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The Effect Of The Poe (Predict-Observe-Explain) Model On Learning Outcomes Of Junior High School Students

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Abstract

This study investigates the effect of the Predict-Observe-Explain (POE) learning model on junior high school students' science learning outcomes amid the suboptimal implementation of the independent curriculum, which remains teacher-centered and limits student engagement. Using a Quasi-Experimental Nonequivalent Control Group Design, the sample consisted of Grade VII students of SMP Negeri 26 Padang selected through purposive sampling. Class VII.1 received POE-based learning, while VII.2 experienced conventional instruction. Data were collected through pretest–posttest multiple-choice assessments, implementation observation sheets, and student response questionnaires. Descriptive and inferential analyses, including normality, homogeneity, and t-tests, revealed that t_count > t_table, indicating a significant effect of the POE model on students' science learning outcomes regarding substances and their changes. Implications highlight the POE model's potential to enhance conceptual understanding and student participation. Recommendations include integrating POE routinely into science instruction and training teachers to apply inquiry-based models effectively.

Informasi Artikel

Kata kunci
model POE, pembelajaran IPA, hasil belajar, quasi eksperimen

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Abstrak

Penelitian ini menganalisis pengaruh model pembelajaran Predict-Observe-Explain (POE) terhadap hasil belajar IPA siswa SMP pada konteks implementasi Kurikulum Merdeka yang masih belum optimal karena pembelajaran berpusat pada guru dan partisipasi siswa rendah. Penelitian menggunakan metode Quasi Experiment dengan desain Nonequivalent Control Group. Sampel ditentukan secara purposive, yaitu kelas VII.1 sebagai kelas eksperimen dengan model POE dan VII.2 sebagai kelas kontrol dengan pembelajaran konvensional. Data diperoleh melalui tes pilihan ganda pretest–posttest, lembar observasi penerapan model, dan angket respons siswa. Analisis menggunakan statistik deskriptif dan inferensial mencakup uji normalitas, homogenitas, dan uji t. Hasil menunjukkan t_hitung > t_tabel sehingga terdapat pengaruh signifikan model POE terhadap hasil belajar materi zat dan perubahannya. Implikasi penelitian menegaskan efektivitas POE dalam meningkatkan pemahaman konsep. Rekomendasi diberikan agar guru mengintegrasikan POE secara konsisten dalam pembelajaran IPA.

INTRODUCTION

Education is a key component in every country's social development efforts. The importance of education demands improvements and reforms to the education system to ensure the quality of human resources (Gulo, 2021, Mastun et al, 2025, Zaini, M et al, 2025). The evolution of the global education system in the 21st century has been referred to as 21st-century learning, due to the increasing importance of education in developing the skills students need to work and survive, use technology, be media literate, and develop life skills (Pratiwi, et al., 2019). 21st-century learning focuses on meaningful and student-oriented learning processes. With mastery of technology as a means of learning, it is directed at activating and building the independence of students (Innayati, 2022; Aini et al, 2023).

The Indonesian government has implemented an independent curriculum to meet the demands of 21st-century learning. The independent curriculum can be understood as a learning system with a pedagogical approach that uses a variety of intracurricular activities and tailored content so that students have the opportunity to explore concepts and hone their learning skills. This curriculum is designed as a flexible programme that emphasises basic learning tools and helps students develop their personalities and skills (Muhammad, 2023). It emphasises individual development, adapts learning materials to students' needs, and allows them to apply concepts and information in line with their individual learning styles (Angga et al., 2022).

The implementation of the independent curriculum is also applied in the scope of science subjects at the junior secondary level. Science is part of the scientific discipline that continues to undergo innovation in line with the rapid advancement of science and technology. Integrated science learning encourages students to apply their developing understanding of issues and events and to tackle problems encountered in everyday life (Yurnetti, 2017). In the independent curriculum, the study of natural sciences is an intellectual and applicative activity that structurally investigates the structure and dynamics of the universe through scientific processes. Through this experience, students learn to understand the working principles of nature empirically and are able to explain them logically (Marfilinda, 2022). In fact, many students complain and dislike science lessons. However, science is very important and closely related to nature and daily life. As a result, students' academic performance in science subjects is poor. According to (Indradinata et al., 2015), student academic achievement is one of the indicators of the quality of education in Indonesia. Therefore, student academic achievement is highly dependent on the learning process at school (Matturungan et al., 2023).

Based on interviews with science teachers at SMP N 26 Padang, science learning has been implemented quite well and teachers have also tried to apply several models in line with the independent curriculum. However, the application of these models has not been optimal and teachers still often use conventional methods such as lectures and discussions. During the learning process, students are generally not focused and often cause disturbances in class. Based on an interview with a science teacher at SMP N 26 Padang, he stated that students have diverse characters that need to be considered in learning. Some students show perseverance and high enthusiasm in learning, but there are also those who still need encouragement to be more disciplined and obedient to teachers. These differences sometimes affect the creation of an optimal learning atmosphere in the classroom.

Substances and their changes are one of the topics in science education in the fields of physics and chemistry. At SMPN 26 Padang, teachers say that students have a low interest in learning science. However, science originates from natural phenomena that students experience in their daily lives. The material on substances and their changes requires observation and is accompanied by interesting practical work so that changes in the form of substances will be better understood through a more contextual learning method using interesting and varied experiments. The POE approach to learning, which includes prediction, observation, and

explanation, is based on constructivism theory. This model is effective in increasing student activity because it encourages them to think, investigate, and conclude independently. Several relevant previous studies confirm that the application of the POE model supports the improvement of students' mastery of science concepts. The description of this problem, reinforced by the results of previous studies, led the researchers to investigate this topic with the title "The Effect of the POE (*Predict-Observe-Explain*) Model on Student Learning Outcomes in Science Education in Junior High School".

METHOD

This study utilised a quasi-experimental approach with a quantitative research design using a *Nonequivalent Control Group Design*. The research population consisted of Year 7 students at SMPN 26 Padang for the 2025/2026 academic year, divided into eight classes. The sample was taken purposively, resulting in two experimental and control groups, namely classes VII.2 and VII.1. The study began with a pretest for both sample groups, followed by the treatment and ending with a posttest. The lecture and discussion methods were applied in the control class, while the experimental class applied the POE learning model. The researcher used instruments including a written pretest-posttest in the form of multiple choice questions, a questionnaire to determine the students' responses to learning, and an observation sheet to measure how the learning model being studied was implemented during the research. The data were then analysed descriptively and using inferential statistics. Data analysis was preceded by prerequisite tests, namely normality and homogeneity tests. After that, the hypothesis was tested using a parametric test (t-test) processed with Microsoft Excel software.

Based on the hypothesis to be tested, there are two classes as research objects designed in this study. Both classes received treatment using varying learning models on the same material, namely Matter and Its Changes. The conventional learning model was used in the control class as it is usually implemented by educators in related subjects, while in the experimental class, a different learning model was applied, namely the POE learning model. The following is the research design:

Table 1. Research Design (*Non Equivalent Control Group Design)* (Sugiyono, 2023)

Class	***Pre-test***	**Expriment**	***Post-test***
Expriment	O1	X	O2
Control	O3	-	O4

RESULTS AND DISCUSSION

The POE learning model in this study was implemented over four cycles consisting of eight meetings on the subject of substances and their changes. The implementation of the POE learning model in this study was observed by two observers using observation sheets. The following are the results of the analysis of the implementation of the POE learning model.

Table 2. Implementability, Syntax, Model, Learning, POE

Sintaks	**Observer**		**Skor**	**Skor Ideal**	**%**
	Observer 1	**Observer 2**			
Predict	100%	100%	200	200	100
Observe	91,6%	100%	191,6	200	95,80
Explain	100%	100%	200	200	100
% Total Keterlaksanaan					98,60%

Referring to the table above, it can be seen that this study has applied the POE learning model, which shows excellent performance, where the percentage of implementation of the POE learning model is 98.60% of the overall learning cycle. After the study was conducted,comparative data before and after treatment in both groupswas obtained. The data was analysed descriptively. The following are the descriptive results of the pretest-posttest of the two samples.

Table 3. Descriptive Statistical Analysis

Date	***Experiment***		***Control***	
	Pretest	*Posttest*	*Pretest*	*Posttest*
N	32	32	32	32
Total	1464	2356	1412	1940
Nilai Max	64	96	60	76
Nilai Min	28	52	24	48
Mean	45.75	73.63	44.13	60.63
Standar Deviasi	12.32	10.89	9.88	6.43
Gain skor	27.88		16.50	

Table 3 illustrates that the average pretest score of students in the control group was 44.13 andthe average pretest score of the experimental class was45.75. The data shows that the pretest scores of the two test groups are relatively comparable. After the treatment, the average posttest score of the control group was 60.63, while the experimental class recorded an average posttest score of 73.63. The data indicates an increase in scores before and after the treatment. The difference between the average score of the control class before and after the treatment was 16.50, while the increase in the experimental class before and after the treatment was 27.88. It can be seen that the learning outcomes of the experimental class improved more than those of the control class.

After the data was analysed using descriptive statistics, it was then analysed through hypothesis testing using inferential statistics with *Microsoft Excel*. Before conducting hypothesis testing, the learning outcome data had to be analysed through a prerequisite test as a preliminary step. This study used a prerequisite test consisting of a normality test and a homogeneity test. The significance level was set at 5% or 0.05, so that the value L_{tabel} The normality test conducted was 0.16 from a sample of 32. The results of the normality test on the control class data showed a value of L_{count} as large as 0.856 (smaller than L_{tabel}) so that it is known the results of the analysis explain that the distribution of data in the control class shows characteristics of a normal distribution. The normality test on the experimental class data produced a value ofL_{count} as large as 0.834 (smaller than L_{tabel}). Based on this significance value, the experimental class data is categorised as having a normal distribution.

Next, the prerequisite test is followed by a homogeneity test aimed at identifying similarities in variance between data groups. This study uses the Fisher test (F test) as a homogeneity test, which is analysed using Microsoft Excel. In this test, the values will be compared. F_{count} with F_{tabel} sample pretest and posttest data. If $F_{count} \leq F_{tabel}$, meaning that the data distribution in that group has homogeneous variance (Sundayana, 2020). The significance level used is 0.05 or 5%, resulting in F_{tabel} as large as 1.82. The homogeneity test of the *pretest* data indicates $F_{count}$with a value of 1.56 ($F_{count} < F_{tabel}$) so that it is known that the *pre-test* data represents a sample that is representative of the population with an equivalent level of variance. The homogeneity test of the *post-test* data shows that F_{count} with a value of

0.35 ($F_{count} < F_{tabel}$) so that it is known that the post-test data has a homogeneous inter-sample variance.

Based on the results of the prerequisite test, the research data was found to be normally distributed in both the control and experimental groups. Therefore, the theoretical test was conducted using the t-test, also known as the parametric test. In this study, the t-test was used to compare the difference in learning achievement means between the two treatment groups.

According to Sundayana (2020), the criteria for decision-making in testing are as follows:$F_{tabel} \leq F_{count} \leq F_{tabel}$ maka H_0 accepted and H_1 rejected. The significance level used is 5% or 0.05, resulting in a value of T_{tabel} is 2.00. The t-test on the pretest data of both sample classes shows T_{count} has a value of -1.58 ($T_{count} < T_{tabel}$) so that H_0 accepted and H_1 rejected. This finding implies that the pretest results of students in the control and experimental classes were at a relatively similar level. A t-test was then conducted on the posttest data of the sample class, yielding a value of T_{count} as much as 2.70 ($T_{count} > T_{tabel}$) so that H_0 rejected and H_1 accepted. H_0 In this study, it was concluded that "there was no significant effect of the POE (*Predict-Observe-Explain*) learning model on the learning outcomes of junior high school students in the subject of substances and their changes". Meanwhile, H_1 This study found that "there is a significant effect of the POE (*Predict-Observe-Explain*) learning model on the learning outcomes of junior high school students in the subject of substances and their changes".

Based on the t-test results, the alternative hypothesis (H_1) was accepted. Thus, the use of the POE (Predict-Observe-Explain) learning model can have a significant impact on junior high school science learning outcomes in the subject of substances and their changes. The results of the study also show that the POE method is superior in improving student learning outcomes compared to the discussion or lecture methods. This is supported by the average increase in learning outcomes, where the experimental class experienced an increase of 27.88, while the control class only experienced an increase of 16.50.

The POE learning model makes it easier for students to understand concepts compared to students taught using conventional methods. In addition, the POE learning model also encourages students to actively and directly reconstruct knowledge through prediction, observation, and explanation. Students discover concepts on their own through activities that involve comparing predictions with observations, which helps them to understand and remember concepts more easily (Safitri et al., 2019).

The POE learning model contributes to developing students' mindsets, helping students explore their understanding, obtain information and learning skills (Amahoru et al., 2023). The findings of this study also reveal that the application of the POE model contributes more significantlyto improving learning outcomes. These findings are consistent with those of Marhento (2020), namely that the POE learning model increases the motivation and activity ofstudents in learning activities, which in turn leads to more optimal learning outcomes. The students' motivation is driven by teamwork and peer support.

Furthermore, findings from several previous studies also reveal that the POE learning model has a positive impact on students' physics learning outcomes compared to conventional learning (Paoliana et al., 2020). These results are also supported by (Matturungan et al., 2023), whose study entitled 'The Effect of the POE (Predict-Observe-Explain) Learning Model on Student Learning Outcomes in Human Digestive System Material' explains how POE can improve learning outcomes and has a significant effect. Furthermore, a study (Amahoru et al., 2023) also concluded the same thing. The application of the POE learning model is more effective in supporting learning outcomes. Together, these studies reinforce the conclusion of this research hypothesis, which concludes that learning with the POE approach has a significant effect in encouraging student learning outcomes.

CONCLUSION

From observations of the implementation of the experimental class learning, it can be concluded that the POE learning model in this study was implemented very well with an overall percentage of 98.60%. Students responded to learning with enthusiasm and positivity towards the implementation of the POE model, with a percentage of 94.87% based on the analysis of the student response questionnaire tabulation. Descriptive data analysis shows that the average learning outcome score (after treatment) in the experimental class was higher than that of the control class, with a difference of 11.38. Based on the results of the hypothesis test, the value shows that T_{count}as much as 2.70 and T_{tabel}= 2,00 (T_{count}> T_{tabel}) so that H_0 rejected and H_1 accepted. The final results of the analysis led to the conclusion that the use of the POE model had a significant positive effect on the learning outcomes of junior high school science students in the subject of substances and their changes.

REFERENCES

Agustina, M. (2018). The Role of the Natural Science Laboratory (IPA) in Science Learning Madrasah Ibtidaiyah MI/SD (In Indonesian). *At-Ta'dib: Jurnal Ilmiah Pendidikan Agama Islam*, *10*(1), 1–10.

Ahdiyat, T., & Nugroho, Y. A. (2022). ANALISIS KINERJA MESIN BANDSAW MENGGUNAKAN METODE OVERALL EQUIPMENT EFFECTIVENESS (OEE) dan SIX BIG LOSSES PADA PT QUARTINDO SEJATI FURNITAMA.*Jurnal Cakrawala Ilmiah*, *2*(1). https://doi.org/10.53625/jcijurnalcakrawalailmiah.v2i1.3509

Aini, M., Ali, L. U., & Suhirman, S. (2023). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Problem Based Learning (PBL) Pada Materi Elastisitas Untuk Melatih Kemampuan Berpikir Kritis. CAHAYA: Journal of Research on Science Education, 1(2), 73–91. https://doi.org/https://doi.org/10.70115/cahaya.v1i2.73

Aisah, S. (2020). Analisis Pemahaman Guru Tentang Konsep Hakikat Ipa Dan Pengaruhnya Terhadap Sikap Ilmiah Siswa Sekolah Dasar Di Depok. In *Al-Mubin; Islamic Scientific Journal* (Vol. 3, Issue 1, pp. 16–26). https://doi.org/10.51192/almubin.v3i1.66

Ali, L. U. (2018). Pengelolaan Pembelajaran IPA Ditinjau Dari Hakikat Sains Pada SMP Di Kabupaten Lombok Timur. *Prisma Sains : Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, *6*(2), 103. https://doi.org/10.33394/j-ps.v6i2.1020

Amahoru, M., Unwakoly, S., & Manoppo, Y. (2023). Penggunaan Model Pembelajaran Predict Observe Explain (POE) dalam Meningkatkan Hasil Belajar Peserta didik. Jurnal Riset Mahasiswa, 1(1), 12–22.

Anas, N., Rizky, R., Adhani, I., Hsb, P. C., & Handayani, N. (2023). Pengaruh POE (Predict, Observasi, Explain) Terhadap Kemampuan Kolaborasi Siswa. Tarbiatuna: Journal of Islami Education Studies, 3(2), 243–249

Angga, A., Suryana, C., Nurwahidah, I., Hernawan, A. H., & Prihantini, P. (2022). Komparasi Penerapan Kurikulum 2013 dan Kurikulum Merdeka di Sekolah Dasar. *Jurnal Basicedu*, *6*(4), 5877–5889.

Dodi, I. (2019). Menggagas Pendidikan Nilai dalam Sistem Pendidikan Nasional. *Didaktika: Jurnal Kependidikan*, *8*(3), 109–122. https://jurnaldidaktika.org/contents/article/view/73

Fadly, I. (2022). Model-Model Pembelajaran untuk Implementasi Kurikulum Merdeka. Bening Pustaka.

Gulo, E. (2021). Inovasi IPTEK dan Mutu Pendidikan dan Berintegritas. *Seminar Nasional Hukum Universitas Negeri Semarang*, *7*(2), 523–546.

Handayani, N.N.L. (2022). Buku Ajar Ilmu Pendidikan & Inovasi Pembelajaran. Banyumas: CV. Pena Persada.

Herniati, R., Sulistri, E., & Rosdianto, H. (2017). Penerapan Model Predict Observe Explain Dengan Pendekatan Learning By Doing Untuk Meningkatkan Hasil Belajar Siswa. *Jurnal Fisika FLUX*, *14*(2), 120. https://doi.org/10.20527/flux.v14i2.4269

Indarta, Y., Jalinus, N., Abdullah, R., & Samala, A. D. (2021). 21st Century Skills : TVET dan Tantangan Abad 21. *Edukatif : Jurnal Ilmu Pendidikan*, *3*(6), 4340–4348. https://doi.org/10.31004/edukatif.v3i6.1458

Irawati, I., Ilhamdi, M. L., & Nasruddin, N. (2021). Pengaruh Gaya Belajar Terhadap Hasil Belajar IPA. *Jurnal Pijar Mipa*, *16*(1), 44–48. https://doi.org/10.29303/jpm.v16i1.2202

Kubicek, J. P. (2014). Inquiry-based learning, the nature of science, and computer technology: New possibilities in science education. *Canadian Journal of Learning and Technology*, *31*(1), 1–8.

L. U. Ali, I. W. Suastra, A. A. I. A. R. S. (2018). Pengelolaan Pembelajaran IPA Ditinjau Dari Hakikat Sains Pada SMP Di Kabupaten Lombok Timur. *Prisma Sains : Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, *6*(2), 103. https://ejournal-pasca.undiksha.ac.id/index.php/jurnal_ipa/article/view/750

Lidi, M. W., Mbia Wae, V. P. S., & Umbu Kaleka, M. B. (2022). Implementasi Etnosains Dalam Pembelajaran Ipa Untuk Mewujudkan Merdeka Belajar Di Kabupaten Ende. *OPTIKA: Jurnal Pendidikan Fisika*, *6*(2), 206–216. https://doi.org/10.37478/optika.v6i2.2218

Mahmudi, I., Athoillah, M. Z., Wicaksono, E. B., & Kusumua, A. R. (2022). Taksonomi Hasil Belajar Menurut Benyamin S. Bloom. *Jurnal Multidisiplin Madani*, *2*(9), 3507–3514.

Mastun, M., Fitriana, I. M., Najamuddin, N., Ali, L. U., & Faqih, M. (2025). Peran Komite Madrasah dalam Meningkatkan Mutu Pendidikan di Madrasah Ibtidaiyah Hidayatul Atfal Batu Samban. TAMADDUN: Jurnal Ilmu Sosial, Seni, Dan Humaniora, 3(2), 91–98. https://doi.org/https://doi.org/10.70115/tamaddun.v3i2.318

Matturungan, S. M. A., Yunus, N. M., & Khaerati, K. (2023). Pengaruh Model Pembelajaran POE (Predict, Observe, Explain) terhadap Hasil Belajar Peserta Didik pada Materi Sistem Pencernaan Manusia Kelas VIII UPT SMP Negeri 3 Sabbang Selatan. *Jurnal Pelita: Jurnal Pembelajaran IPA Terpadu*, *3*(2), 101–113. https://doi.org/10.54065/pelita.3.2.2023.382

Muhammad, D. (2023). *20755-Article Text-66429-1-10-20231106 (1)*. *6*, 1265–1271. https://journal.universitaspahlawan.ac.id/index.php/jrpp/article/view/20755/14904

Muna, I. A. (2017). Model Pembelajaran POE (Predict-Observe- Explain) dalam Meningkatkan Pemahaman Konsep dan Keterampilan Proses IPA. El Wasathiya: Jurnal Studi Agama, 5(1), 73–91

Niyarci, N. (2022). Perkembangan Pendidikan Abad 21 Berdasarkan Teori Ki Hajar Dewantara. *Pedagogika: Jurnal Ilmu-Ilmu Kependidikan*, *2*(1), 46–55.

https://doi.org/10.57251/ped.v2i1.336

Novanto, Y. S., Anitra, R., & Wulandari, F. (2021). Pengaruh Model Pembelajaran Poe Terhadap Kemampuan Pemahaman Konsep Ipa Siswa Sd. *ORBITA: Jurnal Kajian, Inovasi Dan Aplikasi Pendidikan Fisika*, *7*(1), 205. https://doi.org/10.31764/orbita.v7i1.4665

Paoliana, N., Taufik, M., & Rokhmat, J. (2020). Pengaruh Model Pembelajaran POE (Predict-Observe- Explain) terhadap Hasil Belajar dan Kreativitas Fisika Peserta Didik. GeoScienceEdu Journal, 1(1).

Pratiwi, S. N., Cari, C., & Aminah, N. S. (2019). Pembelajaran IPA abad 21 dengan literasi sains siswa. *Jurnal Materi Dan Pembelajaran …*, *9*, 34–42. https://jurnal.uns.ac.id/jmpf/article/view/31612%0Ahttps://jurnal.uns.ac.id/jmpf/article/download/31612/21184

Pristiwanti, D., Badariah, B., Hidayat, S., & Dewi, R. S. (2022). Pendekatan Pendidikan. *Jurnal Pendidikan Dan Konseling*.

Ramadina, E. (2021). Peran Kepala Sekolah Dalam Pengembangan Kurikulum Merdeka Belajar. *Mozaic : Islam Nusantara*, *7*(2), 131–142. https://doi.org/10.47776/mozaic.v7i2.252

Restami, M. P., Suma, ; K, & Pujani, ; M. (2015). Pengaruh Model Pembelajaran Poe (Predict-Observe-Explaint)Terhadap Pemahaman Konsep Ditinjau Dari Gaya Belajar Siswa. *Journal Program Pascasarjana*, *3*(1), 1–11. https://ejournal-pasca.undiksha.ac.id/index.php/jurnal_ipa/ article/view/716

Safitri, E., Kosim, K., & Harjono, A. (2019). Pengaruh Model Pembelajaran Predict Observe Explain (POE) Terhadap Hasil Belajar IPA Fisika Siswa SMP Negeri 1 Lembar Tahun Ajaran 2015/2016. *Jurnal Pendidikan Fisika Dan Teknologi*, *5*(2), 197–204. https://doi.org/10.29303/jpft.v5i2.825

Sudarto, Hafid, A., & Amran, M. (2021). Analisis Implementasi Program Merdeka Belajar di SDN 24 Macanang dalam Kaitannya dengan Pembelajaran IPA/TemaIPA. *Seminar Nasional Hasil Penelitian 2021*, *1*(1), 406–417. https://ojs.unm.ac.id/semnaslemlit/article/view/25268

Sugiyono. (2023). Metode Penelitian Kuantitatif, Kualitatif, dan R&D. Bandung: Alfabeta.

Sundayana, R. (2020). Statistika Penelitian Pendidikan. Bandung: Alfabeta.

Supartama, I. N. W., Pujani, N. M., & Priyanka, L. M. (2023). Analisis Motivasi Belajar IPA pada Kurikulum Merdeka di Kelas VII SMP Negeri 2 Singaraja. *Jurnal Pendidikan Dan Pembelajaran Sains Indonesia*, *6*(2), 194–205. https://ejournal.undiksha.ac.id/index.php/JPPSI/ article/view/69806

Syam, A. R. (2011). Posisi Manajemen Kurikulum Dan Pembelajaran Dalam Pendidikan. *MUADDIB:Studi Kependidikan Dan Keislaman*, *7*(1), 33–46. https://doi.org/10.24269/muaddib.v7n1.2017.33-46

Tuan Soh, T. M., Arsada, N. M., & Osman, K. (2010). The relationship of 21st century skills on students' attitude and perception towards physics. *Procedia - Social and Behavioral Sciences*, *7*(2), 546–554. https://doi.org/10.1016/j.sbspro.2010.10.073

Umam, K., Suhendri, H., Nurhayati, L., & Nuriadin, I. (2024). *Mobile-Based Realistic Mathematics Learning Design to Improve Students ' Reasoning Ability and Problem-Solving Ability*. *14*(148), 335–342.

Widyaningrum, R., Sarwanto, S., & Karyanto, P. (2013). Pengembangan Modul Berorientasi Poe (Predict, Observe, Explain) Berwawasan Lingkungan Padamateri Pencemaran Untuk Meningkatkan Hasil Belajar Siswa. *Bioedukasi: Jurnal Pendidikan Biologi*, *6*(1), 100. https://doi.org/10.20961/bioedukasi-uns.v6i1.3920

Yanto, F., Festiyed, F., & Enjoni, E. (2021). Problem Based Learning Model For Increasing Problem Solving Skills In Physics Learning. *JIPF (Jurnal Ilmu Pendidikan Fisika)*, *6*(1), 53. https://doi.org/10.26737/jipf.v6i1.1870

Yulasri, R. E., Syahril, S., Santoso, Y., & Ningrum, T. A. (2022). Disiplin Belajar Siswa Di SMK Negeri 2 Batusangkar. *Journal of Educational Administration and Leadership*, *2*(3), 312–316. https://doi.org/10.24036/jeal.v2i3.229

Yupani, N. P. E., Garminah, N. N., & Mahadewi, L. P. P. (2013). Pengaruh Model Pembelajaran Predict-Observe-Explain (POE) Berbantuan Materi Bermuatan Kearifan Lokal Terhadap Hasil Belajar IPA Siswa Kelas VI. E-Journal Undiksha

Yurnetti, Y. (2017). Analysis of Student Learning Ability in Science Teaching Based on Mid Semester Examination. *Journal of Physics: Conference Series*, *895*(1). https://doi.org/10.1088/1742-6596/895/1/012022

Zaini, M., Ali, L. U., Handriani, L. S., & Fitriana, I. M. (2025). The influence of guided inquiry learning based on local wisdom and android applications on students ' high-order thinking skills (HOTS). Compton: Jurnal Ilmiah Pendidikan Fisika, 12(1), 161–175. https://doi.org/https://doi.org/10.30738/cjipf.v12i1.19905

Zuleni, E., & Marfilinda, R. (2022). Pengaruh Motivasi Terhadap Pemahaman Konsep Ilmu Pengetahuan Alam Siswa. *Educativo: Jurnal Pendidikan*, *1*(1), 244–250. https://doi.org/10.56248/educativo.v1i1.34