

Effectiveness of Blended Learning Model in Microprocessor Course with Google Classroom

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Abstract: Low student learning outcomes in microprocessor courses. This can be created if students are not able to condition themselves and take the learning process seriously. The importance of independent learning (self-regulated) of students, then an innovative learning process is also needed that can support student skills. One of the learning processes that can support the improvement of student learning outcomes is blended learning. The purpose of this study is to examine how Google Classroom supports the blended learning approach, which enhances student learning outcomes. This kind of study is known as quasi-experimental. Design of Pretest-Posttest. The research was conducted at the Electrical Engineering Education Study Program at Padang State University with a total of 32 experimental class students and 31 control class students. The research instruments used were observation sheets of the application of the blended learning model, student learning outcomes questionnaire. Data analysis was carried out with technical mean percentage, n-gain, and independent t-test. The results showed that the application of blended learning was effective on student learning outcomes at 5% sig tarag which was seen from the value of $t_{count} > t_{table}$, namely $4.75 > 1.67$. There was an increase in student learning outcomes with a posttest value of 80.25. Based on the data that has been analyzed, it can be concluded that the application of blended learning assisted by Google Classroom is effective in supporting to improve student learning outcomes.

Keywords: Blended learning; Effectiveness; Microprocessor course

Introduction

Education is becoming increasingly important in the 21st century, because students are required to have 21st century skills, including there are three types of talents; information technology and media skills, professional and personal skills, educational skills, and creative skills (Sukardi et al., 2024). In order to meet the 21st century demands of students, a new learning process called 21st In this century, it is essential for lecturers and students to acquire knowledge and skills independently. Learning independence is one of the skills that learners need to have in the 21st century. To excel in self-directed learning, students need to have

skills (Can et al., 2024). Learning independence is also a sense of responsibility that a person has in designing his learning and implementing and evaluating his learning process. Learning independence plays an important role in learning (Friantini & Winata, 2020).

Observations and interviews revealed the following findings lecturers did not utilize learning media so that learning seemed monotonous. Learning conducted by lecturers is also not innovative so that it has not been able to support student skills in the learning process. Students are also easily bored with learning. In addition, student learning independence is still lacking, which also affects student skills and student scientific attitudes. Research findings regarding the low student

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learning outcomes in microprocessor courses. This can be created if students are able to condition themselves and take the learning process seriously. The importance of learning independence (self-regulated) of students, then an innovative learning process is also needed that can support student skills blended learning constitutes one among the approaches to teaching which might improve the educational results of students (Rasheed et al., 2020). Blended learning refers to the process of combining in-person instruction with remote learning through the use of internet-based educational tools (Gao et al., 2020; Winatha & Setiawan, 2020).

It was discovered based on the findings of observations and interviews that lecturers did not utilize learning media so that learning seemed monotonous. Learning conducted by lecturers is also not innovative so that it has not been able to support student skills in the learning process. Students are also easily bored with learning. In addition, student learning independence is still lacking, which also affects student skills and student scientific attitudes. Research findings regarding the low student learning outcomes in microprocessor courses. This can be created if students possess the ability to self-condition and accept the process of learning seriously. The importance of learning independence (self-regulated) of students, then an innovative learning process is also needed that can support student skills. blended learning represents a number of the teaching methods that can help improve pupil educational results (Rasheed et al., 2020). Blended learning is learning that integrates face-to-face learning and distance learning using online learning resources (Gao et al., 2020; Winatha & Setiawan, 2020).

Blended Because the offered learning resources are created in a way that makes learning more relevant, learning occurs more effectively students understand them more easily (Setiawan & Jauhari, 2023). Blended learning requires applications that support the implementation of learning activities such as social media applications. In addition, there are also various learning applications for students to learn when studying at home both free and paid (Hamzah et al., 2022). Current technological advances have created many learning application innovations. With the creation of this learning application innovation, it can create easy and interesting learning. An example of learning application innovation is Google Classroom (Nainggolan & Manalu, 2021; Okoye et al., 2024).

Google classroom is an application created by Google that aims to help educators and students to continue to be able to organize classes and communicate and learn anytime and anywhere (Haka et al., 2020). This application is widely applied in the world of education because it is very easy to operate. This shows that google classroom is an application that is quite familiar and

often used by students because of its ease of access. This research combines blended learning with google classroom to create innovative learning and can increase students' learning independence in creative thinking (Ekayana et al., 2021). Blended learning combined with google classroom media has the advantage of helping educators not to waste time and keep the class under control, as well as increasing interaction.

Some studies that support this research are research carried out by Haka et al. (2020) and Zainudin et al. (2021) which states that there is an effect of blended learning google classroom on students' creative thinking skills and learning independence. Another study also revealed that there were disparities in learning results between male and female students, that the learning process was in the good category, that student responses were in the very high category, and that student learning outcomes were in the sufficient category (Kurniawati et al., 2019). Other research conducted by Hew et al. (2020) and Huda et al. (2019) states that Blended Learning and e-learning have an effect on understanding microprocessor concepts in two-variable linear equation material, so that it can be used as knowledge given to students in understanding microprocessor concepts. The purpose of this research is to analyze the effect of blended learning method with google classroom in increasing students' learning independence.

The first step in the blended learning process is to conduct a needs analysis. This research activity focuses on the needs of lecturers and students for teaching materials that will be used in the learning process. 21st century skills for students in accordance with the problems and obstacles that occur in the field show that students are still not in accordance with the expected conditions. Based on observations made at the Faculty of Engineering, Padang State University in the Electrical Engineering Education Study Program, it was found that Microprocessor learning in the Electrical Engineering Education Study Program at Padang State University has implemented an independent curriculum. The media used in learning uses lesson plans, handouts and online at each meeting according to the conditions in the field and the ability of students. From the results of interviews with lecturers, the lesson plans used during learning have referred to the blended learning approach but only emphasise mathematical representation but have not been carried out in accordance with the steps of the blended learning approach. For this reason, it is necessary to apply blended learning that can support the improvement of student learning outcomes. Blended learning that will be interactive by using blended learning, so that blended learning can help lecturers during teaching and learning activities and can improve student learning outcomes to be independent in learning Microprocessors.

Based on the problems that have been raised, the solution offered in this study is to prescribe blended learning methods in the microcontroller learning process. The application of blended learning models in improving learning outcomes and student learning independence is with google classroom (Tong et al., 2022). So the purpose of this research is to find out the difference in improving learning outcomes and increasing student learning outcomes between blended learning models and online learning both overall and based on the level of initial microprocessor ability (high, medium and low).

Method

This research uses experimental research with a Quasi-Experimental research design. The experimental design used is to compare the pre-test, post-test scores in the control and experimental classes. In the experimental class, the blended learning method will be applied. While the control class applied the online method. The initial stage is to explore the initial knowledge of students through a pre-test (O₁), then apply the blended learning method as a treatment in the microcontroller learning process. After applying the treatment in microcontroller learning, the final data collection was carried out, namely the post-test (O₂). Meanwhile, the control class was also given a pre-test with online learning (without blended learning) (O₃). After applying the treatment in microcontroller, the final data collection was carried out, namely the post-test (O₄). This post-test aims to determine student knowledge after carrying out the microcontroller learning process with blended learning methods (Setyawan et al., 2024). The Quasi-Experimental Pretest-Posttest Control Group Design research procedure can be seen in Figure 1.

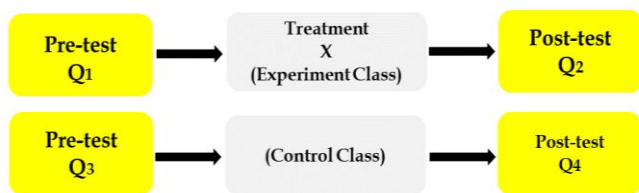


Figure 1. Quasi-experimental pretest-posttest control group design research

The sample in this study were even semester students in the 2023/2024 academic year in the Electrical Engineering Education Study Program at Padang State University. The research subjects totaled 63 students consisting of 2 classes. Namely the experimental class (32 students) and the control class (31 students). The selection of experimental and control classes was not randomized. Students in the experimental class with a

blended learning model while the control class is given online online learning (without blended learning).

The research instruments used were pre-test and post-test observations. The observation sheet was used to assess the implementation of the learning scenario sheet prepared by the lecturer as well as the students' response in learning both for the experimental class taught by blended learning method and the control class taught by online learning. The pre-test and post-test questions are questions in the form of descriptions given to each following are the experimental class and the control class, being taught with their respective methods. This observation sheet has previously been validated by experts. The data analysis technique used the SPSS 22 application with the Independent sample t-test analysis model which previously tested the analysis requirements with normality and homogeneity tests (SPSS 22 for windows). To test the effectiveness of the Blended Learning model, N-Gain test and T-test (independent sample t-test) were used. In the implementation of the blended learning method and student activities were measured through an observation sheet for the implementation of the blended learning method (Ahmad et al., 2020; Khusniyah, 2020).

Result and Discussion

Blended learning is learning that integrates face-to-face learning and distance learning using online learning resources (Gao et al., 2020; Winatha & Setiawan, 2020). Learning happens in a more meaningful way thanks to the fact that the learning materials offered are known as blended learning, students understand them more easily. The learning process as a form of interaction between lecturers and students, learning resources in developing creative thinking skills needs to be accompanied by learning strategies, methods and models. One alternative is the application of Blended Learning which can improve student learning outcomes. Blended Learning can provide a new atmosphere for students, because learning is combined both face-to-face and online which is packaged as well as possible so that learning is not monotonous (Fadhilatunisa et al., 2020). Blended learning refers to the integration of various learning methodologies. Thus, blended learning can be defined as a teaching approach that integrates two or more teaching strategies and methodologies to help students achieve learning objectives (Gao et al., 2020).

Based on the experts' definition of blended learning, blended learning has three learning components that are blended into one form of blended learning. The components consist of first online learning, second face-to-face learning, and third self-learning. The comparison of pretest and posttest results of

experimental class and control class. The experimental class was given a pretest first before the learning began. This test was given with the aim of knowing the initial ability of students. The learning method in the experimental class used blended learning with google classroom. In this teaching and learning activity, namely providing innovative teaching materials, providing worksheets, collecting assignments, online discussions and using the Video conference menu so that they can meet face to face with students even though from a distance. This method can be one solution to overcome the limited face-to-face time in the classroom. Then the researcher gave a posttest which was used as the final test. Meanwhile, the control class was given a pretest before learning began. This test was given with the aim of knowing the initial ability of students. Learning in the control class was carried out online, such as activities carried out were the provision of teaching materials, provision of LKS, task collection, online discussion, and posttest. At the end of learning, a posttest was given which was used as a final test to determine the final ability and improvement of student learning outcomes. Normality data on learning outcomes from the experimental class and control class was tested by Shapiro-Wilk. Testing uses SPSS 22.0 for Windows program with a significance level of 0.05. The data obtained can be seen in Table 1.

Table 1. Normality Test of Pre-test and Post-test Data of Experimental and Control Classes

Class	Data	Shapiro-Wilk		
		Statistic	df	Sig
Experiment	PreTest	0.946	32	0.111
	PostTest	0.935	32	0.053
Control	PreTest	0.952	31	0.175
	PostTest	0.964	31	0.371

Based on the variance normality test that using the Shapiro-Wilk test was used to analyze the pretest-posttest results in the experimental and control classes. The results showed that the experimental class pretest data had a Sig. value of 0.111, while the control posttest data had a Sig. value of 0.053. Meanwhile, for the experimental class pretest data, the Sig. value was 0.175 and for the control class posttest data, the Sig. value was 0.371. Because the significance value of both classes is more than 0.05, it can be said that the experimental class and control class are normally distributed and can be continued with the next analysis.

Table 2. Homogeneity Test Pre-test and Post-test Results for the Experimental Class and Control Class

Value	Levene Statistic	df1	df2	Sig.
Pre-test	0.923	1	61	0.341
Post-tes	0.126	1	61	0.724

Based on data analysis, the Sig (Based on Mean) value of the pretest results is 0.341 and the posttest value is 0.724 greater than 0.05. This indicates that the research data has a homogeneously distributed variation, thus fulfilling the necessary requirements to conduct an independent sample t-test.

Table 3. Independent Samples Test of Experimental Class and Control Class Pre-test and Post- test

	Levene's Test for Equality of Variances		t- Test for Equality of Means		
	F	Sig.(2-tailed)	T	Df	
Equal Variances Assumed	0.126	0.00	4.075	61	
Equal Variances Assumed		0.00	4.086	59.859	

Based on Table 3, the results of the t test, it can be seen that the Sign (2-tailed) value is $0.00 < 0.05$, therefore it is concluded that there is a sign difference between the experimental class and the control class. Thus, it can be said that the application of the Blended Learning model is effective for improving the learning outcomes of students taking microprocessor courses.

After the pretest and posttest results are compared using N-Gain or gain score, the effectiveness of the Blended Learning model can be seen from the students' learning outcomes. If the Gain Score achieved by students is at least ≥ 0.3 with a moderate category, then the learning model is said to be effective. The guidelines for determining the effectiveness of microprocessor learning outcomes with blended learning methods are to use guidelines (Hake & Reece, 1999) as in the following Table 4.

Table 4. N-Gain Effectiveness Interpretation Categories

n-Gain (g)	Interpretation
$g > 0.7$	High
$0.3 < g \leq 0.7$	Medium
$g \leq 0.3$	Low

Based on the results of the analysis, Figure 2 shows that the gain score in the experimental group is higher than the control group, 0.68 which is in the medium category. Meanwhile, the gain score of the control group was 0.56 with a medium category as well. From the gain score data in the graph above, it can be concluded that the blended learning model using Google Classroom can be said to be effective. The results of the analysis of each component of the analysis of student characteristics are presented as follows in graphical form the results of the analysis of student characteristics are shown in Figure 2.

The application of blended learning model to students taking microprocessor courses was conducted in experimental and control classes. The treatment in both classes is different where the experimental class uses blended learning with google classroom while the

control class uses online learning. In the results obtained, it is known that the average post test results for the experimental class were obtained 80.25 while for the control class 70.84. The results of the post test scores of the two classes will be used in data analysis. The use of blended learning model with google classroom conducted on students in the experimental class showed an influence on student cognitive outcomes. These results can be seen using the independent sample t-test significant pull 5% with the value of t_{count} and t_{table} which is 1.670. According to these results, the conclusion is better in the experimental class of students' concept understanding ability than the control class. Therefore, for experimental classes applied with blended learning is considered effective on student learning outcomes (Sya'idah et al., 2020).

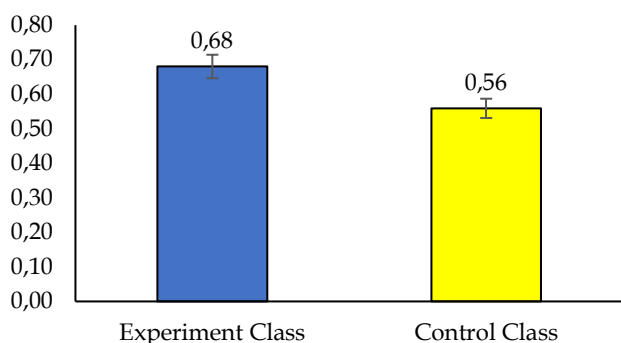


Figure 2. Effectiveness test analysis of gain score value

In the independent sample t-test results in table 3. Shows that the t_{count} value in the experimental class is 4.075. The t_{table} value at a significant level with a degree of freedom (DK) of 61 is 1.670. These results show that the $t_{count} > t_{table}$ is $4.075 > 1.670$. This shows that blended learning with google classroom shows the effectiveness of student cognitive outcomes in the experimental class. This research is in line with research conducted by Gao et al. (2020) and Haka et al. (2020) on learning outcomes that integrate face-to-face learning and distance learning using. Blended learning enhances the learning experience by offering materials in an engaging format, students understand them more easily (Muawanah et al., 2022). In the implementation process, there are three stages, namely information seeking, information gathering, and knowledge synthesis and knowledge acquisition stages (Gao et al., 2020).

In this research, at the seeking of information stage, the lecturer informs the competencies and learning objectives, learning modules, student worksheets and other learning resources that can be used such as articles and youtube videos about proteus simulation material through google classroom and students are independently required to analyze phenomena through videos or images, formulate problems, make hypotheses

and collect data contained in the RPP. At the acquisition of information stage, lecturers assist and facilitate students in analyzing data, making conclusions and presenting the results that have been formulated to determine the right concept through google meets. And at the final stage, namely synthesizing of knowledge, lecturers justify the results of observations and students together conclude the material taught and connect it with existing concepts through google meets (Febriani, 2021).

Blended learning is learning that integrates face-to-face learning and distance learning using online learning resources learning is more meaningful through blended learning because the learning materials are provided and designed in such a way that students understand them more easily (Aulia et al., 2019). Current technological advances have created many learning application innovations. With the creation of this learning application innovation, it can create easy and interesting learning. An example of learning application innovation is Google classroom.

Google classroom is an application created by Google that aims to help educators and students to continue to be able to organize classes and communicate and learn anytime and anywhere (Friantini & Winata, 2020; Haka et al., 2020). Learning independence is a fundamental skill that must be possessed by students. Learning independence is also a sense of responsibility that a person has in designing his learning and implementing and evaluating his learning process (Friantini & Winata, 2020; Haka et al., 2020). Learning independence plays an important role in learning.

Student learning outcomes can be improved by using blended learning with a relatively small use of time and cost. The results of this study are supported by research conducted by Haka et al. (2020) which states that there is an effect of blended learning google classroom on creative thinking skills and student learning independence. Another study also conducted by Kurniawati et al. (2019) showed that the learning process was in the excellent category, student learning outcomes were in the moderate category, there were differences in learning outcomes between male and female students, and student responses were in the very hinh category. Other research conducted by Huda et al. (2022) and Farhan et al. (2021) states that Blended Learning has an effect on understanding concepts in microprocessor courses, so it can be used as knowledge provided to students in understanding microprocessor concepts. The implementation of learning by utilizing technology requires interaction and cooperation between lecturers and students. The existence of good interaction and cooperation between lecturers and students and supported by the use of interesting learning media will foster students' interest in

participating in learning so that in the end it will improve learning outcomes.

Conclusion

The conclusion of this study is that the blended learning model with google classroom is effective on student cognitive learning outcomes at a significant level of 5% as seen from the $t_{count} > t_{table}$ value, namely $4.075 > 1.670$. The learning outcomes of students have increased after the provision of a blended learning model with google classroom as seen from the difference in the average value of the pretest with a posttest value of 33.55% from an average of 38.13 increased to 80.25. Thus, students experienced an increase in the moderate category after using the blended learning model with google classroom.

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Author Contributions

Conceptualization and methodology, H. L. B.; software, validation, formal analysis, and investigation, H. L. B. and A.; data curation, H. L. B. and A.; writing—original draft preparation, H. L. B., A. and R.; writing—review and editing, R.

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Conflicts of Interest

There is no conflict of interest.

References

- Ahmad, A., Nuzula, F., & Makky, K. (2020). Efektivitas Pembelajaran Daring dengan Menggunakan Google Classroom pada Mata Pelajaran Matematika di Madrasah Aliyah Darul Falah Batu Jangkih. *EL-HIKAM: Jurnal Pendidikan Dan Kajian Keislaman*, 13(1), 72. Retrieved from <https://ejournal.kopertais4.or.id/sasambo/index.php/elhikam/article/view/3895>
- Aulia, L. N., Susilo, S., & Subali, B. (2019). Upaya Peningkatan Kemandirian Belajar Siswa dengan Model Problem-Based Learning Berbantuan Media Edmodo. *Jurnal Inovasi Pendidikan IPA*, 5(1), 69–78. <https://doi.org/10.21831/jipi.v5i1.18707>
- Can, H. C., Zorba, E., & İşim, A. T. (2024). The Effect of Blended Learning on 21st-Century Skills and Academic Success in Education of Physical Education Teachers: A Mixed Method Research. *Teaching and Teacher Education*, 145(May). <https://doi.org/10.1016/j.tate.2024.104614>
- Ekayana, A. A. G., Muku, I. D. M. K., & Hartawan, I. N. B. (2021). Implementasi Model Pembelajaran Flipped Classroom pada Mata Kuliah Sensor Transduser dalam Pembelajaran Daring. *Jurnal Teknologi Pembelajaran Indonesia*, 11(2), 6–10. https://doi.org/10.23887/jurnal_tp.v11i2.636
- Fadhilatunisa, D., Fakhri, M. M., & Rosidah, R. (2020). Pengaruh Blended Learning Terhadap Aktivitas Belajar dan Hasil Belajar Mahasiswa Akuntansi. *Jurnal Pendidikan Akuntansi Indonesia*, 18(2), 93–106. Retrieved from <https://journal.uny.ac.id/index.php/jpakun/article/download/35345/14809>
- Farhan, M., & Hakim, A. R. (2021). Kemandirian Belajar, Adversity Quotient dan Kemampuan Penalaran Matematis pada Implementasi Pembelajaran Daring Matakuliah Analisis Real. *Jurnal Pembelajaran Matematika Inovatif*, 4(6), 1687–1698. <https://doi.org/10.22460/jpmi.v4i6.1687-1698>
- Febriani, H. (2021). Meningkatkan Kemandirian Belajar Siswa melalui Metode Blended Learning berbantuan Google Classroom pada Materi Kesetimbangan Kimia. *Jurnal Pendidikan Kimia Indonesia*, 5(1), 9–15. <https://doi.org/10.23887/jpk.v5i1.31343>
- Friantini, R. N., & Winata, R. (2020). Disposisi Matematis dan Kemandirian Belajar Mahasiswa pada Perkuliahan Daring Berbantuan Google Classroom Masa Covid-19. *Jurnal Derivat: Jurnal Matematika Dan Pendidikan Matematika*, 7(2), 53–64. <https://doi.org/10.31316/j.derivat.v7i2.1068>
- Gao, B. W., Jiang, J., & Tang, Y. (2020). The Effect of Blended Learning Platform and Engagement on Students' Satisfaction—The Case from The Tourism Management Teaching. *Journal of Hospitality, Leisure, Sport and Tourism Education*, 27. <https://doi.org/10.1016/j.jhlste>
- Haka, N. B., Anggita, L., Anggoro, B. S., & Hamid, A. (2020). Pengaruh Blended Learning Berbantuan Google Classroom Terhadap Keterampilan Berpikir Kreatif dan Kemandirian Belajar Peserta Didik. *Edu Sains Jurnal Pendidikan Sains & Matematika*, 8(1), 1–12. <https://doi.org/10.23971/eds.v8i1.1806>
- Hake, R., & Reece. (1999). *Analyzing Change/Gain Scores*. USA: Dept of Physics Indiana University. <https://doi.org/10.24036/ekj.v1.i1.a10>
- Hamzah, F., Mujib, A., & Firmansyah, F. (2022). Efektivitas Pembelajaran Blended Learning Menggunakan Schoology pada Pelajaran Matematika. *DELTA Jurnal Ilmiah Pendidikan Matematika*, 10(1), 95–104. <https://doi.org/10.31941/delta.v10i1.1501>

- Hew, K. F., Hu, X., Qiao, C., & Tang, Y. (2020). What Predicts Student Satisfaction with MOOCs: A Gradient Boosting Trees Supervised Machine Learning and Sentiment Analysis Approach. *Computers and Education*, 145, 103724. <https://doi.org/10.1016/j.compedu.2019.103724>
- Huda, N., Mustaji, M., Arianto, F., & Ayubi, N. (2022). The Application of Blended Learning with a Community Science Technology Approach to Improve Student Learning Outcomes in Higher Education. *International Journal of Emerging Technologies in Learning*, 17(14), 246-252. <https://doi.org/10.3991/ijet.v17i14.32927>
- Huda, S., Firmansyah, M., Rinaldi, A., Suherman, S., Sugiharta, I., Astuti, D. W., Fatimah, O., & Prasetyo, A. E. (2019). Understanding of Mathematical Concepts in the Linear Equation with Two Variables: Impact of E-Learning and Blended Learning Using Google Classroom. *Al-Jabar: Jurnal Pendidikan Matematika*, 10(2), 261-270. <https://doi.org/10.24042/ajpm.v10i2.5303>
- Khusniyah, T. W. (2020). Efektivitas E-Learning Terhadap Hasil Belajar. *SAP: Susunan Artikel Penelitian*, 4(3), 207-214. <https://doi.org/10.30998/sap.v4i3.6283>
- Kurniawati, M., Santana Purba, H., & Kusumawati, E. (2019). Penerapan Blended Learning Menggunakan Model Flipped Classroom Berbantuan Google Classroom Dalam Pembelajaran Matematika SMP. *EDU-MAT: Jurnal Pendidikan Matematika*, 7(1), 8-19. <https://doi.org/10.20527/edumat.v7i1.6827>
- Muawanah, N. M. N., Yuzianah, D., & Nugraheni, P. (2022). Efektivitas Model Pembelajaran Blended Learning terhadap Motivasi dan Kemampuan Pemecahan Masalah pada Materi Peluang. *Jurnal Inovasi Pendidikan Matematika (JIPM)*, 4(1), 1-9. <https://doi.org/10.37729/jipm.v4i1.2162>
- Nainggolan, A. P., & Manalu, R. B. B. (2021). Pengaruh Penggunaan Google classroom Terhadap Efektifitas Pembelajaran. *Journal Coaching Education Sports*, 2(1), 17-30. <https://doi.org/10.31599/jces.v2i1.515>
- Okoye, K., Daruich, S. D. N., Castaño, R., Escamilla, J., & Hosseini, S. (2024). Analyzing the Impact of Digitized-Education toward the Future of Education: A Comparative Study Based on Students. In *Evaluation of Teaching Data Studies in Educational Evaluation* (p. 82). <https://doi.org/10.1016/j.stueduc.2024.101359>
- Rasheed, R. A., Kamsin, A., & Abdullah, N. A. (2020). Challenges in the online component of blended learning: A systematic review. *Computers & Education*, 144, 103701. <https://doi.org/10.1016/j.compedu.2019.103701>
- Setiawan, I. D., & Jauhari, M. I. (2023). Efektivitas Pembelajaran Model Blended Berbasis E-Learning di Madrasah Tsanawiyah Negeri 2 Nganjuk. *Al-Fatih: Jurnal Studi Islam*, 11(2), 60-70. Retrieved from <https://ejournal.staimaarif.ac.id/index.php/alfatih/article/view/74>
- Setyawan, H., Sukardi, S., Diati, L. S., Fitri, Y. I., Ambiyar, A., & Rianto, D. (2024). Enhancing Basic Computer Network Learning Outcomes of Vocational High School Students by Implementing A Video-Based Learning Model. *Jurnal Pendidikan Teknologi Kejuruan*, 7(1), 11-21. <https://doi.org/10.24036/jptk.v7i1.35023>
- Sukardi, S., Setyawan, H., Risfendra, R., Usmeldi, U., & Yanto, D. T. P. (2024). Effectiveness of Robotic Technology in Vocational Education: A Meta-Analysis. *International Journal of Information and Education Technology*, 14(4), 521-532. <https://doi.org/10.18178/ijiet.2024.14.4.2073>
- Sya'idah, F. A. N., Wijayati, N., Nuswowati, M., & Haryani, S. (2020). Pengaruh Model Blended Learning Berbantuan E-LKPD Materi Hidrolisis Garam Terhadap Hasil Belajar Peserta Didik. *Chemistry in Education*, 9(1), 1-8. Retrieved from <https://journal.unnes.ac.id/sju/chemined/article/view/39581>
- Tong, D. H., Uyen, B. P., & Ngan, L. K. (2022). The effectiveness of blended learning on students' academic achievement, self-study skills and learning attitudes: A quasi-experiment study in teaching the conventions for coordinates in the plane. *Heliyon*, 8(12). <https://doi.org/10.1016/j.heliyon.2022.e12657>
- Winatha, K. R., & Setiawan, I. M. D. (2020). Pengaruh Game-Based Learning Terhadap Motivasi dan Prestasi Belajar. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, 10(3), 198-206. <https://doi.org/10.24246/j.js.2020.v10.i3.p198-206>
- Zainudin, Z., Wijayanti, R., & Faulina, R. (2021). Efektivitas Pembelajaran Hiybrid Learning Masa Pandemi Covid-19 pada Mata kuliah IPA Kelas Rendah. *Jurnal IPA & Pembelajaran IPA*, 5(3), 242-249. <https://doi.org/10.24815/jipi.v5i3.22029>