

The Problem Based Learning (PBL) Model with Liveworksheets Media on the Outcomes of Science Learning on Ecosystem Materials of Grade V Students of SDN Rejosari 03 Semarang City

Nurul Sabila Fitri¹, Verylana Purnamasari², Fajar Cahyadi³

¹ Universitas PGRI Semarang, Indonesia

ARTICLE INFO

Keywords:

Problem-Based Learning;
Liveworksheets;
learning outcomes;
IPAS;
ecosystem

Article history:

Received 2026-06-06

Revised 2026-07-06

Accepted 2026-08-11

ABSTRACT

This study aims to determine the effectiveness of the Problem-Based Learning (PBL) model, supported by Liveworksheets media, on the Natural and Social Sciences (IPAS) learning outcomes regarding the topic of ecosystems for fifth-grade students at SDN Rejosari 03, Semarang City. The study employed a quantitative approach using a pre-experimental method and a One-Group Pretest-Posttest design. The research subjects consisted of 19 fifth-grade students. Data collection techniques included tests, observations, interviews, questionnaires, and documentation. Data analysis was conducted using the Wilcoxon Signed-Rank Test and the N-Gain test. The results showed that the average pretest score of 53.68 increased to 88.42 in the posttest. The Wilcoxon test yielded an Asymp . Sig. (2-tailed) value of 0.001 (< 0.05), indicating a significant difference in learning outcomes before and after the implementation of the learning model. The N-Gain score was 0.7414, falling into the high category. Furthermore, the learning mastery rate increased from 5.2% to 84.2%, while student response to the instruction reached 93%, falling into the "very good" category. Based on these findings, it can be concluded that the Problem-Based Learning (PBL) model supported by Liveworksheets media is effective in improving IPAS learning outcomes regarding ecosystems for fifth-grade students at SDN Rejosari 03, Semarang City.

This is an open access article under the CC BY SA license.



Corresponding Author:

Nurul Sabila Fitri

Universitas PGRI Semarang, Indonesia; nurulsabilaf@gmail.com

1. INTRODUCTION

Elementary school education plays a crucial role in shaping students' knowledge, thinking skills, and competencies to face the changing times. Teachers play a crucial role in creating innovative learning environments, enabling students to actively participate in the learning process. The Indonesian National Curriculum (Peraturan Menteri Pendidikan Dasar Dan Menengah Nomor 13 Tahun 2025, 2025) states that the learning process should be interactive, inspiring, enjoyable, and student-centered, encouraging

activeness, creativity, and the achievement of competencies and character. In line with this, the Independent Curriculum emphasizes student-centered learning and provides teachers with the opportunity to design innovative, contextual, and meaningful learning (Peraturan Menteri Pendidikan, Kebudayaan, Riset, Dan Teknologi Nomor 12 Tahun 2024, 2024). Learning is also geared toward developing competencies, creativity, critical thinking, and problem-solving skills through learning models and strategies tailored to student needs.

One of the subjects that supports the achievement of these goals is Natural and Social Sciences (IPAS). Learning IPAS in elementary schools emphasizes critical thinking skills and understanding concepts related to real life (Hayudinna & Muzkiyah, 2024). IPAS is a combination of Natural Sciences (IPA) and Social Sciences (IPS) that provides students with an understanding of various natural and social phenomena in the surrounding environment (Lestari et al., 2023). In learning IPAS, students are expected to be able to develop inquiry skills to identify and formulate problems through experience and real action (Azzahra et al., 2023). Science learning also plays a role in developing students' critical, creative, and logical thinking skills (Marhento, 2020). One of the science subjects studied by fifth-grade students is ecosystems. Ecosystems require students to understand the reciprocal relationships between biotic and abiotic components, the function of each component, and the various interactions that occur within a living system (Marwan et al., 2025). This material is closely related to everyday life, so learning should provide students with direct experience in observing, identifying, and understanding problems that occur in the environment. However, the concept of ecosystems has quite complex relationships between components, so students can experience difficulties in understanding the material if learning only focuses on teacher explanations.

This problem was also found in the fifth grade of SDN Rejosari 03, Semarang City. Based on observations and interviews, student engagement in learning is still relatively passive. Students are less willing to ask questions and express their opinions during discussions. The science learning process is still dominated by lectures, while the use of technology-based interactive learning media is still limited. This condition impacts student learning outcomes, particularly in the ecosystem's topic, which is still not optimal. Student learning outcomes can be used as a benchmark to determine the success of the learning process at school (Jauhari et al., 2024). Learning that is still dominated by lecture methods causes students to receive more information than directly involved in the process of finding and solving problems. Therefore, a learning model is needed that can provide opportunities for students to be active in the learning process. One model that can be used is Problem Based Learning (PBL). Problem Based Learning (PBL) is a learning method that emphasizes students and encourages their active participation in learning by solving real problems related to everyday life (Ratno et al., 2024). The PBL model places problems as the basis of learning so that students are involved in identifying problems, discussing them, conducting investigations, finding solutions, and communicating the results of problem-solving. The application of PBL can also train students' critical thinking, collaboration, and problem-solving skills.

The use of appropriate media is also necessary to support the learning process. Learning media plays a crucial role in delivering engaging and easily understood material to students (Fitri et al., 2025). Liveworksheets is an interactive learning tool that can be used to deliver digital learning activities. This tool can help students engage in various learning activities in a more engaging way and provide feedback on their work. The integration of PBL with Liveworksheets is expected to encourage students to be more active in problem-solving while also helping them understand the concepts in ecosystems. Several previous studies have shown that the use of PBL assisted by Liveworksheets provides positive results. (Dwiyanti et al., 2023) shows that PBL assisted by Liveworksheets has a significant effect on the science learning outcomes of fifth grade elementary school students, with an average learning outcome of the experimental class of 81.81, higher than the control class of 52.74. (Lestari et al., 2023) shows that PBL assisted by Liveworksheets has a significant effect on critical thinking skills with a significance value of $0.001 < 0.05$. (Putri et al., 2026) shows that e-LKPD based on Liveworksheets integrated with PBL is declared very valid, practical, and effective with an N-Gain of 0.73 in improving science learning outcomes.

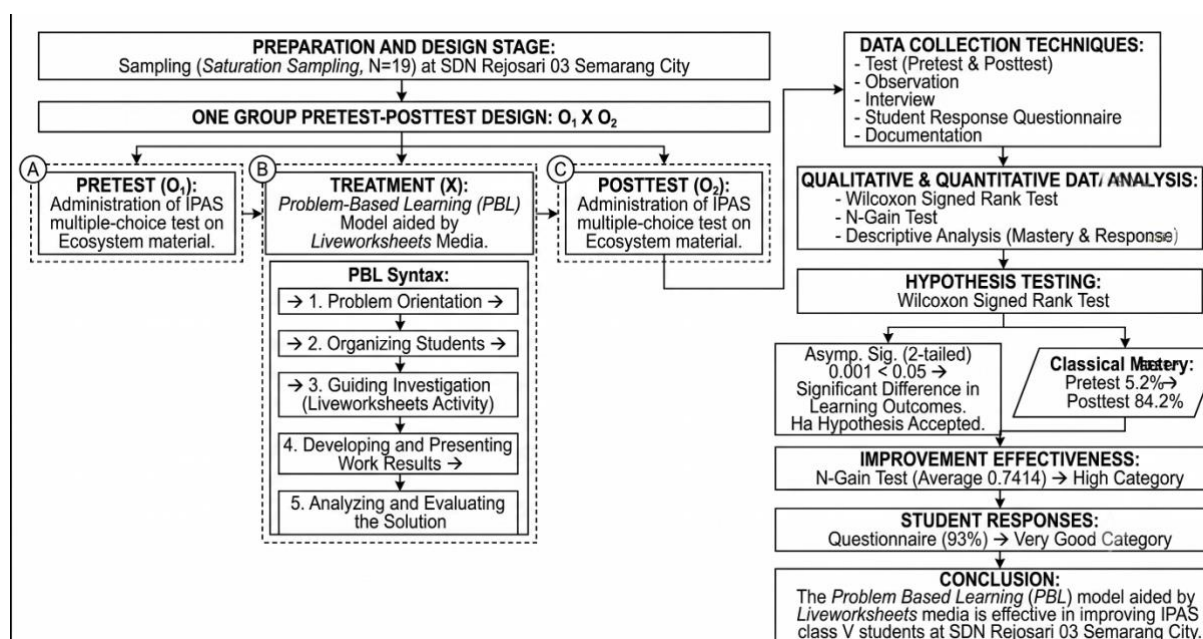
Other research also supports the use of PBL assisted by Liveworksheets (Ardinita et al., 2026). It shows that PBL assisted by interactive LKPD based on Liveworksheets has a significant effect on elementary school students' science learning outcomes. Meanwhile, (Rozaton et al., 2024) it shows that PBL assisted by Liveworksheets has a significant effect on students' critical thinking skills. However, research specifically examining the effectiveness of PBL assisted by Liveworksheets on science learning outcomes in ecosystems material for fifth-grade elementary school students is still limited. Based on the description, there are problems in the form of low student activity, learning that is still dominated by lecture methods, limited use of interactive learning media, and less than optimal learning outcomes for the ecosystem material of science and natural sciences. The application of PBL assisted by Liveworksheets is seen as an alternative to create more active, interactive, and student-centered learning. Therefore, this study was conducted to determine the effectiveness of the Problem Based Learning (PBL) model assisted by Liveworksheets media on the learning outcomes of the ecosystem material of fifth-grade students of SDN Rejosari 03, Semarang City.

2. METHODS

Study This use approach quantitative with Pre-Experimental Design method using One Group Pretest-Posttest Design. According to Sugiyono, (2022), the design This used for know influence something treatment with compare pretest results before treatment and posttest after treatment given. Design research used can depicted as $O_1 \times O_2$, namely pretest (O_1), treatment (X), and posttest (O_2) (Sugiyono, 2022). Study implemented in the even semester Year 2025/2026 Academic Year at SDN Rejosari 03, Semarang City. Population study is all over student class V consisting of 19 students. The sampling technique sample using saturated sampling, namely technique determination sample if all over member population made into sample research (Sugiyono, 2023). Procedure study started with administering a pretest for know ability beginning students. Next, participants educate follow learning using the Problem Based Learning (PBL) model assisted by Liveworksheets media which is implemented in accordance PBL syntax, namely problem-oriented, organizing participant educate, guide research, develop and present results works, as well as analyze and evaluate the problem-solving process problem (Syamidah & Hamidah Suryani, 2018). After learning finished, students given a posttest for know change results Study after get treatment.

Data collection techniques include tests, observations, interviews, questionnaires, and documentation. Instruments test in the form of question choice double used for measure results Study cognitive student through pretest and posttest. Observation sheet used for observe teacher and student activities during the learning process, interviews done with the fifth-grade teacher for get information about condition learning, whereas questionnaire used for know response student to application of the PBL model assisted by Liveworksheets media. Before used, instruments test has through validity, reliability, level tests difficulty, and power differentiator to meet criteria good instrument (Arikunto, 2013). Data analysis was carried out in a way descriptive and inferential analysis descriptive used for describe results learning, completion learning and response students. Prerequisite test done using the Shapiro-Wilk normality test. Because the posttest data did not normally distribute, testing hypothesis using the Wilcoxon Signed Rank Test at the level significance of 5%. Furthermore, the increase results Study analyzed using the N-Gain test for know level effectiveness application of the Problem Based Learning model assisted by Liveworksheets media to results learning science material ecosystem.

Figure 1. Research Flow Effectiveness of Assisted Problem Based Learning (PBL) Model Liveworksheets Media on Learning Outcomes



3. FINDINGS AND DISCUSSION

Findings

This research was conducted on fifth grade students of SDN Rejosari 03 Semarang City with a total of 19 subjects. The science learning provided focused on ecosystem and food chain materials using the *Problem Based Learning* (PBL) model assisted by *Liveworksheets media*. The learning implementation consisted of preliminary activities, core activities, and closing activities. In the preliminary activities, the teacher opened the learning, conducted apperception through questions related to the surrounding environment, then gave a *pretest* to determine students' initial abilities. In the core activities, learning was carried out based on PBL syntax. The teacher presented problems related to ecosystems and food chains, then students identified problems through images, videos, and interactive activities on *Liveworksheets*. Students were divided into groups to discuss problem solving and work on activities on *Liveworksheets*, such as choosing answers, matching images, drag and drop, and answering questions based on the results of observations and discussions. The teacher guided students in understanding biotic and abiotic components, relationships between living things, food chains, and food webs. After that, each group presented the results of the discussion and other groups provided responses. The teacher provided reinforcement and clarification of the results presented by students. In the closing activity, teachers and students conclude the material, reflect, and provide opportunities for students to convey their impressions of learning using *Liveworksheets*. Next, students are given a posttest to find out learning outcomes after taking part in learning using PBL with the help of *Liveworksheets*.

Study This aim for know the effectiveness of the *Problem Based Learning* (PBL) model assisted by *Liveworksheets media* to results learning science material ecosystem student Class V of SDN Rejosari 03, Semarang City. Data on results Study obtained through pretest and posttest given to 19 students before and after application of the learning model in figure 2:

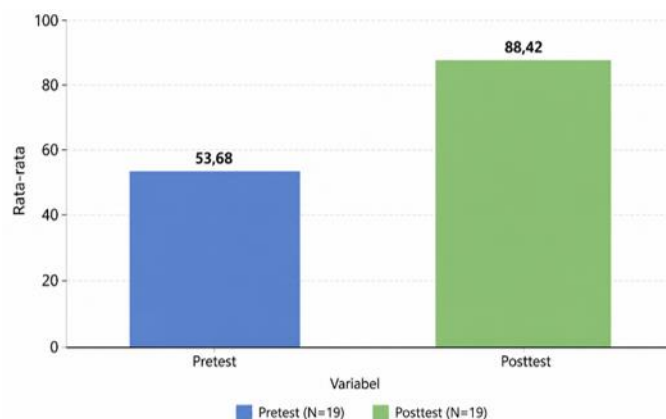


Figure 1. Learning Outcome Data

The results showed that the average student score increased from 53.68 in the pretest to 88.42 in the posttest. This improvement indicates that after participating in learning using the PBL model assisted by *Liveworksheets media*, students' ability to understand ecosystem material improved compared to before being given the treatment.

Before hypothesis testing, the data were first tested for normality using the Shapiro-Wilk test. The analysis showed that the pretest data were normally distributed, while the posttest data were not normally distributed because the significance value was less than 0.05. Therefore, hypothesis testing was continued using the *Wilcoxon Signed Rank Test* as shown in Table 1 below:

Table 1. Wilcoxon Test Results

Test Statistics ^a	
	POSTTETS - PRETEST
Z	-3.850 ^b
Asymp. Sig. (2-tailed)	<.001

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

The Wilcoxon test results show an Asymp. Sig. (2-tailed) value of 0.001, which is smaller than the significance level of 0.05. These results indicate that there is a significant difference between the pretest and posttest scores. Thus, the research hypothesis is accepted, so that the PBL model assisted by *Liveworksheets media* has been proven to have an effect on the science learning outcomes of fifth-grade students at SDN Rejosari 03, Semarang City.

The increase in learning outcomes is then analyzed using the N-Gain test. The calculation results show an average N-Gain value of 0.7414 which is included in the high category, with a minimum value of 0.25 and a maximum value of 1.00. This value shows an increase in students' abilities after learning using PBL with the help of *Liveworksheets*.

Table 2. N-Gain Test Results

Statistics	Mark
N	19
Mean	0.7414
Minimum	0.25
Maximum	1.00

These results indicate that the applied learning model improved student learning outcomes. This improvement occurred because students were given the opportunity to learn actively, work collaboratively in groups, and solve problems related to everyday life. Through these activities, students not only memorized concepts but also understood the relationships between concepts in the ecosystem's material.

The learning outcome completion refers to the KKTP of 75. Classical completion is declared achieved if the percentage of students achieving completion is at least 75%. The following is the student learning outcome completion in Table 3:

Table 3. Learning Outcomes Completion

Criteria	Pretest	Posttest
Completed	1	16
Not finished	18	3

The results showed that in the pretest, only 1 student (5.2%) achieved mastery, while 18 students (94.8%) had not yet achieved mastery. After treatment, the number of students achieving mastery increased to 16 students (84.2%), while 3 students had not yet achieved mastery. Thus, the classical learning mastery in the posttest had reached the established criteria.

A response questionnaire was administered to 19 students after the lesson was completed. The questionnaire was used to determine student responses to the lesson, including interest, ease of use of the media, and understanding of the material. The analysis showed an average student response of 74.2105, with a percentage of 93%, categorized as very good.

Table 4. Student Response Questionnaire Results

Aspect	Results
N	19
Average	74.02105
Presentation	93%
Category	Very good

Very good response show that student give response positive to assisted PBL implementation *Liveworksheets*. Students feel learning more interesting, easy understandable, and enjoyable. The use of interactive digital media also makes student more motivated for follow activity learning and participating in the learning process.

Discussion

Based on experiment instructional to student's class V SDN Rejosari 03 Semarang City, average mark results Study cognitive science at the stage *pretest* recorded of 53.68, then experience improvement

significant to 88.42 on the posttest after Treatment of the Problem-Based Learning (PBL) model assisted by *Liveworksheets* media. Findings This indicates that integration of learning models-based problem with digital media capable restructure understanding cognitive student in a way in-depth, facilitating transformation from understanding limited conceptual going to mastery material comprehensive ecosystem. Improvement progressive average score This in line with study by (Rati et al., 2023), which confirms that accumulation of assisted PBL models *Liveworksheets* give impact substantial to results study science at school base through involvement active student in invention draft. Transformation understanding This happen Because presentation problem contextual demand student for do processing information level tall in a way independent. Intensive mental involvement during the reconstruction process knowledge the proven strengthen retention memory term long student to the material being studied. In addition, the transition from learning passive going to exploration independent clarify that limitations conceptual beginning can overcome in a way effective through approach adaptive instructional.

Quantitative data furthermore show improvement exponential in proportion completeness Study classical students, where at the stage at the beginning (pretest) only 1 student (5.2%) completed it and 18 students (94.8%) had not. completed, while post-treatment (posttest) level The completion rate (KKTP ≥ 75) jumped to 16 students (84.2%), leaving 3 students (15.8%) who had not yet reached the criteria. This phenomenon indicates that there is synergy between the PBL and *Liveworksheets* models. effective minimize gap achievements studying in class as well as help majority student exceed the threshold graduation in a way evenly through learning student - centered. In theoretical, completeness classical This support (Agung Wijaya & Muchlis, 2026) argument which states that results Study post-treatment is indicator main success instructional, where the implementation of innovative models potential increase effectiveness learning in a way significant compared to approach conventional. Decline drastic amount students who do not complete signify that this combination of strategies capable embrace various style Study heterogeneous students within class. Interactive media support provides adequate scaffolding for student achieve low for chase backwardness understanding they. This result validates that climate inclusive and responsive learning can formed in a way consistent through design learning-based problem.

Analysis results inferential use *Wilcoxon Signed Rank Test* produce mark *Asymp. Sig. (2-tailed)* of 0.001, which is below significance threshold of 0.05. Statistical output the in a way empirical confirm difference significant on the results learning science material ecosystem between before and after intervention, so that hypothesis null (H_0) is rejected and the working hypothesis (H_a) is accepted. The validity of this test is in line with with (Milliniawati & Isnaeni, 2023) research's, which proves that the integration of the PBL model with interactive LKPD has a real influence on improving critical thinking skills and cognitive achievement student school base. Rejection H_0 strengthen certainty statistics that change the score that occurred is not results from as it happens or factor outside that is not controlled. Non- parametric testing This selected Because capable give estimate difference precise quantitative analysis of the distribution of data that is not normally distributed. With Thus, the internal validity of treatment learning This can accountable in a way scientific in context research education.

Efficiency level improvement results Study student Class V of SDN Rejosari 03 was measured more carry-on use N-Gain analysis, which yielded an average of 0.7414, with mark the smallest is 0.25 and the value highest 1.00. The N-Gain achievement enters in category high, which reflects level effectiveness strong from assisted PBL intervention *Liveworksheets* in optimize understanding student from condition beginning until condition end. The height effectiveness This relevant with findings, which conclude that e-LKPD is based on Integrated *liveworksheets* to in PBL syntax has practicality as well as effectiveness high (N-Gain 0.73) in increase understanding science student (Maha & Manalu, 2025). Range N-Gain score of minimum value up to maximum reflect existence variation rate growth cognitive between individuals within class. Recapitulate achievements in category tall prove that treatment given give Power push development optimal knowledge in overall. Therefore, that is, the amount of gain obtained confirm efficiency of the model in cut deficit knowledge beginning student.

Qualitative data analysis from questionnaire response student post-learning shows average percentage by 93% with "Very Good" qualification. Findings This indicates that integration technology in interactive LKPD capable grow motivation Study intrinsic and extrinsic, at the same time reduce boredom consequence domination method expository One direction previously. The height response positive This in line with mandate Minister of Education, Culture, Research and Technology Regulation Number 12 of 2024 and the Minister of Elementary and Secondary Education Regulation Number 13 of 2025, which emphasizes importance organization interactive, inspiring, fun, and instructional needs - oriented participant Education (Peraturan Menteri Pendidikan, Kebudayaan, Riset, Dan Teknologi Nomor 12 Tahun 2024, 2024) and (Peraturan Menteri Pendidikan Dasar Dan Menengah Nomor 13 Tahun 2025, 2025)..High enthusiasm from participant educate contribute direct to creation atmosphere conducive class For exploration academic . Sense of attachment active (engaged) students during the learning process become lighter main in maintain focus attention they. The implication, the high motivation This No only impact on climate class, but also reflected real in achievement mark high cognitive.

Implementation all over assisted PBL model syntax *Liveworksheets* start from orientation problem contextual until stage analysis and evaluation solution problem ecosystem proven effective transform position student become subject active learning. Implementation syntax This show that digital features such as matching images and filling short on *Liveworksheets* make things easier student visualize interaction comparative between component biotic-abiotic as well as chain food that is abstract. Relevance findings This reinforced by opinion (Qodri et al., 2026) and (Nabila Syarifah et al., 2025), which states that the interactive problem-based learning model assisted by LKPD is proven to be effective in facilitating students' critical, creative, and collaborative thinking skills in solving concrete problems. Change's role student becomes agent active in learning push formation independence think moment formulate solution on problem ecosystem presented. Visualization concrete through digital media successfully bridges limitations stages development cognitive student school the basis that is still is in phase operational concretely. In overall, success execution syntax This confirm importance harmonious instructional media design with systematics of the selected learning model.

4. CONCLUSION

Based on the research results, the application of the Problem Based Learning (PBL) model assisted by Liveworksheets media has proven effective on the learning outcomes of fifth-grade students of SDN Rejosari 03 Semarang City in the subject of ecosystems. This effectiveness is shown by the increase in the average student score from 53.68 in the pretest to 88.42 in the posttest. The results of the Wilcoxon Signed Rank Test obtained an Asymp. Sig. (2-tailed) value of 0.001 (<0.05) which indicates a significant difference in learning outcomes before and after treatment. In addition, the results of the N-Gain test of 0.7414 are included in the high category, which indicates that the increase in learning outcomes is at a high level of effectiveness. Student responses to learning also obtained a percentage of 93% with a very good category. Thus, the Problem Based Learning (PBL) model assisted by Liveworksheets media can be used as an effective learning alternative to improve learning outcomes of the subject of ecosystems in elementary schools.

REFERENCES

- Agung Wijaya, & Muchlis, M. (2026). Effectiveness of the Detective Game of Chemistry Media on Students Learning Outcomes in Green Chemistry Material. *UNESA Journal of Chemical Education*, 15(2), 136–145. <https://doi.org/10.26740/ujced.v15n2.p136-145>
- Ardinita, M., Nurhasanah, & Andhika, I. P. H. W. (2026). Pengaruh Model Pembelajaran Problem Based Learning Berbantuan LKPD Interaktif terhadap Hasil Belajar IPAS Siswa Kelas III SDN 15 Cakranegara. *Jurnal Pendidikan, Sains, Geologi, Dan Geofisika (GeoScienceEd Journal)*, 7(3 SE-Articles), 2822–2829. <https://doi.org/10.29303/goescienceed.v7i3.2335>
- Azzahra, I. E., Nurhasanah, A., & Hermawati, E. (2023). Implementasi Kurikulum Merdeka Pada

- Pembelajaran IPAS. *Jurnal Ilmiah PGSD. Jurnal Ilmiah PGSD Universitas Mandiri*, 9(2).
- Dwiyanti, N. K. E. M., Rati, N. W., & Lestari, L. P. S. (2023). Dampak Model Problem Based Learning Berbantuan Liveworksheet Terhadap Hasil Belajar IPA Siswa Kelas V SD. *Jurnal Ilmiah Pendidikan Dan Pembelajaran*, 7(2 SE-Articles), 285–294. <https://doi.org/10.23887/jipp.v7i2.60494>
- Fitri, D., Cahyadi, F., & Subekti, E. E. (2025). Analisis Kebutuhan Media Pembelajaran Matematika Kelas Iv Mengacu Pada Buku Guru Dan Buku Siswa. *Jurnal Wawasan Pendidikan*, 5(2), 753–766.
- Hayudinna, H. G., & Muzkiyah, A. (2024). Analisis Kemampuan Bernalar Kritis pada Pembelajaran Ilmu Pendidikan Alam dan Sosial (IPAS) dalam Kurikulum Merdeka di Sekolah Dasar. *Jurnal Basicedu*, 8(3 SE-Articles), 2438–2447. <https://doi.org/10.31004/basicedu.v8i3.7825>
- Jauhari, S. F., Purnamasari, V., & Purwaningrum, M. R. (2024). Pengaruh Model Problem Based Learning berbantuan Media Audio Visual terhadap Hasil Belajar IPAS. *Jurnal Inovasi, Evaluasi Dan Pengembangan Pembelajaran (JIEPP)*, 4(1 SE-Articles), 36–43. <https://doi.org/10.54371/jiepp.v4i1.391>
- Peraturan Menteri Pendidikan, Kebudayaan, Riset, dan Teknologi Nomor 12 Tahun 2024, (2024).
- Lestari, R., Jasiah, J., Rizal, S. U., & Syar, N. I. (2023). Pengembangan Media Berbasis Video pada Pembelajaran IPAS Materi Permasalahan Lingkungan di Kelas V SD. *Jurnal Holistika*, 7(1), 34. <https://doi.org/10.24853/holistika.7.1.34-43>
- Maha, D. B., & Manalu, K. (2025). Pengembangan E-LKPD Berbasis Problem Based Learning (PBL) dalam Meningkatkan Keterampilan Berpikir Kritis Pada Materi Sistem Peredaran Darah Kelas XI IPA di SMA Negeri 1 Lau Baleng. *Bioscientist : Jurnal Ilmiah Biologi*, 13(3 SE-Articles), 2111–2123. <https://doi.org/10.33394/bioscientist.v13i3.17575>
- Marhento, G. (2020). Prosiding Seminar Nasional Sains Model Pembelajaran POE (Predict Observe Explain) Solusi Alternatif Meningkatkan Hasil Belajar Ilmu Pengetahuan Alam. *Prosiding Seminar Nasional Sains*, 1(1)(1), 267–272.
- Marwan, Vebrianto, R., Aramudin, & Radeswandri. (2025). ANALISIS KESULITAN SISWA PADA MATERI EKOSISTEM MAKHLUK HIDUP DALAM PEMBELAJARAN IPA MUATAN IPAS KELAS V SD BABUSSALAM KOTA PEKANBARU. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, 10(2), 500–510.
- Peraturan Menteri Pendidikan Dasar dan Menengah Nomor 13 Tahun 2025, (2025).
- Milliniawati, S., & Isnaeni, W. (2023). Critical Thinking Ability, Cognitive Learning Outcomes, and Student Learning Activities in Excretion System Learning Using PBL-Based E-LKPD. *Journal of Biology Education*, 12(1), 43–52. <https://doi.org/10.15294/jbe.v12i1.61050>
- Nabila Syarifah, Moh. Affaf, & Dwi Ivayana Sari. (2025). Development of Canva-Based Interactive Student Worksheets Using the Problem-Based Learning Model. *Journal of Practice Learning and Educational Development*, 5(3 SE-Articles), 939–948. <https://doi.org/10.58737/jpled.v5i3.517>
- Putri, D. M., Syam, S. S., Ahmad, S., & Masniladevi. (2026). PENGEMBANGAN E-LKPD BERBASIS PROBLEM BASED LEARNING MENGGUNAKAN LIVEWORKSHEETS PADA ELEMEN PENGUKURAN PEMBELAJARAN MATEMATIKA DI KELAS IV SEKOLAH DASAR. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, 11(2), 213–227.
- Qodri, L. L., Erita, Y., Zahara, L., & Rayendra, R. (2026). Development of Problem Based Learning-Based Student Worksheets to Improve 4C Skills in Science Learning in Elementary Schools. *Jurnal Penelitian Pendidikan IPA*, 12(1 SE-Research Articles), 978–990. <https://doi.org/10.29303/jppipa.v12i1.13475>
- Rati, N. W., Arnyana, I. B. P., Dantes, G. R., & Dantes, N. (2023). HOTS-Oriented e-Project-Based Learning: Improving 4C Skills and Science Learning Outcome of Elementary School Students. *International Journal of Information and Education Technology*, 13(6), 959–968. <https://doi.org/10.18178/ijiet.2023.13.6.1892>
- Ratno, S., Fadillah, S., Ramadani, Situmeang, E., Azzahrawani, F., Pos, M. P., Sagala, P. V., & Naibaho, R. Y. (2024). Analisis Implementasi Problem Based Learning (PBL) Berbasis Hots Untuk Meningkatkan Berfikir Kreatif Siswa Dalam Pembelajaran IPAS Di SDN 060874 Medan. *Jurnal Intelek Dan Cendekiawan Nusantara*, 1(6 SE-Articles), 9183–9191.

<https://jicnusantara.com/index.php/jicn/article/view/1674>

Rozaton, N., Elisa, Wahyuni, A., Saputri, M., & Hamid, A. (2024). PENGARUH MODEL PEMBELAJARAN PBL BERBANTUAN LIVEWORKSHEET TERHADAP KEMAMPUAN BERPIKIR KRITIS SISWA SMA. *RELATIVITAS: Jurnal Riset Inovasi Pembelajaran Fisika*, 2(2), 306–312.

Sugiyono. (2023). *Metode penelitian kuantitatif, kualitatif dan R&D*. Alfabeta.