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The implementation of online learning during the COVID-19 pandemic regarding students' mathematics learning outcomes

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Abstract:
This study aimed to determine how well online learning was used during the Covid-19 pandemic regarding the academic outcomes for class VII students at SMP Negeri 38 Buton. This study was an experiment in research methodology. The population of this study was made up of all of the class VII students from SMP Negeri 38 Buton, which had two classes. Twenty students of class VII1 served as the experimental class, and twenty students of class VII2 served as the control class, and samples were collected using random sampling. In this study, tests were used as data-gathering methods. Descriptive and inferential statistics were employed in the data analysis for this investigation. According to the research findings, class VII students at SMP Negeri 38 Buton did not benefit from online learning during the Covid-19 pandemic regarding their learning outcomes.

Keywords: Covid-19 Pandemic, Learning Outcomes, Mathematics, Online Learning

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Introduction

Education is an effort or activity that is carried out consciously, intentionally, regularly, and planned to change or develop the potential and desired behavior. One of the means of formal educational institutions in the context of achieving these educational goals is the school. Through school, students can learn various things about their potential and life experiences (Kadeni, 2014). One of Indonesia's education goals has been stated in the 1945 Constitution: to educate the nation's life. It means that everything related to education is the responsibility of the government. Mathematics is one of the subjects that must be taken at every level of education; this becomes learning and fosters a spirit of working together with group mates (Rahmatia & Ihwana, 2021).

Learning is a positive change so that new skills and knowledge will be obtained in the final stage. According to Irwanto (2020), learning is a process of transformation

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from being unable to capable to occur within a certain period. By learning, students can realize the expected goals.

Along with the current conditions, the teaching and learning process was not optimal because of the Covid-19 pandemic, commonly known as the Corona Virus. Thus teachers were required to learn directly without face-to-face or commonly called online. To facilitate learning, they must have used online media such as Internet media, WhatsApp, Zoom, google classroom, google meet, and other online media. The rapid progress of science and technology has resulted in the transformation of people's commitment to life. Very dynamic progress requires the ability to adapt quickly and the development of a good mindset. Suppose learning was done by familiarizing students to construct their knowledge. Thus the plans owned by students could develop optimally; therefore, innovation in learning patterns was the main thing to be able to deal with advances in science and technology (Serdyukov, 2017).

The World Health Organization (WHO) classifies this illness as a pandemic because Covid-19 could infect anyone anywhere. In the context of health, a pandemic is an epidemic of a disease that spreads to numerous nations and affects many people. The government had made it illegal to keep a safe distance from others, avoid crowds, and wash hands frequently. As a result, universities were not permitted to perform direct learning activities by the Ministry of Education. Universities should be ready to plan online or distance learning (Mushtaha et al., 2022).

The rapid development of information technology is currently creating challenges for teachers. Considering that teachers are no longer the only source of information, the opinion appears that education can occur without teachers. Education is indeed defined as the process of acquiring knowledge. However, remember that education is a medium for maturing, so the process can only occur with a teacher (Pereira et al., 2020). Online education was being used as a remedy for the Covid-19 epidemic. Online learning is instruction through a network of computers that is accessible, connected, and flexible, allowing for various learning exchanges (Fikri et al., 2021). Zhang et al.'s research (Firman & Rahayu, 2020) demonstrated how the Internet and multimedia technology might transform how knowledge is transmitted and can substitute classroom instruction. The educator applied the online learning concept in this way.

An electronic-based learning method is online. The utilization of a computer network is one of the media. It is possible to create a computer network using the web, which can later be expanded into the internet, a larger computer network. According to Ardiansyah & Setiawan (2023), the teaching and learning process depends on the Internet since it is carried out via an online learning system, eliminating the need for face-to-face interactions between teachers and students.

Research conducted by Sulistiani et al. (2021) the results showed that online learning using WhatsApp group media with learning video interventions was better and more effective in improving learning outcomes in class VIII students of SMP N 1 Air Naningan during the Covid-19 Pandemic. Research conducted by Husna (2020) When looking at student learning outcomes, the findings demonstrated that the calculus course's derivative material using M-Learning media was highly effective. The results of student learning using M-Learning after lectures were better than those of student learning using M-Learning beforehand. Research conducted by Muniroh et al. (2020) When viewed from the perspective of student learning, the study's findings indicated that the significance value was $0.04<0.05$, meaning that there were differences in the student learning outcomes between classes that use Google Meet media and classes that

did not. As a result, learning mathematics using the Google Meet application media was quite effective. Research conducted by Putri (2021) obtained in this study are: 1) Using the Whatsapp Group platform for learning significantly improves learning outcomes; 2) Using the Google Meet platform for learning significantly improves learning outcomes; and 3) The learning platform used in the experimental class, namely Google Meet, has a more significant impact. It is also suitable for what Bintara & Kocimaheni (2020) said: Google Meet is a flexible application because it can be accessed through the application and the web. From some of these studies, researchers tried to conduct research at SMP Negeri 38 Buton, which researchers categorized as a school where the research was conducted in a rural place far from the crowd, and the network in the area was not very good.

As a substitute for face-to-face learning amid the Covid-19 pandemic, this video conference was an alternative that could be used effectively (Simamora, 2020). But on the other hand, its use in online learning experienced many obstacles, including requiring a good internet network. There were obstacles, such as sound or video interference, if no good internet network was available (Lerman et al., 2020). In addition to applications such as WhatsApp, Zoom and learning platforms such as Google Classroom and others, there are also learning media that support online learning. Learning media must be made in such a way as to support students in mastering the material because learning media is a means of conveying learning messages and information. The means or tools to carry messages and information from educators to recipients of learning messages, namely students, is the definition of learning media (Mulyati et al., 2022).

At SMP Negeri 38 Buton, several teachers, such as math teachers, had implemented online learning. Mathematics teachers implemented online learning using the media Zoom Group. By using the application media Zoom, this application facilitated the teaching and learning process for teachers and students because wherever they could take part in learning, there was no need to pay to go to school, and they were safe from the covid-19 virus. However, there were a few obstacles to this learning; students must have had smartphones and an internet network. Also, students must have studied even harder because the teacher only expected the textbooks given to students.

Based on the background that has been stated, researchers conducted research on the application of online learning during the Covid-19 pandemic in terms of the learning outcomes of VII grade mathematics students at SMP Negeri 38 Buton. The formulation of the problem in this study is whether the application of online learning is effective during the Covid-19 pandemic on the mathematics learning outcomes of VII grade students at SMP Negeri 38 Buton. Then, by the formulating of the problem, this research aims to determine the application of online learning effectively used during the Covid-19 pandemic on the mathematics learning outcomes of VII grade students at SMP Negeri 38 Buton.

Research Methods

This research is Quasy Experiment. Quasy Experiment research with a Pre-test post-test Control Group design uses two classes (control and experimental classes).

In the experimental class, a pre-test is given to see students' basic abilities after being given treatment as an experiment with an online learning application after completing the learning process. Then, students are given a posttest to see changes in

student math learning outcomes. Likewise, an initial test will also be given in the control class before the material is taught. After the learning process, a final test is given to see the progress. The design used is a pre-test post-test control group design, according to Furchan (2016) research implementation design, as shown in Table 1.

Table 1. Research Design

Group	Pre-test	Treatment Learning	Post-test
E	Y_1	online learning	Y_2
K	Y_1	offline learning	Y_2

Description:
E : Experimental class with online learning
K : Control class with offline learning (direct face-to-face)
Y_1 : Student learning outcomes before being given treatment
Y_2 : Student learning outcomes after being given treatment

The research variables consist of two variables, namely the independent variable (variable X) and the dependent variable (variable Y) (Uyanık & Güler, 2013). The independent variable in this study is online learning (X); online learning is a learning activity carried out face-to-face indirectly between students and teachers using the help of online media. The dependent variable in this study is the results of learning mathematics (Y). The learning outcomes in question are the results obtained by students after carrying out the learning activities that have been achieved.

This research was conducted in class VII of SMP Negeri 38 Buton in the odd semester of the 2020/2021 academic year. The population of this study was all class VII students of SMP Negeri 38 Buton for the 2020/2021 academic year, which consisted of 2 classes, namely class VII1 and class VII2, with a total of 40 students. The samples taken in this study were 2 classes where class VII1 consisting of 20 students using the online learning model, and the other class, namely class VII2, using the offline learning model.

The instrument used in this study was a test instrument. In this study, the experimental and control initial test data were given before implementing online and offline learning. After implementing online and offline learning, the final test data (post-test) experiments and controls were given. The data analysis technique in this study used 2 tests, namely the prerequisite test and the hypothesis test, which consisted of a data normality test and a data homogeneity test.

The normality test tests the data to see whether the residual values are normally distributed (Kozak & Piepho, 2018). For testing whether the sample is normal, it is calculated by testing two independent samples, Kolmogorov-Smirnov, using a significant level of 0.05. Research data is said to be normally distributed if the significant value is more than 0.05. The homogeneity test was carried out to find out whether the data obtained the same population variance or not, then a variant homogeneity test was carried out with the formula (Wibisono, 2017):

$$F = \frac{biggest\ variant}{smallest\ variant} = \frac{s_b^2}{s_k^2}$$

The test was conducted at α = 0.05 with the test criteria: Reject H_0 If $F_{count} \geq F_{tab}$ means the group variance is not homogeneous. Conversely, if $F_{count} \leq F_{tab}$, H_0 means that the group is homogeneous.

Hypothesis testing was conducted to determine whether online learning was effective during the Covid-19 pandemic on students in mathematics learning outcomes class VII at SMP Negeri 38 Buton. Then the *t* test can be used with the following steps: 1) Formulate the null hypothesis and the alternative hypothesis; 2) Determine the value of t_{count} calculated by the formula (Azis & Dewangga, 2020):

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

with:

$$s = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

(Sundayana, 2014)

3) Determine the value of t_{table} = t= (dk = n_1 + n_2 -2); 4) Criteria for testing the hypothesis: If: $-t_{table} \leq t_{value} \leq t_{table}$ face H_0 accepted.

Results and Discussions

The research conducted is research quasi-experiment that was carried out at SMP Negeri 38 Buton. The research was conducted in two classes, namely class VII_1 and class VII_2. Class VII_1 has 20 students as an experimental class in the online learning model. In comparison, Class VII_2 has 20 students as the control class in the offline learning model.

Table 2. Results of Descriptive Analysis of Experimental Class Data

		Pre-test	**Post-test**
N	**Valid**	**20**	**20**
	Missing	**0**	**0**
Mean		64.00	61.00
Median		65.00	60.00
Modus		80.00	60.00
Std. Deviation		18.46	9.67
Minimum		30.00	40.00
Maximum		90.00	80.00
Ideal Value		100	100

From the descriptive analysis using the SPSS initial test (pre-test) 20 students got a mean of 64.00, a median of 65.00, a mode of 80.00, a minimum score of 30, a maximum of 90 and a standard deviation of 18,46 from an ideal value of 100. While the final test (post-test) of 20 students. Students get a mean of 61.00, a median of 60.00, a mode of 60.00, and a standard deviation of 9.67, a minimum of 40 and a maximum value of 80 from an ideal value of 100.

Table 3. Results of Descriptive Analysis of Control Class Data

		Pre-test	Post-test
N	Valid	20	20
	Missing	0	0
Mean		62.50	72.50
Median		60.00	70.00
Modus		60.00	70.00
Std. Deviation		10.69	7.16
Minimum		40.00	60.00
Maximum		80.00	80.00
Ideal Value		100	100

From the descriptive analysis using SPSS, the initial test scores of 20 students was the mean value of 62.500, the median of 60.00, and the mode of 60.00 standard deviation of 10.69, the minimum value of 40.00 and the maximum value of 80.00 from the ideal value are 100. While the final test (post-test) score of 20 students has an average value of 72.50, the median is 70.00, the mode is 70.00, the standard deviation is 7.163, the minimum value is 60.00, and the maximum is 80 from the ideal value of 100.

The prerequisite test consists of a data normality test and a data homogeneity test. For testing whether the sample is normal or not, it is calculated using the two independent sample, Kolmogorov-Smirnov test using a significant level of 0.05.

Table 4. Results of Instrument Normality Test Analysis Pretest Experiment Class and Control Class

Test Statistics[a]		
		Data Pre-test
Most Extreme Differences	Absolute	0.300
	Positive	0.200
	Negative	-0.300
Kolmogorov-Smirnov Z		0.949
Asymp. Sig. (2-tailed)		0.329
a. Grouping Variable: Kelas		

Based on the results of the analysis above, where there were two comparison classes, namely the experimental class and the control class, using the test of two independent samples, Kolmogorov-Smirnov. The Kolmogorov-Smirnov Z value was 0.949 with a significant value of 0.329; this value was more than 0.05, meaning accepted H_0. It can be concluded that the treatment between the experimental and control classes is normally distributed.

The homogeneity test used Levene's Test for Equality of Variances using a significant level of 0.05.

Table 5. Results of Homogeneity Test Analysis on Progress (Difference) Experiment Class and Control Class

		Levene's Test for Equality of Variances	
		F	**Sig.**
Progress	Equal variances assumed	3.269	0.079
	Equal variances not assumed		

The results of the above analysis show that the F value on the test Levene's Test for Equality of Variances of 3.269 with a significant value of 0.079 more than the value of 0.05. It means accepting H0 or the two classes in the online learning test data during the Covid-19 pandemic was stated to be homogeneous.

Then in the hypothesis analysis, the results of the SPSS program analysis can be seen in Table 6:

Tabel 6. Results of Hypothesis Testing Data for Experiment Class and Control Class

Independent Samples Test

		t-test for Equality of Means						
		t	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence Interval of the Difference**	
							Lower	**Upper**
Progress	Equal variances assumed	-2.729	38	0.010	-13.00000	4.76279	-22.64177	-3.35823
	Equal variances not assumed	-2.729	36.378	0.010	-13.00000	4.76279	-22.65591	-3.34409

The analysis of the normality and homogeneity tests (prerequisite tests) showed that the control and experimental class data were normal and homogeneous. Thus, the test uses the independent sample *t* test. From the results of the value hypothesis progress or difference posttest with pretest in the experimental class and control class, namely the *t* value of -2.729 with a significance of 0.010, compared with the sig taking of 0.05. therefore it can be concluded that the two classes, namely experiments with online learning and controls with offline learning, differ significantly. But if looking at the value mean difference of -13.00000, the result of the difference between the experiment and the control class means that the average progress of the control class is greater than the experiment class, which means that the control class is more effective than the experimental class. Thus, it is concluded that accepting H0, or the application of online learning during the Covid-19 pandemic, was ineffective regarding the learning outcomes of class VII students at SMP Negeri 38 Buton.

The descriptive analysis obtained data after being given a final test (post-test) on student learning outcomes. The experimental class uses an online learning model with an average of 61.00. The median is 70.00, the mode is 70.00, the standard deviation is 9.679, the minimum value is 40, and the maximum is 80 from the ideal value of 100. It

means online learning is not effective in learning integer material. In the control class using the offline learning model (face-to-face), obtaining the average score of student learning outcomes of 72.50, the median is 70.00, the mode is 70.00 with a standard deviation of 7.163, the minimum score is 60, and the maximum is 80 from the ideal value of 100.

Based on the results of the normality test with the experimental class using online learning and the control class using offline learning on student mathematics learning outcomes, from the test results of the two groups using test two independent sample Kolmogorov-Smirnov. The Kolmogorov-Smirnov Z value is 0.949 with a significant value of 0.329, where this value is more than 0.05, meaning accept H0 or the treatment between the experimental and the control classes are normally distributed. While the homogeneity test of students' mathematics learning outcomes on the test Levene's Test for Equality of Variances of 3.269 with a significant value of 0.079 is more than the value of 0.05. It means accepting H_0 or the two classes in the online learning test data during the Covid-19 pandemic were stated to be homogeneous.

The *t* test showed that the results of learning mathematics in the control and experimental classes differ. Significantly the average value of the learning outcomes of the control and experimental classes is different. If the mathematics learning outcomes of control class students are higher than the experimental class, it means that the control class learning is more effective than the experimental class.

Online learning at SMP Negeri 38 Buton was implemented for the first time. From that, many students were not too familiar with the learning process, and there were many obstacles in each implementation, ranging from the lack of students not having their own smartphones to the problem of poor networks. It is also suitable to research by Fikri et al. (2021). However, learning during the pandemic, namely online learning, must have been done to reduce the spread of covid-19. Baber (2022) said that the social and physical distancing policies implemented to reduce the spread of Covid-19 encourage all elements of education to activate classes even though schools were closed. School closures were the most effective mitigation measure to minimize the outbreak's spread to children. The solution was to implement learning at home by utilizing various supporting facilities.

In the online learning process, all students tried to accept the learning process well. Implementing online learning was attended by 20 students who were used as an experimental class. All children played an active role in the teaching and learning process. It was the first time online learning had been carried out at SMP Negeri 38 Buton because the government required the implementation of online learning. However, the researcher tried to conduct research by comparing classes that allowed for face-to-face learning. In online learning, because that was the first time, there were still children who did not even understand how to use smartphone media, or when providing subject matter, some children did not really understand the subject matter because the students received material such as videos only. Saputra et al. (2021) said some students thought online learning was ineffective. But It is also suitable to what was stated by Harefa and Sumiyati (2020) students indicated that conventional (face-to-face) learning systems were still needed by interpreting data from several research indicators. The results of this study are also suitable to research conducted (Azis & Rikfan, 2022). There was no effect of student responses to online learning during the Covid-19 pandemic on class IX students of SMP Negeri 2 Baubau. This is because: 1) A lack of enthusiasm in student learning is demonstrated by the majority of student learning test results that are

low and under of the standard KKM scores; 2) The majority of students struggle to answer the math problems they are given; and 3) The teacher's teaching strategies are constrained, which results in less contact between teachers and students and affects how well students learn and how much they understand.

Some of the conclusions obtained in other studies such as Azis and Nurmayanti (2022) with a *t*-count of 0.628 and a significant value achieved 0.534 > 0.05, who concluded that there was no impact on students' opinions of the online learning experience during the Covid-19 pandemic on the outcomes of learning mathematics in class XII Madrasah Aliyah Kaledupa. Then research Azis and Murniati (2022) it was found that online learning had little impact on the mathematical learning achievements of SMA Negeri 2 Kaledupa's Grade 12 Science students during the Covid-19 pandemic. It is demonstrated by the estimated F value of 0.569 with a critical value of 0.574 > 0.05, indicating that H0 was accepted. In other words, the Covid-19 outbreak did not affect the grade 12 students at SMA Negeri 2 Kaledupa's learning outcomes because of the online learning process.

Conclusions

Implementing online learning during the Covid-19 epidemic was not beneficial regarding the learning outcomes for class VII students at SMP Negeri 38 Buton. It can be inferred based on the data analysis and discussion findings. Based on the results of the researcher's observations, the ineffectiveness of online learning was because it required smartphones; that was the first time it had been used at SMP Negeri 38 Buton. Then the network available in students' homes through smartphone transmitters is not very strong, so they are forced to face virtual intermittent. So that sometimes the subject matter delivered by the teacher seems to be missed. From the conclusions of the research, several suggestions are addressed to parties who have interests, including 1) For teachers, it is expected that they can use online learning models in the learning process on subject matter that is according to this learning model. 2) Students are expected to study even harder to optimize the learning results, even if it's only from home. 3) For readers, it can be used as a reference matter for further research. Researchers recommend that because the Covid-19 pandemic has passed and the opportunity for students to learn face-to-face can be done. A teacher must be more creative in delivering learning matters, or learning can be done in a hybrid of offline and online environments.

References

Ardiansyah, R., & Setiawan, C. (2023). Physical education teachers' reflection about their learning in post-pandemic era: A Mixed-Method study. *International Journal of Social Science Research and Review*, *6*(6), 279–286. https://doi.org/10.47814/ijssrr.v6i6.1363

Azis, A., & Dewangga, J. (2020). Efektivitas model pembelajaran explicit intruction dan reward and punishment ditinjau dari hasil belajar matematika siswa [The effectiveness of explicit instruction and reward and punishment learning models is seen from the results of students' mathematic. *Jurnal Akademik Pendidikan Matematika*, *6*(1), 1–9. https://doi.org/10.31219/osf.io/7xh46

Azis, A., & Murniati, W. O. I. (2022). Pengaruh pembelajaran daring di masa pandemi COVID-19 terhadap prestasi belajar matematika siswa SMA [The effect of online learning during the COVID-19 pandemic on high school students' mathematics learning achievement]. *Jurnal Axioma : Jurnal Matematika Dan Pembelajaran*, *7*(2). https://doi.org/10.56013/axi.v7i2.1240

Azis, A., & Nurmayanti, N. (2022). Persepsi siswa pada proses pembelajaran daring di masa pandemi COVID-19 terhadap hasil belajar matematika siswa Madrasah Aliyah [Students' perceptions of the online learning process during the COVID-19 pandemic on the results of mathematics learning for Madr. *SUPERMAT: Jurnal Pendidikan Matematika*, *6*(1), 18–34. https://doi.org/10.33627/sm.v6i1.723

Azis, A., & Rikfan, R. (2022). Pengaruh Respon siswa dalam pembelajaran daring dimasa pandemi COVID-19 terhadap hasil belajar matematika siswa [The effect of student responses in online learning during the COVID-19 pandemic on student learning outcomes in mathematics]. *Journal of Mathematics Education and Science*, *5*(1), 13. https://doi.org/10.32665/james.v5i1.29

Baber, H. (2022). Social interaction and effectiveness of the online learning–A moderating role of maintaining social distance during the pandemic COVID-19. *Asian Education and Development Studies*, *11*(1), 159–171. https://doi.org/10.1108/AEDS-09-2020-0209

Bintara, A. P. P., & Kocimaheni, amira agustin. (2020). Persepsi mahasiswa terhadap penggunaan aplikasi google meets pada mata kuliah hyouki level shokyu [Student perceptions of the use of the Google application meet the shokyu level Hyouki course]. *Hikari (Jurnal Ilmiah Mahasiswa Jurusan Bahasa Dan Sastra Jepang Universitas Negeri Surabaya)*, *4*(2). https://jurnalmahasiswa.unesa.ac.id/index.php/hikari/article/view/35964

Fikri, M., Faizah, N., Elian, S. A., Rahmani, R., Ananda, M. Z., & Suryanda, A. (2021). Kendala dalam pembelajaran jarak jauh di masa pandemi COVID-19: sebuah kajian kritis [Obstacles in distance learning during the COVID-19 pandemic: A critical study]. *Jurnal Education and Development*, *9*(1), 145. https://doi.org/10.37081/ed.v9i1.2290

Firman, F., & Rahayu, S. (2020). Pembelajaran online di tengah pandemi COVID-19 [Online learning in the midst of the COVID-19 pandemic]. *Indonesian Journal of Educational Science (IJES)*, *2*(2), 81–89. https://doi.org/10.31605/ijes.v2i2.659

Furchan, A. (2016). *Pengantar metode penelitian kualitatif [Introduction to qualitative research methods]*. Usaha Nasional.

Harefa, N., & Sumiyati, S. (2020). Persepsi siswa terhadap google classroom sebagai LMS pada masa pandemi COVID-19 [Students' perceptions of Google Classroom as an LMS during the COVID-19 pandemic]. *Science Education and Application Journal*, *2*(2). https://doi.org/10.30736/seaj.v2i2.270

Husna, R. (2020). Efektivitas pembelajaran turunan pada masa pandemi COVID-19 melalui media mobile learning ditinjau dari hasil belajar mahasiswa [The effectiveness of derivative learning during the COVID-19 pandemic through mobile learning media was seen from student lear. *Numeracy*, *7*(2), 324–333. https://doi.org/10.46244/numeracy.v7i2.1187

Irwanto, I. (2020). Use of e-learning models for lesson activities on microcontroller's eyes to improve student learning outcomes in vocational education in electrical engineering Sultan Ageng Tirtayasa University. *VANOS Journal of Mechanical Engineering Education*, *5*(1), 81–90. https://doi.org/10.30870/vanos.v5i1.8571

Kadeni, K. (2014). Pentingnya kecerdasan emosional dalam pembelajaran [The importance of emotional intelligence in learning]. *EQUILIBRIUM: Jurnal Ilmiah Ekonomi Dan Pembelajarannya*, *2*(1), 1–14. https://doi.org/10.25273/equilibrium.v2i1.601

Kozak, M., & Piepho, H. (2018). What's normal anyway? Residual plots are more telling than significance tests when checking ANOVA assumptions. *Journal of Agronomy and Crop Science*, *204*(1), 86–98. https://doi.org/10.1111/jac.12220

Lerman, D. C., O'Brien, M. J., Neely, L., Call, N. A., Tsami, L., Schieltz, K. M., Berg, W. K., Graber, J., Huang, P., & Kopelman, T. (2020). Remote coaching of caregivers via telehealth: Challenges and potential solutions. *Journal of Behavioral Education*, *29*(4), 195–221. https://doi.org/10.1007/s10864-020-09378-2

Mulyati, I., Astuti, I., & Ernawaty, E. (2022). Development of canva application assisted learning media in class XII advanced study materials with 4-D Models. *JTP-Jurnal Teknologi Pendidikan*, *24*(3), 322–329. https://doi.org/10.21009/jtp.v24i3.30483

Muniroh, S. H., Rojanah, S., & Raharjo, S. (2020). Efektivitas pembelajaran matematika melalui media google meet ditinjau dari hasil belajar siswa di masa pandemi COVID-19 [The effectiveness of learning mathematics through Google Meet media is seen from student learning outcomes during the COVID-19 pandem. In *EDISI : Jurnal Edukasi dan Sains* (Vol. 2, Issue 2). https://www.ejournal.stitpn.ac.id/index.php/edisi/article/view/1059

Mushtaha, E., Dabous, S. A., Alsyouf, I., Ahmed, A., & Abdraboh, N. R. (2022). The challenges and opportunities of online learning and teaching at engineering and theoretical colleges during the pandemic. *Ain Shams Engineering Journal*, *13*(6), 1–13. https://doi.org/10.1016/j.asej.2022.101770

Pereira, J., Tan, S., Li, L., & Purnama, A. (2020). Developing a mathematics learning media to explain formula of area of Kite using Hawgent. *Indonesian Journal of Science and Mathematics Education*, *3*(3), 272–281. https://doi.org/10.24042/ijsme.v3i3.7391

Putri, E. A. R. (2021). Perbedaan efektivitas pembelajaran berbasis platform whatsapp group dan google meet pada siswa di masa pandemi COVID-19 [Differences in the effectiveness of whatsapp group and google meet platform-based learning for students during the COVID-19 pandemic]. *Edukatif: Jurnal Ilmu Pendidikan*, *3*(6), 4456–4469. https://doi.org/10.31004/edukatif.v3i6.1326

Rahmatia, R., & Ihwana, L. (2021). Pengaruh penerapan model pembelajaran kooperatif tipe think pair share (TPS) terhadap motivasi belajar siswa kelas VII SMP Negeri 2 Wangi-Wangi Selatan [The effect of applying the think pair share (TPS) cooperative learning model to the learning motivatio. *Jurnal Akademik Pendidikan Matematika*, *7*(1), 22–28. https://doi.org/10.55340/japm.v7i1.386

Saputra, W. N. E., Wahyudi, A., Supriyanto, A., Muyana, S., Rohmadheny, P. S., Ariyanto, R. D., & Kurniawan, S. J. (2021). Student perceptions of online learning during the COVID-19 pandemic in Indonesia: A study of Phenomenology. *European Journal of*

Educational Research, *10*(3), 1515–1528. https://doi.org/10.12973/eu-jer.10.3.1515

Serdyukov, P. (2017). Innovation in education: what works, what doesn't, and what to do about it? *Journal of Research in Innovative Teaching & Learning*, *10*(1), 4–33. https://doi.org/10.1108/JRIT-10-2016-0007

Simamora, R. M. (2020). The challenges of online learning during the COVID-19 pandemic: An essay analysis of performing arts education students. *Studies in Learning and Teaching*, *1*(2), 86–103. https://doi.org/10.46627/silet.v1i2.38

Sulistiani, S., Suminto, S., & Suningsih, A. (2021). Pembelajaran daring dengan intervensi video pembelajaran pada masa pandemi COVID-19 [Online learning with instructional video interventions during the COVID-19 pandemic]. *Jurnal E-DuMath*, *7*(1). https://doi.org/10.52657/je.v7i1.1344

Sundayana, R. (2014). *Statistika penelitian pendidikan [Educational research statistics]*. *Alfabeta*.

Uyanık, G. K., & Güler, N. (2013). A study on multiple linear regression analysis. *Procedia-Social and Behavioral Sciences*, *106*, 234–240. https://doi.org/10.1016/j.sbspro.2013.12.027

Wibisono, Y. (2017). *Metode Statistik [Statistical Method]*. Gadjah Mada University Press.