore, mathematics learning needs to be developed in order to achieve the desired learning objectives, one of which is the mathematical communication skills that exist in students.

One way of learning mathematics through online learning apart from the knowledge provided by educators, students can increase their knowledge by actively learning independently, discussing with other friends through social media (Nur & Afidah, 2019). The media plays a very important role in the learning process, including to improve mathematical communication in education. With communication in mathematics, it can also make it easier for students to read mathematical discourse with understanding, be able to develop mathematical language and symbols so that they can communicate orally and in writing, be able to visually describe and reflect (Yustina et al, 2021). When students discuss, there will be

communication in the form of message transfer and it contains material that can be in the form of formulas, material concepts and problem solving concepts.

Mathematical communication skills consist of, oral communication and written communication. Oral communication such as: discussion and explaining. Written communication such as: expressing mathematical ideas through pictures/graphs, tables, equations, or in the students' own language (Hodiyanto, 2017). Communication skills in learning are very important for students to have in order to support activities inside and outside the classroom. Especially when teaching and learning activities in mathematics, students must have mathematical communication skills to solve problems and also convey ideas (Gayati & Suryawan, 2020). Several factors affect mathematical communication skills:

- Prerequisite Knowledge (Prior Knowledge)
- Ability to read, discuss, and write
- Understanding Mathematics (Mathematical Knowledge)

The indicators of mathematical communication skills proposed are as follows:

- The ability to write down what is known and asked according to the problem.
- Ability to write answers in accordance with the intent of the question.
- Ability to write reasons in answering questions.
- Ability to write mathematical terms and symbols.
- Ability to draw conclusions in writing using their own language.

Several authors define the term communication in different ways, NCTM or the National Council of Teacher Mathematics in Hendriana, et al. (2017) stated that mathematical communication is an essential mathematical basic competency of mathematics and mathematics education. Mathematical communication needs to be developed again in learning mathematics. Besides being useful so that students are able to express an idea or ideas, they are also able to shape students in explaining a mathematical model to ordinary language (Anderha & Maskar, 2020). Based on this background, researchers are interested in researching "The Effect of Online Learning on Mathematical Communication Ability of Class 10th Students".

The research was conducted with a written test and a questionnaire as the main instrument and interviews as a supporting instrument. The data obtained will be analyzed based on indicators of mathematical communication skills in order to obtain a description of the desired data. The formulation of the problem in this research is "is there an effect of online learning on the mathematical communication skills of students in class 10th MAN 3 Jombang?". If there is a significant influence between online learning on students' mathematical communication skills, then the results of this study support the theory that online learning affects students' mathematical communication skills, especially in class 10th Program of MAN 3 Jombang. Based on the formulation of the problem, this research has the following objectives:

- Knowing whether there is an effect of online learning on the mathematical communication skills of class 10th MAN 3 Jombang.
- Describe the effect of online learning on the mathematical communication skills of class 10th MAN 3 Jombang.

METHOD

This research was conducted at MAN 3 Jombang. The population in this study were students of class 10th MAN 3 Jombang, while the sample was students of class 10th MAN 3 which consisted of 46 students. This study aims to analyze the presence or absence of the influence of online learning on the mathematical communication skills of students in class 10th MAN 3 Jombang. This research was conducted by requesting a research permit from the secretariat of the mathematics education department and then submitting it to the principal of MAN 3 Jombang as a research permit application. This research was conducted by preparing research instruments, namely: mathematical communication ability test instrument, student response questionnaire instrument, and interview guide for mathematical communication ability test. The method used in this research is Quasi Experimental Design or quasi-experimental, sampling using Random Assignment technique. In this study, the results obtained will be processed using the One-Sample T-test test, with the aim of knowing the truth of the statement hypothesized by the researcher.

A good measuring instrument or instrument must meet two requirements, namely validity and reliability. A measuring instrument that is not reliable or valid will result in conclusions that are not in accordance with what it should be, so that it can produce erroneous information (Sari, Dewi, & Kartini, 2020). The test instrument used in this study was to provide 3 test questions. Student response questionnaires were given to compare the test results obtained with the students' answers written in the questionnaire. In this study, the researcher analyzed the instrument using the instrument validity test, both tests, questionnaires and interviews by the validator with reference to the criteria for the level of instrument validity.

The analysis technique on the mathematical communication ability test is by calculating the results of the test scores, by testing the normality of the test questions using the Kolmogorov-Smirnov Test calculation (Sugiyono, 2017). The analysis technique in the questionnaire uses a Likert Scale, with normality testing using the Kolmogorov-Smirnov Test (Sugiyono, 2017). The results of the calculations obtained will be tested using the One-Sample T-test analysis (Sugiyono, 2013) to prove the hypothesis whether there is an effect of online learning on the mathematical communication skills of students in class 10th MAN 3 Jombang.

RESULT AND DISCUSSION

Result

The instrument validity test was carried out by two experts, namely Mr. M. Farid Nasrulloh M.Pd. as a lecturer in mathematics at the University of KH. A. Wahab Hasbullah and Mr. Arik Veprianto, S.Pd as mathematics teachers at MAN 3 Jombang. The results of the content validity test consisting of 3 questions which were carried out by asking for consideration from the two experts obtained an average score of the essay question instrument which was 86%. Based on the general assessment criteria listed on the validator sheet, the instrument can be used with minor revisions. The result of the percentage obtained is 86%. The percentage is found at the interval of $84\% \leq 100\%$ which means the validity is very high.

Table 1. Assessment of Test Questions by The Validator

Question Number	Score Validator	
	Validator 1	Validator 2
1a	4	4
2a	4	4
2b	4	4
3a	4	5
3b	5	5
Amount	21	22
Total Score		43
Max Score		50

$$\text{Score} = \frac{43}{50} \times 100\% = 86\%$$

The results of the questionnaire obtained an average score of 84%. Based on the general assessment criteria in the validator sheet, the instrument can also be used without revision. Based on the results of the percentage obtained is 84%. The percentage is found at the interval of $84\% \leq 100\%$ which means the validity is very high

Table 2. Questionnaire Assessment by Validator

Question Number	Score Validator	
	Validator 1	Validator 2
1a	4	4
2a	4	4
2b	4	4
3a	5	4
3b	4	5
Amount	21	21
Total Score		42
Max Score		50

$$\text{Score} = \frac{42}{50} \times 100\% = 84\%$$

Interview results also obtained an average score of 84%. Based on the general assessment criteria in the validator sheet, the instrument can also be used without revision. Based on the results of the percentage obtained is 84%. The percentage is found at the interval of $84\% \leq 100\%$ which means the validity is very high. Descriptive analysis of the test scores of students' mathematical communication skills after online learning for class X Language 2 can be seen in the following table.

Table 3. Value of Mathematical Communication Ability Test Results

Statistic	Class X Stats Score
Number Of Sample	46
Lowest Value	26,67
Upper Value	86,67
Score \geq KKM	27
Score < KKM	19
Mean	71,74

Based on the table above, it can be seen that the number of students who scored above the KKM was 27 with an average test of 71.74. The results of the calculation of the percentage of students' mathematical communication ability questionnaires are presented in the following table:

Table 4. Percentage Results of Mathematical Communication Ability Questionnaire

No	Value Interval	Category	N	F	Percentage
1	64 – 80	Good	46	37	80,4 %
2	47 – 63	Pretty Good		9	19,6 %
3	30 – 46	Less		0	0 %
4	13 – 29	Not Good		0	0 %
Amount			46	27	100 %

Based on the results of the highest percentage obtained, which is 80.4%, the percentage is in the interval which means high. So the value of students' mathematical communication skills is high.

Discussion

The analysis of the results of the prerequisite test before testing the hypothesis is the normality test. The results of the distribution normality test were tested using the Kolmogorov Smirnov technique using the help of IBM SPSS Statistics 21, which had a significant number greater than 0.05. This is indicated by the value of the mathematical communication ability test result of 0.092. While the results of the questionnaire of mathematical communication skills of 0.612. Both test and questionnaire results are normally distributed because the significance value is > 0.05 . The results of the normality test of mathematical communication skills in the form of a description test based on calculations with the help of IBM SPSS Statistics 21 are obtained:

Table 5. The Result of The Normality Test

Normal Parameters ^{a,b}	Mean	71,717
	Std. Deviation	13,77
Most Extreme Differences	Absolute	,183
	Positive	,107
	Negative	-,183
Kolmogorov-Smirnov Z		1,240
Asymp. Sig. (2-tailed)		,092
<ul style="list-style-type: none"> ▪ Test distribution is Normal. ▪ Calculated from data. 		

The results of the normality test of students' mathematical communication skills in the form of a questionnaire based on calculations with the help of IBM SPSS Statistics 21 obtained:

Table 6. The Result of The Normality Questionnaire Test

Normal Parameters ^{a,b}	Mean	76,043
	Std. Deviation	5,04
Most Extreme Differences	Absolute	,179
	Positive	,086
	Negative	-,179
Kolmogorov-Smirnov Z		1,213
Asymp. Sig. (2-tailed)		,106
<ul style="list-style-type: none"> ▪ Test distribution is Normal. ▪ Calculated from data. 		

Because the prerequisite test has been carried out, it can be continued with hypothesis testing to answer the problem formulation in this study using a one sample t-test with the help of IBM SPSS Statistics 21. The results of the research sample at MAN 3 Jombang whose learning using an online system showed significant results. This is in accordance with the average results of the description test scores (post-test) that were tested on students. The results of the analysis show that the influence of online learning on the mathematical communication skills of students in class X Language 2 MAN 3 Jombang in the form of a test of students' mathematical communication skills and a questionnaire of $0.000 < 0.05$. It is clear that the average result of the students' mathematical communication ability questionnaire is 76,043 and the highest percentage of students' questionnaire results is 83.75%. The results of the hypothesis test description test with one sample t-test test on mathematical communication skills based on calculations with the help of IBM SPSS Statistics 21 obtained the following results:

Table 7. The Result One-Sample T-Test

	Test Value = 0					
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Result	35.327	45	.000	71.71739	67.6285	75.8063

The results of the questionnaire hypothesis test with a one sample t-test on mathematical communication skills based on calculations with the help of IBM SPSS Statistics 21 obtained the following results:

Table 8. The Result One-Sample T-Test (Respondent)

	Test Value = 0					
	t	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Result	102.384	45	.000	76.043	74.55	77.54

The implementation of the online learning process cannot be separated from the communication skills of students. Learning that goes well will have a good impact on students' communication skills, especially on mathematical communication, and vice versa if learning does not go well it will have an impact on students' low communication skills. Mathematical communication skills are one of the important goals in learning, providing an understanding that the materials taught to students are not only memorised, but more than that with communication students can better understand the concept of the subject matter itself, especially in learning mathematics that is often considered difficult for student. Based on the description of the explanation and analysis of the research, it can be stated that online learning can affect students' mathematical communication skills in the mathematics learning process, so it can directly be said that the hypothesis states that "There is a significant effect of online learning on the mathematical communication skills of class X Language 2 MAN 3 Jombang" is accepted.

CONCLUSION

Based on the results of the analysis and discussion of research that has been described in the previous chapter regarding the presence or absence of "The Influence of Online Learning on Mathematical Communication Ability of Class X Language 2 MAN 3 Jombang Students" the researchers can conclude that: It is shown by the results of the calculation of the one sample t-test formula that the t-count values in the description test and questionnaire are 35,327 and 102,384, respectively, with a significance of 0.000. The significance value shows $0.000 < 0.05$, then H_0 is rejected and H_a is accepted, meaning that there is a significant effect of online learning on the mathematical communication skills of class X Language 2 MAN 3 Jombang.

REFERENCES

- Anderha, R. R., & Maskar, S. (2020). Analisis Kemampuan Komunikasi Matematis Siswa Pada Pembelajaran Daring Materi Eksponensial. *Jurnal Ilmiah Matematika Realistik (JI-MR)*, 1(2), 1-7.
- Gayati, S. A., & Suryawan, I. P. (2020). Pengaruh Model Pembelajaran Kooperatif Tipe ETH Melalui Pembelajaran Daring Terhadap Kemampuan Komunikasi Matematis Siswa. *Jurnal Pendidikan Matematika Undiksha*, 11(2), 26-35.
- Hariono, T., Ashoumi, H., Aprilia, D., & Ulya, A. Z. (2020). Pelatihan Pembelajaran E-Learning melalui Google Classroom. *Jumat Informatika: Jurnal Pengabdian Masyarakat*, 1(1), 35-38.
- Hodiyanto. (2017). Kemampuan Komunikasi Matematis dalam Pembelajaran Matematika. *AdMathEdu*, 7(1), 9-17.
- Nur, L. C. N., & Afidah, N. (2019, November). Designing Website Learning Media Based Wordpress Application For Senior High School Students. In *National Conference on Seminar Nasional Multidisiplin*, 72-79. <https://ejournal.unwaha.ac.id/index.php/snami/article/view/671>
- Rahmawati, N. S., Bernard, M., & Akbar, P. (2019). Analisis Kemampuan Komunikasi Matematis Siswa SMK pada Materi Sistem Persamaan Linier Dua Variabel (SPLDV). *Jurnal On Education*, 01(02), 344-352.
- Rosyidah, L. A. U., & Sholihah, F. N. (2021). Pengembangan Perangkat Pembelajaran Berbasis Discovery Learning Melalui E-Learning pada Materi Ekosistem. *Eduscope: Jurnal Pendidikan, Pembelajaran, dan Teknologi*, 7(1), 59-66.
- Sadikin, A., & Hamidah, A. (2020). Pembelajaran Daring di Tengah Wabah Covid-19. *Jurnal Ilmiah Pendidikan Biologi*, 6(2). doi.org/10.22437/bio.v6i2.9759
- Sari, N. W., Dewi, M. N., & Kartini, H. R. (2020). Analisis Kemampuan Komunikasi Matematis Dalam Meningkatkan Hasil Belajar Mahasiswa Pada Pembelajaran Online Matematika Kimia. *Jurnal Pendidikan Matematika*, 8(2). doi.org/10.23960/mtk/v8i2.pp68-76
- Sugiyono. (2013). *Metode Penelitian Pendidikan Kuantitatif, Kualitatif dan R&D*. Bandung: Alfabeta.
- Sugiyono. (2017). *Statistika Untuk Penelitian*. Bandung: Alfabeta.
- Yustina, D., Prihatin, I., & Hodiyanto, &. (2021). Pengaruh Penggunaan Media Instagram Bermuatan Problem Posing Terhadap Kemampuan Komunikasi Matematis Siswa SMA. *Prima Magistra: Jurnal Ilmiah Kependidikan*, 2(1). doi.org/10.37478/jpm.v2i1.776