

The Influence of 3D Interactive Animation Media with a Project-Based Learning Approach on IPAS Learning Outcomes

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ABSTRACT

Natural and Social Sciences (IPAS) is one of the important subjects in elementary schools that aims to form students to have an understanding of natural and social phenomena, and to be able to think critically about the surrounding environment. This study aims to determine the effect of the use of 3D interactive animation media with a Project Based Learning approach on student learning outcomes in learning Natural and Social Sciences (IPAS) animal life cycle material in grade V of SD Negeri 143 Palembang. This study uses a quantitative research method with a Pre-Experimental Design type One Group Pretest-Posttest Design. The population in this study is all grade V students of SD Negeri 143 Palembang. The research sample was 36 students in class V.A with purposive sampling technique. Data collection techniques are carried out through tests (pretest and posttest) and documentation. Data analysis included normality tests and hypothesis tests using paired sample t-tests. The results of the study show that there is an influence of the use of 3D interactive animation media with the Project Based Learning approach on student learning outcomes. This is evidenced by an increase in the average score of student learning outcomes after being given treatment and the results of a hypothesis test that showed a significance value of less than 0.05 so that H_0 was rejected and H_a was accepted. Thus, the use of 3D interactive animation media with the Project Based Learning approach is effective in improving student learning outcomes in learning social science of animal life cycle materials in grade V of SD Negeri 143 Palembang.

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1. INTRODUCTION

Natural and Social Sciences (IPAS) is one of the important subjects in elementary schools that aims to form students to have an understanding of natural and social phenomena, and to be able to think critically about the surrounding environment. In the animal life cycle material, students are expected to understand the stages of animal development, the relationship with the ecosystem, and the importance of preserving the environment. However, the implementation of learning in schools is still dominated by conventional methods that are oriented towards memorization without actively

involving students in the learning process. This condition causes learning to be less meaningful and not able to develop students' critical thinking skills and conceptual understanding. In addition, the limited use of learning media makes abstract material difficult for students to understand.

Previous research has also shown that the application of a student-centered learning model is able to improve the quality of social studies learning. The results of Wardah, Hakim, and Utomo (2025) research show that the application of differentiated learning has a positive influence on student learning outcomes in social studies subjects because it is able to accommodate the diverse learning needs of students. In addition, research by Salu Islamia, Diansyah, Hakim, and Utomo (2025) proves that the implementation of Project Based Learning can improve students' creative thinking skills in social studies learning through learning activities that require students to be active, collaborative, and able to solve problems. These findings reinforce that the use of innovative learning approaches supported by attractive media has the potential to improve student learning outcomes.

Based on the results of observations at SD Negeri 143 Palembang, science learning in classes V.A and V.B is still dominated by lecture methods, simple discussions, and the use of theme books. Teachers have not taken advantage of technology-based learning media, especially animated videos that are able to provide visualization of the material. As a result, students tend to be less interested in participating in learning, learning concentration decreases, and have difficulty understanding animal life cycle material. The learning outcome data shows that around 55% of the 64 students have not reached the Learning Goal Achievement Criteria (KKTP) of 70. The low learning outcomes show the need for innovation in the learning process so that students are more active, motivated, and able to understand the material better.

One alternative that can be applied is the use of 3D interactive animation media combined with the Project Based Learning (PjBL) approach. 3D animation media is able to present moving images, characters, text, and audio so that the material can be visualized in a real, interesting, and easy to understand by students. In the animal life cycle material, this media allows students to observe each stage of animal development in order so that concepts that were originally abstract become more concrete. Meanwhile, the Project Based Learning approach encourages students to be actively involved in learning through project activities, problem-solving, cooperation, and exploration independently. The combination of 3D interactive animation media with PjBL is expected to increase learning motivation, strengthen concept understanding, and create a more meaningful learning experience.

Based on this description, it can be concluded that the low learning outcomes of students in social studies subjects are influenced by the use of less varied learning methods and the lack of use of technology-based media. Therefore, the application of 3D interactive animation media based on Project Based Learning is seen as the right solution to improve the quality of the learning process. Through interesting visualizations and project-based learning activities, students are expected to be more active, easily understand the material, and obtain more optimal learning outcomes. This research is expected to contribute to improving the quality of science learning, especially in animal life cycle materials at SD Negeri 143 Palembang.

2. METHODS

This study uses a quantitative research method with a type of quasi experimental research. The research design used is Nonequivalent Control Group Design, which involves two groups, namely the experimental class and the control class. The experimental class was given treatment in the form of learning using 3D interactive animation media with a Project Based Learning (PjBL) approach, while the control class received conventional learning. Before being given treatment, both groups were given a *pretest* to find out the students' initial abilities, then after the learning process was completed, both groups were given a *posttest* to find out the improvement of student learning outcomes.

The research was carried out at SD Negeri 143 Palembang in the even semester of the 2025/2026 Academic Year. The population in this study is all students of class V consisting of two classes with a total of 65 students. The research sample was determined using the purposive sampling technique, so

that class V.A was obtained as an experimental class with 36 students and class V.B as a control class with 29 students. The determination of the sample was carried out based on consideration of the similarity of the characteristics of academic ability and recommendations from the school.

The data collection technique in this study uses tests and documentation. The test instrument is in the form of multiple-choice questions that have gone through validity, reliability, difficulty, and differentiating power tests before being used as a research instrument. Tests are given in the form of pretest and posttest to measure student learning outcomes on animal life cycle materials in Natural and Social Sciences (IPAS) subjects. Documentation is used to obtain supporting data in the form of a list of student names, the number of students, photos of research activities, and other documents related to the implementation of research.

The data obtained was analyzed using the help of the IBM SPSS Statistics version 23 program. The analysis begins with descriptive statistics to find out the average score, highest score, and lowest score of student learning outcomes. Furthermore, a prerequisite test was carried out which included a normality test using the Shapiro-Wilk test and a homogeneity test using the Levene's Test. After the data was declared to be normally and homogeneously distributed, hypothesis testing was carried out using Independent Samples t-Test at a significance level of 0.05 to determine whether or not there was an effect of the use of 3D interactive animation media with the Project Based Learning approach on the learning outcomes of IPAS students in grade V of SD Negeri 143 Palembang. The decision-making criterion is that if the significance value (Sig. 2-tailed) < 0.05 , H_0 is rejected and H_1 is accepted, so it can be concluded that there is a significant influence of the use of 3D interactive animation media with the Project Based Learning approach on student learning outcomes.

3. RESULTS AND DISCUSSION

This research was carried out at SD Negeri 143 Palembang for grade V students for the 2025/2026 school year. The research sample consisted of two classes, namely the VA class as an experimental class that obtained learning using 3D interactive animation media with a Project Based Learning (PjBL) approach and the VB class as a control class that obtained conventional learning. This study aims to determine the effect of the use of 3D interactive animation media with a Project Based Learning approach on student learning outcomes in the science subject of animal life cycle material. To find out the initial and final abilities of students after the learning process, the researcher gave a pretest and posttest to both classes. The results of students' pretest and posttest scores in the experimental class and the control class are presented in the following Tables 1 and 2.

Table 1. Pre Test and Post Test Score Results of Control Class and Experimental Class

No	Control Class		Experimental Classes	
	Pre Test	Pos Test	Pre Test	Post Test
1	70	80	65	95
2	60	60	65	90
3	50	85	55	85
4	55	70	65	100
5	50	75	65	80
6	65	55	45	75
7	60	60	65	80
8	40	80	65	75
9	55	55	70	85
10	40	75	60	85
11	65	55	50	100
12	60	60	50	85
13	50	80	60	90
14	50	70	55	85
15	45	75	45	100

16	50	70	40	85
17	40	65	40	80
18	55	75	55	80
19	50	75	70	90
20	65	70	50	85
21	60	80	45	95
22	55	55	50	80
23	70	60	40	80
24	45	80	45	90
25	55	70	50	95
26	65	80	70	85
27	70	65	50	85
28	50	60	55	90
29	40	55	55	80
30			45	85
31			50	80
32			45	100
33			60	85
34			50	80
35			45	100
36			70	90

Source: processed from SPSS, 2026

Based on Table 1, it is known that the number of students in the control class was 29 people, while in the experimental class there were 36 people. Both classes are given a pre-test before learning to find out the initial ability of students, then a post-test after the learning process is completed to determine the improvement of learning outcomes.

In the control class, the pre-test value is in the range of 40–70. The highest score obtained by students before learning is 70, while the lowest score is 40. After being given learning using the learning model applied to the control class, the post-test score changed with a value range of 55–85. The highest score increased to 85, while the lowest score became 55. In general, most students experienced an increase in learning outcomes, although there were some students who obtained fixed scores or experienced a slight decrease compared to pre-test scores. This shows that learning in the control class has an effect on improving learning outcomes, but the improvement has not occurred evenly in all students.

Meanwhile, in the experimental class, the number of students was 36 people. The results of the pre-test showed that the students' initial ability was in the range of 40–70 scores. The highest score obtained before learning is 70, while the lowest score is 40. After being given treatment using the learning model that became the research variable, the post-test results showed a significant improvement. The post-test score is in the range of 75–100, with the highest score reaching 100 and the lowest score of 75. Almost all students experienced an increase in scores compared to the pre-test results, even some students managed to get a perfect score (100).

When compared between the two classes, it can be seen that the improvement in learning outcomes in the experimental class is higher than in the control class. In the control class, the highest post-test score reached only 85, while in the experimental class it reached 100. In addition, the lowest post-test score in the experimental class of 75 was also higher than the lowest post-test score of the control class which was 55. This difference indicates that the treatment given in the experimental class is able to improve students' learning outcomes more optimally than the learning applied in the control class. Thus, based on the data in Table 1, it can be concluded that there is a tendency to improve learning outcomes better in the experimental class compared to the control class after being given the learning treatment.

In quantitative studies, normality tests are often performed using Shapiro-Wilk (for a sample of < 50). Where the basis for decision-making in the normality test is as follows:

- a. If the Sig $\geq 0.05 \rightarrow$ the data is normally distributed.
- b. If the Sig $< 0.05 \rightarrow$ the data is not distributed normally.

Table 2. Shapiro Wilk Normality Test Results Pre Test and Post Test Group

		Shapiro-Wilk		
	Groups	Statistic	df	Sig.
Value	Selisih PreTest	.958	36	.192
	Selisih PostTes	.950	29	.179

Source: processed SPSS, 23.0

Based on table 2, it is explained that the results of the difference value test pre-test Got a significant value Shapiro Wilk of 0.192 and the difference value post-test Got a significant value Shapiro Wilk 0.179. Where it means that all data shows a value of ≥ 0.05 , meaning that the data used is distributed normally.

Homogeneity testing is one of the important requirements before hypothesis testing using the Independent Samples t-Test. In this study, the homogeneity test was carried out using Levene's Test of Homogeneity of Variances through the help of the SPSS version 23 program The basis for decision-making in the homogeneity test is as follows:

- a. If the Sig. value ≥ 0.05 , then H_0 is accepted, so that the variance of data between groups is homogeneous.
- b. If the value of Sig. < 0.05 , then H_0 is rejected, so the variance of data between groups is not homogeneous.

Table 3. Homogeneity Test Results of Pre Test and Post Test Groups

		Levene Statistic	df1	df2	Sig.
Value	Based on Mean	2.044	1	63	.158
	Based on Median	1.946	1	63	.168
	Based on Median and with adjusted df	1.946	1	62.922	.168
	Based on trimmed mean	2.062	1	63	.156

Source: processed SPSS, 23.0

Based on the results of table 3, the results of the homogeneity test are shown by the Levene's Test method. The Levene value is shown on the line of Value *based on Mean*, which is 2.044 with a p value (sig) of 0.158 which is greater than 0.05 which means that there is a similarity of variance between groups or which means homogeneous.

Based on the results of the normality test and homogeneity test that has been carried out, it is known that the research data is normally distributed and has a homogeneous variance. With the fulfillment of these two conditions, the data is worth analyzing using parametric statistics.

Therefore, the next stage is to conduct a hypothesis test to find out whether there is an effect of the use of 3D interactive animation media with the Project Based Learning (PjBL) approach on student learning outcomes in science subjects at SD Negeri 143 Palembang.

Hypothesis testing in this study uses Independent Samples t-Test with the help of the SPSS version 23 program. This test was used to compare the average learning outcomes between two independent groups, namely the experimental class that obtained learning using 3D interactive animation media with the Project Based Learning approach and the control class that obtained conventional learning. Through this test, it can be found whether the difference in average learning outcomes that occurred between the two groups was significant or only occurred due to a coincidental factor.

The basis for decision-making in the Independent Samples t-Test is as follows:

- a. If the significance value (Sig. 2-tailed) < 0.05 , then H_0 is rejected and H_1 is accepted, which means that there is a significant influence of the use of 3D interactive animation media with the Project Based Learning approach on student learning outcomes in IPAS learning at SD Negeri 143 Palembang.
- b. If the significance value (Sig. 2-tailed) ≥ 0.05 , then H_0 is accepted and H_1 is rejected, which means that there is no significant effect of the use of 3D interactive animation media with the Project Based Learning approach on student learning outcomes in social studies learning at SD Negeri 143 Palembang.

Table 4 Independent Test Results T Pre Test and Post Test Group Samples

		t	df	Sig. (2-tailed)
Value	Equal variances assumed	5.476	63	.000
	Equal variances not assumed	5.357	53.767	.000

Source: processed from SPSS, 23.0

Based on Table 4, the results of the Independent Samples t-Test show that the significance value (Sig. 2-tailed) in the Equal variances row assumed is 0.000. Since the significance value is less than 0.05 ($0.000 < 0.05$), H_0 is rejected and H_1 is accepted. Thus, there is a significant influence of the use of 3D interactive animation media with a Project Based Learning approach on student learning outcomes in science studies learning at SD Negeri 143 Palembang. These results show that there is a significant difference in average learning outcomes between the experimental class using 3D interactive animation media and the *Project Based Learning* approach and the control class using conventional learning.

Discussion

Based on the results of the study, it is known that the use of 3D interactive animation media with the Project Based Learning (PjBL) approach has a positive influence on student learning outcomes in the science subject of animal life cycle material at SD Negeri 143 Palembang. This can be seen from the increase in learning outcomes in the experimental class which is higher than the control class. Before being given treatment, the initial ability of the two classes was relatively the same, which was shown by the range of pre-test scores that were not much different, namely 40–70. After the learning process took place, the post-test score of the experimental class increased by a range of 75–100, while the control class only reached a range of 55–85. These differences show that learning using 3D interactive animation media combined with the Project Based Learning approach is able to provide a more effective learning experience than conventional learning.

The increase in learning outcomes in the experimental class occurred because 3D interactive animation media was able to present animal life cycle material visually, interestingly, and easily understood by students. Material that was previously abstract became more concrete through the display of three-dimensional animations so that students could more easily understand each stage of the animal's life cycle. In addition, the use of animation makes students' attention and motivation to learn increase because learning becomes more interesting and not monotonous. This condition has an impact on increasing understanding of concepts which ultimately affects student learning outcomes.

The Project Based Learning (PjBL) approach also makes a great contribution to improving student learning outcomes. Through this approach, students not only receive information from the teacher, but are also actively involved in completing projects, discussing, working together in groups, and presenting the results of their work. These activities provide opportunities for students to develop critical thinking, communication, collaboration, and problem-solving skills. With active involvement during the learning process, the knowledge gained by students becomes more meaningful and lasts longer, thus having an impact on improving learning outcomes.

The results of this study are strengthened by the results of a hypothesis test using the Independent Samples t-Test which shows a significance value (Sig. 2-tailed) of 0.000, which means it is smaller than

0.05. Thus, the alternative hypothesis (H_1) is accepted and the null hypothesis (H_0) is rejected. These results prove that there is a significant influence of the use of 3D interactive animation media with the Project Based Learning approach on student learning outcomes. In addition, the results of the normality test showed that the data were normally distributed and the homogeneity test showed that both groups had homogeneous variance, so that the hypothesis test results were reliable and qualified for parametric statistical analysis.

The results of this study are in line with research conducted by Firmansyah et al. (2023), which states that the use of 3D animation media combined with active learning models is able to improve student learning outcomes because it provides a more interesting and interactive learning experience. This research is also supported by Ergantara and Sari (2023) who explain that 3D animation media helps students understand abstract IPAS material through concrete visualization. In addition, Hikmah et al. (2023) stated that the Project Based Learning approach is able to improve students' critical thinking skills, creativity, and learning outcomes. Thus, the results of this study further strengthen that the use of 3D interactive animation media with the Project Based Learning approach is an effective learning alternative in improving the learning outcomes of elementary school students.

4. CONCLUSION

Based on the results of research that has been conducted at SD Negeri 143 Palembang, it can be concluded that the use of 3D interactive animation media with the Project Based Learning (PjBL) approach has a significant effect on student learning outcomes in the science subject of animal life cycle material. The results of the hypothesis test showed a Sig. (2-tailed) value of $0.000 < 0.05$, so that the alternative hypothesis (H_1) was accepted and the null hypothesis (H_0) was rejected.

The application of 3D interactive animation media combined with the Project Based Learning approach is able to increase students' understanding of learning materials because the material is presented in a more concrete, interesting, and easy-to-understand manner. In addition, the Project Based Learning approach encourages students to be more active in discussing, cooperating, solving problems, and being directly involved in the learning process.

This can be seen from the increase in average student learning outcomes in the experimental class which is higher than the control class. Thus, 3D interactive animation media with a Project Based Learning approach can be used as an effective learning alternative to improve student learning outcomes in science subjects in elementary schools.

REFERENCES

- Aditya, D. T., & Anggalih, N. N. (2024). Perancangan video animasi menghadapi bencana banjir untuk anak usia 6-8 tahun. *Jurnal Desgrafia*, 2(1), 100-114. <http://ejournal.unesa.ac.id/index.php/desgrafia/article/view/64081>
- Agustira, S., & Rahmi, R. (2022). Penggunaan media pembelajaran untuk meningkatkan hasil belajar siswa pada tingkat SD. *MUBTADI: Jurnal Pendidikan Ibtidaiyah*, 4(1), 72-80. <https://doi.org/10.19105/mubtadi.v4i1.6267>
- Andreani, D., & Gunansyah, G. (2023). Persepsi guru sekolah dasar tentang mata pelajaran IPAS pada Kurikulum Merdeka. *Jurnal Penelitian Pendidikan Guru Sekolah Dasar*, 11(9), 20-29. <https://ejournal.unesa.ac.id/index.php/jurnal-penelitian-pgsd/article/view/54388>
- Anggriawan, A., Sidik, M. Y., Firdaus, A., Mahmudah, G., & Nurfauziah, A. (2023). Asumsi-asumsi dasar penelitian tindakan kelas. *Jurnal Kreativitas Mahasiswa*, 1(2), 204-210. <https://riset-iaid.net/index.php/jpm/article/view/1458>
- Cahyani, I. R. (2020). Pemanfaatan media animasi 3D di SMA. *Jurnal Teknologi Pendidikan: Jurnal Penelitian dan Pengembangan Pembelajaran*, 5(1), 57-62. <https://doi.org/10.33394/jtp.v5i1.2854>
- Fadilah, A., Nurzakiyah, K. R., Kanya, N. A., Hidayat, S. P., & Setiawan, U. (2023). Pengertian media, tujuan, fungsi, manfaat dan urgensi media pembelajaran. *Journal of Student Research (JSR)*, 1(2), 1-17. <https://doi.org/10.55606/jsr.v1i2.938>

- Firmansyah, A. F., Azizah, W. A., Widodo, S. T., & Isdhianti, E. (2023). Pengaruh penerapan model PBL berbantuan media animasi 3D terhadap hasil belajar pendidikan Pancasila kelas V. *Bada'a: Jurnal Ilmiah Pendidikan Dasar*, 5(2), 317-330. <https://doi.org/10.37216/badaa.v5i2.1221>
- Hadi, A. (2021). *Penelitian kualitatif: Studi fenomenologi, case study, grounded theory, etnografi, biografi*. CV Pena Persada.
- Hamijaya, M. W., & Suryaman, R. A. (2023). Determinan minat beli KPR generasi urban milenial di Kota Bandung. *Jurnal Riset Ilmu Ekonomi*, 3(1), 47-63. <https://doi.org/10.23969/jrie.v3i1.47>
- Hasriadi, H., Marwiyah, S., Ihsan, M., Arifuddin, A., Yamin, M., Putri, D. M., & Al-Hamdany, Z. (2022). Media pembelajaran inovatif berbasis lingkungan pembelajaran pendidikan agama Islam di Pondok Pesantren Pengkondakan Luwu Utara. *Madaniya*, 4(2), 531-539. <https://doi.org/10.53696/27214834.426>
- Hikmah, N., Febriya, D., Asrizal, A., & Mufit, F. (2023). The impact of the project-based learning model on students' critical and creative thinking skills in science and physics learning: A meta-analysis. *Jurnal Penelitian Pendidikan IPA*, 9(10), 892-902. <https://doi.org/10.29303/jppipa.v9i10.4384>
- Irawan, D. B., Putri, P., & Idris, M. (2023). Pengembangan media video animasi berbantuan CapCut pada pembelajaran IPS materi indahny keragaman di negeriku kelas IV sekolah dasar. *Innovative: Journal of Social Science Research*, 3(3), 122-134. <https://j-innovative.org/index.php/Innovative/article/view/2300>
- Lestari, P. I., & Nurhidayah, N. (2025). Pengalaman dan persepsi guru biologi dalam mengimplementasikan project based learning di SMA Negeri Kabupaten Maros. *Jurnal Binomial*, 8(2), 1-12. <https://doi.org/10.46918/bn.v8i2.2764>
- Marlina, L., & Sholehun, S. (2021). Analisis faktor-faktor yang mempengaruhi hasil belajar bahasa Indonesia pada siswa kelas IV SD Muhammadiyah Majaran Kabupaten Sorong. *FRASA: Jurnal Keilmuan, Bahasa, Sastra, dan Pengajarannya*, 2(1), 66-74. <https://ejournal.unimudasorong.ac.id/index.php/jurnalfrasa/article/view/854>
- Munir, A., Ishafit, I., & Widodo, W. (2024). Pengembangan media video animasi dengan Kinemaster untuk pembelajaran fisika pada topik gerak parabola kelas X SMA. *JiIP: Jurnal Ilmiah Ilmu Pendidikan*, 7(2), 2064-2070. <https://doi.org/10.54371/jiip.v7i2.4011>
- Nadya, N., & Sari, Y. P. (2020). Analisis visual penerapan 12 prinsip animasi dalam film *Grey & Jingga: The Twilight Animated Series* episode 1. *Titik Imaji*, 2(2), 1-12. <https://doi.org/10.30813/v2i2.1955>
- Nurfadhillah, S. (2021). *Media pembelajaran*. CV Jejak.
- Pagarra, H., Syawaluddin, A., & Krismanto, W. (2022). *Media pembelajaran*. Badan Penerbit UNM.
- Partayasa, W., Suharta, I. G. P., & Suparta, I. N. (2020). Pengaruh model creative problem solving (CPS) berbantuan video pembelajaran terhadap kemampuan pemecahan masalah ditinjau dari minat. *JNPM (Jurnal Nasional Pendidikan Matematika)*, 4(1), 168-179. <https://doi.org/10.33603/jnpm.v4i1.2644>
- Pratiwi, E. M., Gunawan, G., & Ermiana, I. (2022). Pengaruh penggunaan video pembelajaran terhadap pemahaman konsep IPA siswa. *Jurnal Ilmiah Profesi Pendidikan*, 7(2), 381-386.
- Prawitasari, N. R. N., Wijastuti, A., & Budiyanto, B. (2023). Assistive technology in improving daily living. In *Proceedings of the International Joint Conference on Arts and Humanities 2022 (IJCAH 2022)* (Vol. 724, p. 466). Atlantis Press. https://doi.org/10.2991/978-2-38476-008-4_52
- Purwanza, S. W. (2022). *Metodologi penelitian kuantitatif, kualitatif dan kombinasi*. CV Media Sains Indonesia.
- Salu Islamia, A., Diansyah, A., Hakim, L., & Utomo, B. (2025). Pengaruh Model Project Based Learning terhadap Kemampuan Berpikir Kreatif Siswa Pembelajaran IPAS Kelas IV SD Negeri 06 Palembang. *BADA'A: Jurnal Ilmiah Pendidikan Dasar*, 7(3), 45-62. <https://doi.org/10.37216/badaa.v7i3.2338>
- Sari, S. U. R., Lestari, R. D., & Kinasih, I. A. (2022). Efektivitas model pembelajaran PjBL terintegrasi STEM untuk meningkatkan kemampuan pemahaman konsep dan disposisi matematis dalam menyelesaikan permasalahan matematika. *Jurnal Pendidikan Matematika Indonesia*, 7(2), 61-66. <https://repository.uin-malang.ac.id/11902/>

- Siregar, N., Lestari, N., Yarshal, D., Fitria, D., & Harahap, Y. S. (2025). Classroom action research investigation conducted by pre-service teachers education program. *Jurnal Ilmiah Pendidikan Profesi Guru*, 8(1), 163-175. <https://doi.org/10.23887/jippg.v8i1.75903>
- Tsamarah, M., & Handayani, K. D. (2022). Penerapan media pembelajaran video animasi 3D menggunakan model pembelajaran problem based learning pada mata pelajaran gambar teknik di SMKN 7 Surabaya. *Jurnal Kajian Pendidikan Teknik Bangunan*, 8(2), 1-9. <https://doi.org/10.26740/jkptb.v8i2.49123>
- Ulfah, U., Arifudin, O., & Kartika, I. (2021). Pengaruh aspek kognitif, afektif, dan psikomotor terhadap hasil belajar peserta didik. *Jurnal Al-Amar: Ekonomi Syariah, Perbankan Syariah, Agama Islam, Manajemen dan Pendidikan*, 2(1), 1-9. <http://ojs-steialamar.org/index.php/IAA/article/view/88>
- Viola, A. W., & Rizvi, F. N. (2025). Observasi tentang penerapan mata pelajaran IPAS di SDN 12 Sungai Sapih Padang, Sumatera Barat. *Journal of Biology, Chemistry, Mathematics and Physics Education*, 2(2), 40-45. <https://doi.org/10.61761/biochamp.2.2.40-45>
- Wardah, Hakim, L., & Utomo, B. (2025). Pengaruh Pembelajaran Berdiferensiasi pada Mata Pelajaran IPAS terhadap Hasil Belajar Siswa. *Lambda: Jurnal Pendidikan MIPA dan Aplikasinya*, 5(3), 868–876. <https://doi.org/10.58218/lambda.v5i3.1604>
- Widianto, E. (2021). Pemanfaatan media pembelajaran berbasis teknologi informasi. *Journal of Education and Teaching*, 2(2), 213-224. <https://doi.org/10.24014/jete.v2i2.11707>
- Wulandari, N. (2025). Pengembangan LKPD IPAS berbasis model pembelajaran contextual teaching and learning pada kelas III SD Negeri 1 Adiwarno [Skripsi, UIN Raden Intan Lampung].
- Yandi, A., Putri, A. N. K., & Putri, Y. S. K. (2023). Faktor-faktor yang mempengaruhi hasil belajar peserta didik (literature review). *Jurnal Pendidikan Siber Nusantara*, 1(1), 13-24. <https://doi.org/10.38035/jpsn.v1i1.14>