The Analysis of Mathematics Learning Outcomes on Senior High School in Madiun City, Indonesia in Covid-19 Pandemic

Abstract. This study aims to determine: (1) the effect of online learning on student mathematics learning outcomes, and (2) student responses in learning mathematics through online learning. This research is descriptive quantitative research. This research was conducted in the even semester of the academic year 2019/2020. While the sample in this study is the grade XI students of two senior high schools in Madiun City, Indonesia. Data collection techniques using the method of documentation and questionnaires. The sampling technique in this study uses non-random sampling. There are two sources of data, namely mathematics learning outcome data and student response data. The instrument used in this method is an online questionnaire in the form of student responses. The student mathematics learning outcome data is used to determine the effect of online learning during the COVID-19 pandemic, while student response questionnaires are used to determine student responses to the online mathematics learning process. Based on the results of hypothesis testing obtained: (1) The average of Mathematics Learning Outcomes of grade XI students before online learning are greater than the average after online learning, and (2) Based on the effect of online learning, as many as 45% of students like mathematics and 54,67% of students do not like mathematics.

Comment [AJ1]: Please add one or two sentences as a background.

Comment [AJ2]: How many did students involve in this study?

1. Introduction

One measure of a student's success is learning outcomes, especially in schools. Learning outcomes obtained at school are the results that can be achieved by students after participating in a series of activities or learning processes or learning activities. The level of mastery of learning outcomes called learning outcomes is generally indicated by test scores or grades given by the teacher, and the value is usually determined through measurement and assessment. High and low values determined through measurement and assessment indicate high and low student learning outcomes. Because student learning outcomes are the result of participating in a series of learning processes, learning outcomes cannot be separated from how the learning activities or processes take place, meaning that the learning outcomes of a student are very dependent on whether the learning activities carried out by these students take place in conditions that enable them to obtain high levels of learning. If the learning activities carried out by students take place in conditions that allow for the achievement of high learning outcomes, then the student's academic achievement will be high and vice versa.

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Mathematics is one of the disciplines studied in schools, both elementary, junior high schools, senior high school, and even in college. Mathematics is one component of basic education in teaching fields that requires students not only to be skilled in using mathematics but able to understand the mathematics that can provide provisions for the management of reason that is useful in people's lives. At the end of 2019, the world was shocked by the coronavirus that struck Wuhan, one of the cities in China. Not too long afterward, several countries also experienced the same outbreak. So on January 30, 2020, the World Health Organization (WHO) declared this outbreak as a Public Health Emergency. WHO wrote to President Joko Widodo regarding the handling of the coronavirus that causes COVID-19 disease in Indonesia. In the letter, WHO asked President Jokowi to take several

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steps, including declaring a national emergency coronavirus. The letter was signed by WHO Director-General Tedros Adhanom and sent to Jokowi on March 10, 2020. The letter was also forwarded to the Ministry of Health and the Ministry of Foreign Affairs (Sari, 2020). And now has infected more than 4.7 million people, as many as 1.8 million recovered and killed more than 300 thousand people worldwide, based on an update on May 17, 2020 (Sari, 2000).

Therefore on January 30, 2020, the World Health Organization (WHO) declared this outbreak as a Public Health Emergency. In a letter written by WHO's Director-General, Tedros Adhanom, to President Jokowi on March 10, 2020, the organization advised Indonesia to undertake several steps to prevent the spread of the virus declaring a national coronavirus emergency. The letter was also forwarded to the Ministries of Health and Foreign Affairs (Sari, 2020). Currently, COVID-19 has infected more than 4.7 million people, with 1.8 million recoveries, and more than 300 thousand deaths, based on updated across the world on May 17, 2020. Therefore, President Joko Widodo has declared the virus a public health disaster, and it is recommended to work, study, and worship from home. The government's appeal to the community was also conveyed through the Minister of Education and Culture, Nadiem Makarim. Due to these new rules, learning activities that are usually carried out at school eventually take place online (Sari, 2020).

Online learning is education that takes place over the Internet. Online learning is just one type of distance learning for any learning that takes place across distance and not in a traditional classroom. One of the main reasons for this is it gives students' greater access to education in comparison to traditional methods of teaching as students can undertake their study from anywhere and at any time as well as being given the option to study part-time or full-time (El-Seoud et.al., 2014). Through online learning, interactive activities such as teacher-student interaction, student-student interaction, student–content interaction, and student–technology interaction are considered. Students participated in the blended learning course in which formative assessment was used to evaluate student learning outcomes by the combination of different learning activities through a learning management system (Nguyen, 2017). Online learning can refer to the situation where the interaction between the students and the teacher is done through an online system. Students have received training and taught through online system and teacher may also in the same building with them (Salamat, et.al., 2018)

Therefore, learning activities that are usually routinely carried out in schools finally take place online. Regarding learning from home, the Minister of Education and Culture emphasizes that online or distance learning is carried out to provide meaningful learning experiences for students, without being burdened with the demands of completing all curriculum achievements for grade promotion or graduation. The Minister of Education and Culture also recommends regions that have learned from home to ensure that teachers also teach from home to maintain teacher safety (Sari, 2020).

Various school efforts have been made to continue learning even though the school is on vacation. Related to the description above, the problem of this research as follows:

a. Is there a difference in the mathematics learning outcomes of class XI students in Madiun City before online learning with the mathematics learning outcomes of class XI students in Kota Madiun after online learning?

b. What is the response of students in learning mathematics through online learning?

2. Research Methods

2.1. Type of Research

Because this study aims to determine the effect of online learning in the COVID-19 pandemic period on the learning outcomes of students of class XI mathematics learning in the City of Madiun, the type

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Comment [AJ5]: Is it only one reference? Please add more relevant references.

Comment [AJ6]: But, this statements probably correct in a normal situation—not in the pandemic situation.

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Comment [AJ8]: The selection of this place should be described in the background.

Comment [AJ9]: If you would like to find student response about the online learning, you should also mention in the background that this is also important to investigate.

Comment [AJ10]: In general, the procedure of this research is not clear yet: how the data was collected, how the treatments were given to sample, etc.

of this research is descriptive quantitative research. It is a quantitative study because the research data are in the form of numbers and statistical processing.

The quantitative research method was used to determine the effect of the online learning outcome of mathematics in Senior High School students at Madiun. This is a quantitative study because the research data were taken in the form of numbers and statistical processing. Furthermore, this is a quantitative research due to its ability to use samples to solve problems related to online learning. This research used the one-group pretest-posttest design to compare the conditions before and after online learning (Wijayanto, P.A. et.al, 2017).

Another reason for using quantitative research is because it works using samples to solve the problems at hand. Meanwhile, included in descriptive quantitative research because it would be described or described the situation of students in this case the results of student responses to online mathematics learning. Also, the research design used was one group pretest-posttest design because it compared conditions before and after the treatment (Rea and Parker, 2014).

2.2. Population and Sample

In this study, the research population consists of grade XI students from two Senior High School in Madiun City, Indonesia. The technique used in sampling is the Non-Random Sampling method. It is used to obtain data from teachers who are alumni of the Mathematics Education Study Program at Surabaya Widya Mandala Catholic University, Madiun City Campus, Indonesia. This technique was chosen with the consideration that during the COVID-19 pandemic several cities implemented the Large-Scale Social Restrictions (PSBB) to stop the spread of the coronavirus, so it was not possible to meet samples directly in many schools in Madiun City. Therefore, the research team contacted the teacher through telephone interviews.

2.3. Data collection technique

The data collection techniques in this study are the documentation method and the questionnaire method. The documentation is in the form of student mathematics learning outcomes before and after online learning. Meanwhile, a questionnaire in the form of several questions must be answered or responded to by students.

2.4. Data Analysis Techniques

Because the secondary data, namely the mathematics test score of the student, are processed in intervals so data will be compared on the same subject on the Paired Sample Test (Rea and Parker, 2014). The paired samples test can be interpreted as samples with the same subject but experience

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Comment [AJ11]: What did you mean by the quantitative research method?

Comment [AJ12]: Please describe how many classes/schools involved in this study; also how many students involved?

Comment [AJ13]: Please give reasons.

Comment [AJ14]: How many questions? Where can we access the questions? In which mathematics topics were the questions?

different treatments. As a prefix to a statistical test, the population normality test is will be conducted. Both statistical tests were carried out using the SPSS program.

The population normality test uses the Kolmogorov Smirnov Goodness of Fit Test test statistics. The computing data processing uses the SPSS program with menu procedures, namely Analyze, Descriptive Statistics, and Explore. In Display, select Plot and check the Normality Plot With Test. From the output in the Tests of Normality table, record the Kolmogorov-Smirnov Statistics value as the Kolmogorov-Smirnov count (KS_{count}).

Meanwhile, the paired sample tests have two conditions. When both data are normally distributed, then the Paired Sample t-Tests are used. Furthermore, data processing is carried out by using the SPSS program with the menu procedure, namely, Analyze, Compare Means, and Paired Sample t-Test. Based on the outputs results in the Paired Samples Test table, the t- value is recorded as t-count (t_{count}) and the df value as degrees of freedom to determine t table (t_{table}). Assuming one or both of the data are not normally distributed, then the non-parametric statistical testing which is the Wilcoxon Signed Ranking Test, test the two paired samples is used. Data processing is carried out using the SPSS program with the menu procedure, namely Analyze, Compare Means, and 2 Related Samples, with the Test Type selected by Wilcoxon. Based on the output results in the Test Statistics table, the Asymp Sig. (2-tailed) is recorded as the Asymp count ($Asymp_{count}$).

3. Results and Discussion

3.1. The Student Mathematics Learning Outcomes

After conducting research and obtaining data on the student mathematics learning outcomes, data analysis was conducted. The data obtained in this study are secondary data that is the data obtained not directly from the data source. The sample is chosen because the data is given by the mathematics' teacher. The samples in this study are 96 grade XI students from two Senior High Schools in Madiun City, Indonesia. Table 1 shows the results of student mathematics learning outcomes based on data processing using the SPSS program.

Comment [AJ15]: This must be informed in the method section.

Table 1. Description of Statistics Learning Outcomes of Mathematics

Comment [AJ16]: Please follow the template for lay outing the table.

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
The Mathematics Learning Outcomes Before Online Learning	96	60	100	83.60	9.153	83.779
The Mathematics Learning Outcomes After Online Learning	96	53	98	76.82	9.072	82.295
Valid N (listwise)	96					

A normality test is carried out to determine whether the data from the population is normally distributed. Based on the analysis of normality tests, the results showed that student mathematics learning outcomes before and after online learning does not come from normally distributed populations. The processing of data obtained using the SPSS program is the following table.

Table 2. Calculation Results for Normally Test with Kolmogorov-Sminorv Test before and after the online learning

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
The Mathematics Learning Outcomes Before Online Learning	.172	96	.000	.919	96	.000
The Mathematics Learning Outcomes After Online Learning	.170	96	.000	.954	96	.002

Base on Table 2, the Mathematics Learning Outcomes before online learning have KS_{count} = 0.172 as the Kolmogorov-Smirnov statistical values. Furthermore, we have Kolmogorov-Smirnov table KS_{table} = 0.1364 based on the Kolmogorov-Smirnov Test Critical Value Table with n = 96 and a significant level (α) = 0.05. So, the critical area is DK = {KS | KS> 0.1364}. Because KS_{count} $\in$ DK, H_0 is rejected, which means that the Mathematics Learning Outcomes of Grade XI Students before online learning does not come from a normally distributed population. Analog with the Mathematics Learning Outcomes before the online learning process, we have the Mathematics Learning Results of Class XI students after online learning did not come from a normally distributed population.

Therefore, the Paired Sample Test has been used to analysis of the student mathematics learning outcomes before and after online learning. In this study, two research hypotheses were examined to determine which hypotheses should be accepted and which should be rejected. The H_0 hypothesis is there is a difference between the average of the Mathematics Learning Outcomes of Class XI Students before online learning and the average of the Mathematics Learning Outcomes of Class XI Students after the online learning. Because the two data are not normally distributed, so the two paired samples use non-parametric statistical testing, namely, the Wilcoxon Signed Ranking Test. Data processing using SPSS assisted with the menu procedure Analyze, Compare Means, and 2 Related Samples, with Test Type selected by Wilcoxon.

Table 3. The Results of Wilcoxon Signed Ranks Test

		N	Mean Rank	Sum of Ranks
Mathematics Learning Outcomes After Online Learning- Mathematics Learning Outcomes Before Online Learning	Negative Ranks	63[a]	48.02	3025.00
	Positive Ranks	21[b]	25.95	545.00
	Ties	12[c]		
	Total	96		

a. Mathematics Learning Outcomes After Online Learning< Mathematics Learning Outcomes Before Online Learning
b. Mathematics Learning Outcomes After Online Learning> Mathematics Learning Outcomes Before Online Learning
c. Mathematics Learning Outcomes After Online Learning = Mathematics Learning Outcomes Before Online Learning

Table 4. Wilcoxon Test Table

Test Statistics[b]

|	Hasil Belajar Matematika Sesudah Pembelajaran Online - Hasil Belajar Matematika Sebelum Pembelajaran Online
Z	-5.538[a]
Asymp. Sig. (2-tailed)	.000

    a. Based on positive ranks
    b. Wilcoxon Signed Ranks Test

Based on the Statistics Test table for an Asymp Sig (2-tailed), we have $\text{Asymp}_{count} = 0,000$. Furthermore, because of area of criticism is DK = {Asymp | Asymp < 0.05} and $\text{Asymp}_{count} = 0,000 \in$ DK, so H_0 is rejected. We conclude that the average Mathematics Learning Outcomes of Class XI Students before learning online are different from the average Mathematical Learning Outcomes of Class XI Students after online learning. Based on the average in the Descriptive Statistics table, we conclude that the average Mathematics Learning Outcomes of Class XI students before online learning is greater than the average Mathematics Learning Outcomes of Class XI students after online learning.

3.2. The Student's Response to Mathematics

Questionnaire data of the student's response to Mathematics was obtained from 75 high school students in Madiun City. From the processing of questionnaire of students' responses to Mathematics, we obtain the following results were:

Figure 5. The Student's Response to Mathematics
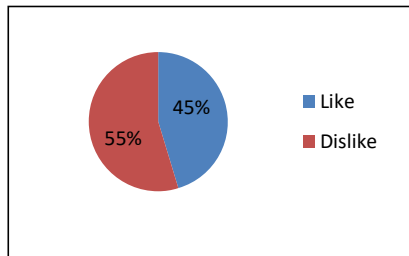
Positive responses to mathematics after students take online learning were obtained from questionnaires. The following are the results obtained from filling out the questionnaire as many as 75 students, namely:

1. Based on Figure 5, as many as 45% of students like mathematics and 55% of students do not like mathematics;
2. Obstacles faced by students when participating in online learning, namely non-smooth signals, limited quota, the teacher directly gives questions without any material explaining how to solve problems so that students do not understand the material, and feel disturbed by noise in the home environment;
3. The efforts that have been made by students in overcoming these obstacles, namely: look for a smooth internet/wifi network to neighbors or other places outside the home; search for material on the internet (browsing) and access YouTube; asking friends and doing it together; studying in the room to avoid noise;
4. Media used in online mathematics learning, namely Whatsapp (WA), Google Classroom (GC), Zoom, E-learning schools, and e-mail;
5. As many as 58.16% of students study itself, but there are also those who help in learning, namely friends, relatives, tutors, and even parents;
6. Suggestions from students for online mathematics learning, that is, teachers should make videos or explain material through videos so that students can better understand completion steps and formulas that can be used.

4. Conclusions

Based on the discussion of research results, it can be concluded as follows:

1. The average student learning outcomes in mathematics before online learning are greater than the average student learning outcomes in mathematics after online learning;
2. Based on the effect of online learning, as many as 45% of students like mathematics and 55% of students do not like mathematics.

References

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Comment [AJ17]: How many questions are there in the questionnaire?

Comment [AJ18]: ?

Comment [AJ19]: ?

Comment [AJ20]: This is not clearly described in the method section.

Comment [AJ21]: Please rewrite this paragraph in a narrative way.

Also, please add limitations of this study and recommendation for further research.

Comment [AJ22]: Please add relevant references as suggested in the comments (above).