Comparison of Mathematics Learning Outcomes Online and Offline Students at Senior STIKES Medan Using Independent T-Test

Dame Meldaria Sipahutar

Radiodiagnostik & Radioterapi, STIKES Senior Medan, Indonesia
Corresponding Email: meldariasipahutar12@gmail.com, Phone Number: 0852 xxxx xxxx

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Abstract: Mathematics is one of the compulsory subjects in formal education and has an essential role in the world of education. This research was conducted to determine the results of learning mathematics in students at STIKes Senior Medan online and offline. This study used a quasi-experiment using the comparative method. The number of samples used was from two classes and given two other learning treatments, namely online and offline. The samples used were 34 students for the odd school year 2020/2021 (online) and 39 for the bizarre school year 2021/2022 (offline). Then a normality and homogeneity test was carried out using the Statistical Product and Service Solution (SPSS) application program to determine whether the data were normally distributed and had the same variance. The results of testing the hypothesis using the independent t-test sig (2-tailed) 0.048 <0.05, so that as a basis for decision making in the independent sample t-test, it can be concluded that Ho is rejected and Ha is accepted. Thus, with a 95% confidence level, there is a significant (significant) difference between online learning UAS mathematics learning outcomes and offline learning UAS mathematics learning outcomes.

Abstrak: Matematika merupakan salah satu mata pelajaran wajib dalam pendidikan formal dan memiliki peran penting dalam dunia pendidikan. Penelitian ini dilakukan untuk mengetahui hasil belajar matematika pada mahasiswa di STIKes Senior Medan secara daring dan luring. Penelitian ini menggunakan kuasi eksperimen yang menggunakan metode komparasi. Jumlah sampel yang digunakan dari dua kelas yang berbeda dan diberikan dua perlakuan pembelajaran yang berbeda, yaitu kelas daring dan luring. Sampel yang digunakan adalah 34 siswa tahun ajaran ganjil 2020/2021 (online) dan 39 siswa tahun ajaran ganjil 2021/2022 (offline). Selanjutnya dilakukan uji normalitas dan uji homogenitas dengan menggunakan program aplikasi Statistical Product and Service Solution (SPSS) untuk mengetahui apakah data terdistribusi secara normal dan data memiliki varians yang sama atau tidak. Hasil dari uji hipotesis dengan menggunakan uji independent t-tes sig (2-tailed) 0.048<0.05, sehingga sebagai dasar pengambilan keputusan dalam independent sample t test dapat disimpulkan bahwa Ho ditolak dan Ha diterima. Dengan demikian dapat disimpulkan bahwa dengan tingkat kepercayaan 95% terdapat perbedaan yang signifikan (signifikan) antara hasil belajar matematika UAS pembelajaran online dengan hasil belajar matematika UAS pembelajaran offline.

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A. Introduction

During the Covid-19 pandemic, education in Indonesia did not occur as usual. Education in Indonesia is experiencing obstacles where students and educators must meet face-to-face to learn. Instead, learning online (Novidya et al., 2021). Online learning is learning that is carried out by educators and students remotely by utilizing the internet network through websites (e-learning) such as Zoom, WhatsApp and Classroom applications as a tool for conveying information or learning that educators will convey (Baring & Berame, 2022). Meanwhile, offline learning is done directly or face-to-face (Pratama & Prastyaningrum, 2019). In addition to direct learning, students can use applications such as YouTube, Television and Radio media, and books as additional capital and a handle on learning difficulties.

With changes in learning during the pandemic, it is necessary to improve the quality of education, namely by developing and improving components or parts of education (Mutohhari et al., 2021). Teachers or educators are one component of education in the teaching and learning process (Yuniarti, 2021). Thus, good skills are needed in delivering material, mastery of classrooms and understanding student abilities, including in learning mathematics (Distrik et al., 2022). According to Permendiknas Number 22 of 2006 (Dewantari et al., 2021), the purpose of learning mathematics is for students to understand mathematical concepts, the relationship between concepts and algorithms, be accurate, efficient, and precise in solving problems (Mardhiyyah et al., 2022).

Mathematics is a general science that underlies the development of modern technology and is required in various disciplines. Mathematics can also develop human thinking power (Sutriyani, 2020). Mathematics is one of the compulsory subjects in formal education and has an essential role in the world of education. This is important because mathematics can train students to think logically, be responsible, have a good personality and have the ability to solve problems in everyday life. This shows that mathematics must be taught to students to improve human resources.

According to Sari (2022), mathematics is a subject that students do not like. They think that math is complicated. Students' view of mathematics is complex because mathematics is a set of facts or formulas that must be faced (Maskar et al., 2020). In addition, mathematical objects are abstract, tiered concepts and principles and processing procedures that manipulate (Selvie et al., 2022). From the statement above, students understanding of mathematical concepts is still low. In addition, the situation and conditions of the Covid-19 pandemic made it difficult for students to interpret mathematical symbols and formulas (Novera et al., 2021).

Here the researcher wants to research learning outcomes at the Senior Stikes Medan. Learning that is already underway is carried out online via Zoom, WhatsApp and Google Classroom, and offline or face-to-face learning. The researcher made observations of two classes, namely, the first class studied online, and the second class studied offline. The results are as follows, with the same questions given to the online class. Determine the quadratic equation if the vertex (1,2) and through the point (0,3).

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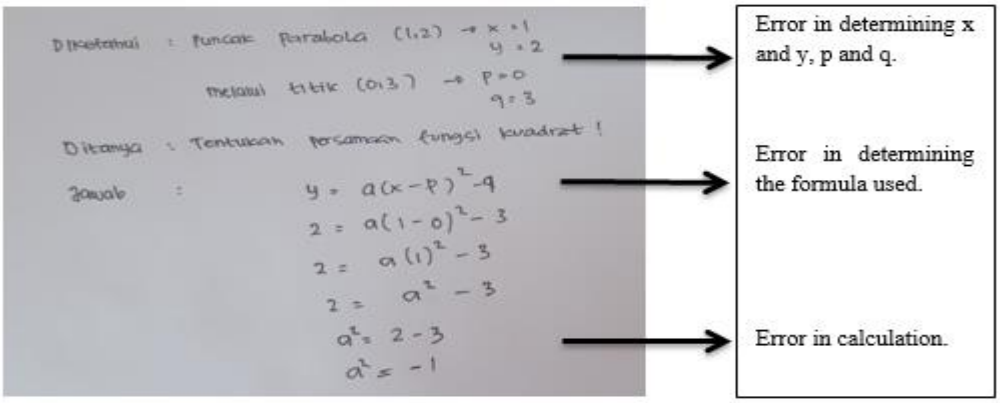

Figure 1. Results of Online Class Answers

It can be seen that the results of online class student answers show that the ability to understand mathematics still needs to improve, where students still need to be precise in determining x and y values, determining the formulas used, and performing calculations (Nasution et al., 2021). The low ability of students' mathematical understanding is because educators need help providing optimal learning online (Ramadina et al., 2022).

Many learning models can be used in online learning. Teachers must be more creative in choosing appropriate and appropriate learning media to support the online learning process (Lutvaidah et al., 2023). Several learning media can be used or utilized by teachers in online learning during the Covid-19 pandemic, namely Zoom, WhatsApp, and Google Classroom/Media Class. However, with this application, educators still have difficulties and limitations in delivering material, so students' understanding of mathematical concepts with online classes still needs to be improved. In addition, researchers obtained results with the same questions in offline/face-to-face classes (Aisyah et al., 2022).

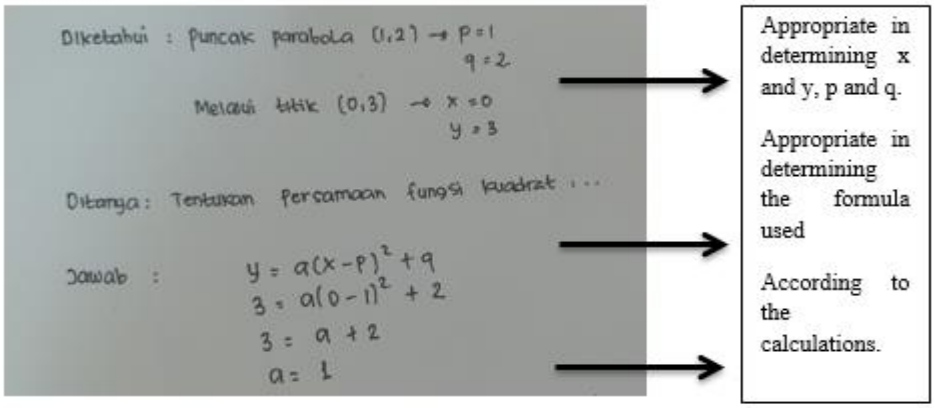

Figure 2. Results of Face-to-Face Class Answers

The learning outcomes of face-to-face classes have better results, as seen in Figure 2. Students can understand formulas and complete calculations. Previously there was research conducted by Susilawati & Supriyatno (2020) titled "Effectiveness of Online Learning in

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Science Subjects during the Covid-19 Pandemic: Comparative Study of Offline and Online Learning in Middle School Science Subjects". The study results show that the average Science Semester End Examination score in offline learning is higher than in online learning.

The results of research conducted by Yustina et al (2020) also show that students prefer online learning because it is more interesting. However, there are several obstacles, such as some students who do not do assignments because of the facilities they need to support them. In addition to the research above, some studies have opposite results. The research conducted by Mkhatshwa (2020) concluded that learning mathematics that is carried out offline further improves student learning outcomes seen from the average student learning outcome, which is 70.29, while the average value of learning outcomes for students who apply mathematics learning online is 60,43. The results of research conducted by Dhawan (2020) also show that online learning is less effective than face-to-face learning.

Based on the description stated above, the researcher is interested in conducting research titled: "Comparison of Online and Offline Student Mathematics Learning Outcomes at STIKes Senior Medan using an Independent T-Test ".

B. Method

The type of research used is quasi-experimental research using the comparative method (Siedlecki, 2020; Miller et al., 2020; Gopalan et al., 2020). The results of learning mathematics during the COVID-19 pandemic (online) will be compared with those of learning mathematics after the COVID-19 pandemic (offline). The sample used was 34 students in the 2020/2021 odd school year (online) and 39 students in the 2021/2022 odd school year (offline). To make it easier to know the research design, the following is a quasi-experimental research design.

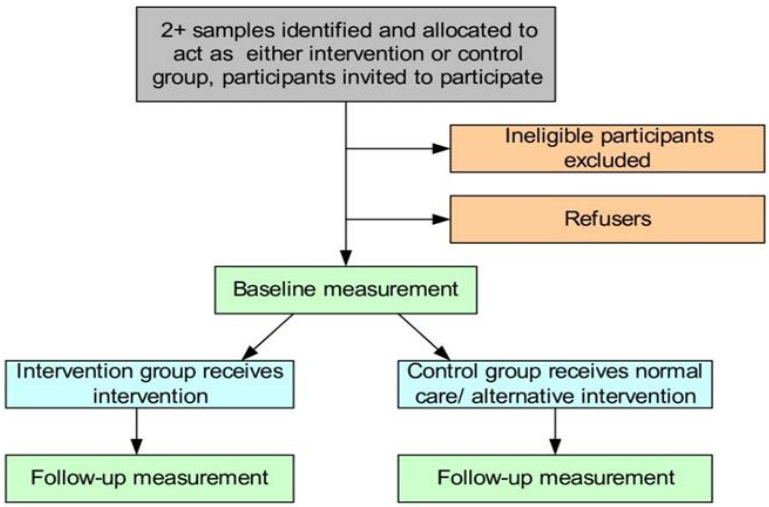

Figure 3. Quasi-Experimental Research Design

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Analysis of learning outcomes in mathematics courses can be seen from student UAS scores, namely online learning (2020/2021 odd UAS scores) and learning offline (2021/2022 odd UAS scores). The results of this UAS score will be analyzed using the Independent Sample T-Test. The subjects are students in different classes and are given two different learning treatments: online and offline (Agustine & Aini, 2022). There is a significant difference between online and offline learning if the significance value is less than 0.05 or $(sig.) < 0.05$ (Nurhidayah & Apriyady, 2023).

H_0: There is no significant difference in ability in mathematics scores between online learning and offline learning

H_a: There are significant differences in ability in math scores between online learning and offline learning.

C. Result and Discussion

Result

As a first step before carrying out the Independent Sample T-Test, a normality test is carried out first, and then a homogeneity test is carried out. The normality test was carried out to find out whether the data distribution was normal or not, and the data was normally distributed if the value was $(sig.) > 0.05$ (Atiya et al., 2021). Meanwhile, this homogeneity test is carried out to test whether the average independent data group has the same variance. The data is said to be homogeneous if $(sig.) > 0.05$. After that, an independent t-test was carried out with the help of SPSS software to test whether there was a significant difference in the UAS mathematics scores using online and offline learning (Azizah & Fajeriah, 2021).

Table 1. Normality Test Results with the Kolmogorov – Smirnov Test

One-Sample Kolmogorov-Smirnov Test			
		Online Learning	**Offline Learning**
N		34	39
Normal Parameters [a, b]	Means	77.8353	80.1026
	Std. Deviation	5.12770	4.49412
Symp. Sig. (2-tailed)		.195[c]	.144[c]

Table 1 shows that the Kolmogorov-Smirnov significance value for online learning is 0.195 and 0.144 for offline learning $\propto = 0.05$. According to (Fox & Weisberg, 2013), if the Kolmogorov-Smirnov value is greater than the significance level $\propto = 0.05$, then the results are significant, and the data is shown to be normally distributed. The results obtained for online learning $0.195 > 0.05$ and $0.144 > 0.05$ mean that the data used in this study is normally distributed.

From table 2, it is known that the sig. Levene's Test for Equality of Variances is $0.419 > 0.05$, which means that the variance between online UAS scores and offline UAS scores is homogeneous or the same.

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Table 2. Homogeneity Test Results

		Levene's Test for Equality of Variances	
		F	**Sig.**
UAS Value	Equal variances assumed	.660	.419
	Equal variances are not assumed.		

Analyzed by comparing the odd 2020/2021 UAS scores to the odd 2021/2022 UAS scores. It can be seen in table 3 that the lowest mathematics UAS scores were obtained in online learning, while the highest mathematics UAS scores were obtained in offline learning. It can also be seen that the effectiveness of online learning in mathematics courses during the Covid-19 pandemic was (Kristianto & Gandajaya, 2023).

Table 3. Mathematics UAS Scores in Online Learning and Offline Learning

	N	**Means**	**Std. Deviation**	**Minimum**	**Maximum**
Online Learning	34	77.8353	5.12770	68.50	88.80
Offline Learning	39	80.1026	4.49412	71.80	92.00

According to Priyatno (2016), the Independent t-test is a test carried out on two independent or independent variables or on two factors as well as on the interaction between the two factors to see whether there is a difference in the average of the two samples whose final results can be used to draw reliable conclusions (Veerasamy & Goswami, 2022). The reason for applying the independent t-test in this study is because it is a statistical technique which can see the results of whether there are differences between one variable and another (Kamalia et al., 2022).

Table 4. Results of UAS Scores Using Independent T-Tests

		t	**df**	**Sig. (2-tailed)**
UAS Value	Equal variances assumed	-2.014	71	.048
	Equal variances not assumed	-1.995	66.211	.050

The independent t-test shows the difference between the odd UAS scores in 2020/2021 and 2021/2022. Based on the results of independent t-test statistics, if the significance value is $ig.(2-tailed) < 0.05$, then H_0 rejected, H_a accepted. In table 4, using the independent t-test on the Equal variances assumed section, it is known that $sig.(2-tailed)0.048 < 0.05$, so as the basis for decision making in the independent sample t-test, it can be concluded that H_0 is rejected and H_a is accepted. Thus it can be concluded

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that with a level of confidence of 95%, there is a significant (significant) difference between the results of the UAS mathematics results in online learning and the results of the UAS mathematics results in offline learning (Azzajjad et al., 2021).

Discussion

The government implemented a Work From Home (WFH) policy. The Ministry of Education also issued a policy by temporarily closing educational institutions and changing the method of teaching and learning activities (KBM) online. Dhawan (2020); Shen et al (2020) explain that two impacts caused by the Covid-19 pandemic affect the sustainability of educational activities, namely short-term and long-term impacts. One of the short-term impacts felt by various groups of people is learning activities carried out from home online, which have never happened on such a large scale, so these activities have never been measured and tested for success. Especially for residents in villages who have limited technology, many student assessments are cancelled due to trial and error where there is no certainty. Meanwhile, the long-term impact is justice and increasing equality between community groups and between regions in Indonesia.

The large number of schools that lack the readiness to carry out online education has resulted in discrimination and inequality in the education system, especially for schools that have financial difficulties, as well as students who come from low-income families (Mulyono et al., 2021). This sudden shift in learning methods has also resulted in many educators and education staff needing to be more organized. They must carry out online learning activities unfamiliar to Indonesians, especially for primary and secondary education units. Limited mastery of technology for some teachers and students, inadequate facilities and infrastructure, internet access that still needs to be evenly distributed, and the lack of preparedness for the provision of the budget are some of the problems still being sought by the government for the right solution. The research findings, which also included the findings of interviews with students who had completed their learning both online and offline, as well as with lecturers as educators, to ascertain the differences, show that learning outcomes in online learning are more significant in this respect. It is felt from offline learning for the previous two years and then online. Based on the results of the interviews, students prefer offline learning because they can ask the lecturer for clarification. However, after extensive home study online, they report difficulty following the learning activities in class when studying offline. They frequently receive help from their relatives when completing schoolwork or other tasks. Students receive guidance from their relatives while learning online.

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Online learning at STKIES Senior Medan has the same effect as face-to-face learning. This can be seen from learning the odd semester mathematics PAS for face-to-face learning and even semester mathematics PAS for online learning, which has an average difference in PAS of 0.34. This study's results align with AbdelSalam et al (2021) that the online learning system does not affect student learning outcomes. However, this study's results differ from the research of Anderson et al (2018), which states that there are differences in learning outcomes in online and face-to-face learning. This is because online learning carried out by teachers has not been carried out optimally.

D. Conclusion

The large number of schools that need more readiness to carry out online education has resulted in discrimination and inequality in the education system, especially for schools with financial difficulties and students from low-income families. The research findings, which also included the findings of interviews with students who had completed their learning both online and offline, as well as with lecturers as educators, to ascertain the differences, show that learning outcomes in online learning are more significant in this respect.

Based on research conducted by testing the hypothesis using *the independent t-test* with it $sig = 0{,}048 < 0{,}05$can be concluded that there are differences in mathematics learning outcomes based on UAS results in online learning and offline learning in mathematics courses at the Senior STIKes Medan. The results of the UAS scores with the highest score, 92,00, were obtained from offline learning, and the lowest score, 68,50, was obtained from online learning. By looking at the UAS scores' results, students' offline or face-to-face abilities are more effective.

With the current situation, offline learning has been carried out again, so the teacher is expected to be able to rebuild the enthusiasm of students in learning, as well as student self-confidence, so that it is expected to be able to improve again learning outcomes in learning that takes place at school or offline, especially in subjects mathematics.

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