The effect of distance learning during Covid-19 pandemics on the mathematical learning results

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Abstract. During the COVID-19 pandemic, the education system was faced with a situation that required teachers to master distance learning media. Distance learning is still a polemic among the community, this is because distance learning is still considered no better than conventional direct learning, especially in mathematics learning that requires understanding of concepts to be able to master the material. The purpose of this research is find out which method is better between the class using the distance learning method during the COVID-19 pandemic and the class using the conventional direct method. This type of research conducted in this study is ex post facto research with a causal comparative design. The sample in this study was class 11th grade of the 2018/2019 and 2019/2020 school year at one of the senior high school in Sukabumi. Mathematics learning outcome data is obtained from the end of semester exam results, the data is then processed using the Mann-Whitney nonparametric difference test. The results showed that there were differences in mathematics learning outcomes between students who used the distance learning method and students who used conventional direct methods, and students who used distance learning had better results than students who used conventional direct methods.

1. Introduction
Mathematics is a subject that has a very important role in education. Almost all fields of study require mathematics. Given the importance of the role of mathematics, mathematics is studied starting from kindergarten, elementary, middle and high school. However, some students still think that mathematics is a difficult subject. Not a few of them are avoiding mathematics, even though mathematics is a science that is very important for everyday life. Even to be able to continue college mathematics school as one of the subjects being tested.

So far, mathematics taught in schools prioritizes theories that are sometimes difficult for students to apply in real life. In general students are only able to solve mathematical problems without understanding the application. In learning mathematics, understanding concepts are needed to be able to master mathematical material, because by understanding mathematical concepts students can better understand the concepts of the subject matter itself.

To improve students' mathematical abilities in mathematics, serious effort is needed by the teacher to manage learning by providing opportunities for students to be actively involved in the assessment of material and be able to construct concepts with their own abilities. One model that embraces constructivism learning theory that emphasizes the active involvement of students is the PACE learning model. The PACE model was developed by Lee [10] which stands for Project, Activity, Cooperative
Learning and Exercise. Students taught by the PACE Model are far more involved in active learning through group work and class discussions [10].

But the problem is, during the COVID-19 pandemic outbreak the education system was faced with a situation that demanded that teachers be able to master the distance learning media. Distance education system is one of the solutions to overcome difficulties in face to face learning with the existence of social distancing rules given the problems of time, location, distance and cost which are major obstacles today [9]. When the situation of the Pandemic Covid-19 outbreak hit the world, including Indonesia, it has not yet ended, almost all educators use distance learning (not face to face). The interaction of educators and students is done directly or indirectly, for example by chatting through an internet connection (directly) or by send an email (indirectly) to just collecting assignments [12].

In relation to learning outcomes, distance learning is still a polemic in the community [5]. That is because distance learning is still considered no better than conventional direct learning, especially in learning mathematics. This is because in studying mathematics one must think so that he is able to understand mathematical concepts learned and be able to use these concepts appropriately when he has to find answers to various mathematical problems [13], while the thought process cannot be obtained from distance learning [6].

Based on the above problems, a study was conducted to find out whether there were differences in learning outcomes in mathematics between students who used the distance learning method during the COVID-19 pandemic period with conventional direct learning methods. If there are differences, which method is better between the distance learning methods during the COVID-19 pandemic and conventional direct learning methods.

2. Methods
This research is an ex post facto research, meaning the data collected after all the events in question occurred. This study is to look at the differences in mathematics learning outcomes by comparing the learning outcomes of two class groups namely the control group (students who get learning in class, namely class 11th grade for science 2018/2019 school year) and the experimental group (students who get distance learning because in the COVID-19 namely class 11th grade for science year 2019/2020) The design used is a comparative causal design.

The sample in this research took 2 classes, namely class 11th grade for science for the 2018/2019 school year, totaling 52 students as the control class and class 11th grade for science for the 2019/2020 school year, totaling 59 students as the experimental class. The application of conventional direct learning methods is used in the control class while the application of distance learning methods during the COVID-19 pandemic was used in the experimental class.

Mathematics learning outcome data obtained from the final semester exams, the data is then processed using SPSS 23 software with the following steps:

a. Calculate the mean and standard deviation (descriptive analysis of sample data)
b. Test the normality of sample data.
c. Average Difference Test

3. Result and Discussion
The following is the result of a descriptive analysis of student learning outcomes in mathematics class 11th grade for science as presented in Table 1 below.

| Group         | Mean | Std. Deviation | Maximum | Minimum |
|---------------|------|----------------|---------|---------|
| Control Class | 76,94| 3,68           | 85      | 71      |
| Experiment Class | 82,95| 1,02           | 86      | 81      |

Table 1 above shows the mean mathematical learning outcomes for the experimental class using distance learning methods get a higher average value of 82.95 compared to the mean value of the control class
that is 76.94. The maximum score achieved by the experimental class students is higher that is 86 compared to the control class which gets a maximum score of 85. The minimum score achieved by the experimental class students is also higher that is 81 compared to the control class that is 71. It can be concluded from the table above that the experimental class get better value compared to the control class.

To answer the research questions, a statistical test was performed using the average difference test. Previously conducted a test of the normality of student learning outcomes data distribution, normality testing was carried out on the results of the final semester mathematics test results in the academic year 2018/2019 and 2019/2020 conducted in the experiment and control class using kolmogorov–smirnov test.

### Table 2. Test of normality

|                      | Kolmogorov-Smirnov Statistic | Sig. |
|----------------------|------------------------------|------|
| Experiment Class     | 0.286                        | 0.000|
| Control Class        | 0.124                        | 0.044|

Based on table 2 above, the significance level previously determined is $\alpha = 0.05$. Based on the results of processing with SPSS, the sign for the control group is obtained equal to 0.000 ($\text{sig} = 0.000$) thus it can be concluded that the end of semester examination data for the control group is not normally distributed because $\text{Sig.}$ smaller than $\alpha$ or $0.000 < 0.05$. In the experimental group equal to 0.044 ($\text{sig} = 0.044$), it can be concluded that the final semester examination data for the experimental group was not normally distributed because $\text{Sig.}$ smaller than $\alpha$ or $0.044 < 0.05$. Based on these findings, the nonparametric statistic will be used, namely the Mann-Whitney test.

### Table 3. Mann-Whitney Test Results

| Mathematics Learning Outcomes | Mann-Whitney U | Wilcoxon W | Z         | Asymp. Sig. (2 tailed) |
|-------------------------------|----------------|------------|-----------|------------------------|
|                               | 284,500        | 1662,500   | -7.519    | .000                   |

Based on table 3 above, the Mann-Whitney test results on the results of the end of the semester exam which produces a probability value ($\text{sig}$) <0.05 (0.00 <0.05). Based on this in level of significance 95%, asymp.Sig. (2-tailed) is obtained which means that null hypothesis (Ho) state that there is no significant different in learning outcomes between classes with distance learning methods during the COVID-19 pandemic period and classes that use conventional direct learning methods is rejected.

The results of the study above illustrate that students who do distance learning have better results when compared to students who use conventional direct learning methods. Based on the findings in the field with interviews with several students who use online learning methods, it is known that there are many advantages when learning with this method:

1) The material provided by the teacher consists of learning videos that can be stored directly by students so students can learn without using space and time
2) Students can discuss with other students in WhatsApp groups if there are questions that are difficult to answer
3) Assignments given by the teacher have a long time limit so that students can work on problems more thoroughly
4) Questions from students directly responded by the teacher through the application WhatsApp
5) The questions given by the teacher are more diverse so students are more active in solving problems
6) During the COVID-19 period one TV channel providing online learning helped students gain more knowledge.
7) Students are more independent in looking for additional material that has not been given by the teacher.

4. Conclusion

Based on the results of research and the results of data analysis that has been done, it can be stated that there are significant differences between student learning outcomes in this case using the final semester exam between students who use the distance learning method during the COVID-19 pandemic period with students who use the direct learning method Conventionally, especially in mathematics class 11th grade for science at senior high school in Sukabumi in the 2018/2019 school year and 2019/2020 school year. And by comparing the magnitude of the two samples above, students who use the distance learning method have better results when compared with students who use conventional direct learning methods.

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