

JPPIPA 11(2) (2025)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education



http://jppipa.unram.ac.id/index.php/jppipa/index

The Use of the PBL (Problem Based Learning) Model in the Material of Matter and Object Form to Improve Critical Thinking Skills and Student Learning Outcomes

Alamha^{1*}, Sukendro¹, Indryani¹

¹Teacher Training and Education, Master of Elementary Education, University of Jambi, Jambi, Indonesia.

Received: June 09, 2024 Revised: October 23, 2024 Accepted: February 25, 2025 Published: February 28, 2025

Corresponding Author: Alamha alamhaps13@gmai.com

DOI: 10.29303/jppipa.v11i2.9512

© 2025 The Authors. This open access article is distributed under a (CC-BY License)

Abstract: PBL (Problem-Based Learning) teaching with problem-based skills is effective for improving learning through critical thinking activities and enhancing learning outcomes. Critical thinking is logical and reflective thinking that focuses on deciding what should be believed or done. This study is classroom action research aimed at improving students' critical thinking skills and learning outcomes by using the PBL (Problem Based Learning) model in the material of matter and its states. Data were collected using observation sheets and evaluation questions at the end of each cycle. Critical thinking skills data were obtained by summing all scores across 5 indicators, dividing by the total maximum score, then multiplying by 100. The score obtained was 49, which met the criteria for sufficient critical thinking in cycle I, and increased to 63, meeting the criteria for critical thinking in cycle II. The percentage of learning mastery increased from 11% in the pre-cycle to 66.7% in cycle I, and further increased to 83% in cycle II. This proves that the use of PBL (Problem Based Learning) can enhance students' critical thinking skills and learning outcomes.

Keywords: Critical thinking skills; Learning outcomes; PBL (Problem Based Learning).

Introduction

Education is an essential aspect of the educational world, both for individuals and for all of humanity. Through education, it is hoped that changes can occur in an individual. In the present day, conventional teaching models result in learning activities that are quite ordinary. Traditional teaching methods often cause students to feel bored, which is why a change in the way education is delivered is necessary. In elementary school, a teaching model must provide effective and proper learning, one of which is implementing a problem-based learning model, such as the PBL (Problem-Based Learning) model. The problem-based learning model teaches students to collaborate with others in solving problems (Afelia et al., 2023). In the PBL model, problems presented by the teacher are analyzed by students in groups, allowing students to be trained to collaborate in problem-solving and develop their critical thinking skills. This model encourages students to work together in group activities to solve real-world problems because PBL emphasizes student-centered learning. This aligns with the opinion of (Sakti & Luthfiyah, 2024), which states that the application of problem-based learning methods can build student participation in learning and improve students' learning outcomes through this method.

Moreover, the problem-based learning method (PBL) facilitates critical thinking in learning activities, especially in IPAS (Science and Social Studies) subjects, to improve learning outcomes. IPAS is a process that

How to Cite:

Alamha, Sukendro, & Indryani. (2025). The Use of the PBL (Problem Based Learning) Model in the Material of Matter and Object Form to Improve Critical Thinking Skills and Student Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, 11(2), 425–430. https://doi.org/10.29303/jppipa.v11i2.9512

uses various methods to conduct scientific investigations and produce IPAS products. Sakti & Luthfiyah (2024) state that research using the PBL approach can improve students' learning outcomes. Additionally, in their research, Afelia et al. (2023) also highlight improvements in learning when using the PBL model.

PBL (Problem-Based Learning) teaching with problem-based skills is effective for improving learning through critical thinking activities and enhancing learning outcomes. Critical thinking is logical and reflective thinking that focuses on deciding what should be believed or done (Alfajri et al., 2023). According to Roviati & Widodo (2019), critical thinking involves skilled and active interpretation and evaluation of observations and communication, information, and arguments. Critical thinking skills, according to Hermawan (2018), are identified in five categories: 1) Basic clarification, 2) Basic support, 3) Drawing conclusions, 4) Advanced clarification, and 5) Strategies and tactics. These categories have been elaborated into specific indicators: 1) Clarifying basic points, 2) Assessing basic support, 3) Drawing conclusions, 4) Making advanced clarifications, and 5) Applying strategies and tactics to solve problems. Critical thinking is skilled and active interpretation and evaluation of observations, communication, information, and arguments (Yanti, 2020).

Based on the researcher's findings, most students struggle to understand and remember material about matter and its states. When faced with new contextual problems that differ from the examples given, students are unable or slow to understand, recall, and find the correct solutions, often providing incorrect answers and attributing it to the difficulty of the questions. Most students are less active and lack critical thinking in the material on matter and its states. This is evident in the daily test results, where the average score for students in the IPAS (Science and Social Studies) subject is below 70, or below the minimum passing grade (KKM), especially in the material on matter and its states. The formative average score was only 63. Out of 28 students, only 11 students (39%) scored 70 or above, while the remaining 17 students (61%) scored below 70. Furthermore, 7 students (25%) scored below 50, which is concerning. The solution to this issue in the 4th-grade class at SD Negeri 2 Banyu Lencir is to implement an appropriate method for the material on matter and its states that encourages students to actively participate in the learning process. According to Halifah (2020), using the right method is expected to enhance students' critical thinking skills in solving problems, which will improve their learning outcomes.

Problem-Based Learning (PBL) is an approach that uses real-world problems as a context for students to learn critical thinking and problem-solving skills, as well as to acquire essential knowledge and concepts from the subject material (Burhana et al., 2021). According to Agus et al. (2022), the PBL model encourages students to learn how to work together in groups to find solutions to real-world problems. Based on the issues above, the researcher is interested in conducting research on efforts to improve critical thinking skills and learning outcomes for the material on matter and its states using the PBL (Problem-Based Learning) model in the 4th-grade students of SDN 2 Bayung Lencir.

Method

This research uses a Classroom Action Research (CAR) design. According to Kiska et al. (2024), Classroom Action Research is research conducted by educators or prospective educators in their own classrooms collaboratively/participatively to improve educator performance in terms of the quality of the learning process and enhance student learning outcomes, both academically and non-academically, through reflective actions in the form of cycles (recycling). This study uses the PBL (Problem-Based Learning) method to improve critical thinking skills and learning outcomes of students on the material of matter and its states. The Classroom Action Research design follows the Kemmis and Taggart model, as outlined by Arikunto, consisting of planning, implementation, observation, and reflection.

This Classroom Action Research was conducted at SDN 2 Bayung Lencir, Bayung Lencir Subdistrict, Musi Banyuasin Regency, South Sumatra Province. The research was carried out in the 4th grade on the material of matter and its states in the first semester of the 2024/2025 school year. Among the two classes in 4th grade, namely class A and B, the main subjects of this research are the 27 students of class IV.A SDN 2 Bayung Lencir, consisting of 15 female students and 12 male students, with varying backgrounds and abilities.

Data collection techniques are crucial steps in research aimed at obtaining both qualitative and quantitative data. Quantitative data are data in the form of numbers and are analyzed using statistics based on the results of evaluations conducted after the learning sessions, processed using descriptive percentage techniques (Syahrial et al., 2022). The scores are analyzed based on student achievement, including the highest and lowest scores, total scores, average class scores, and learning completion. Qualitative data, on the other hand, are collected in a more descriptive and qualitative manner, obtained from the researcher's observations of students during the learning activities and from the observer's notes during the learning process. The qualitative data are analyzed using descriptive 426 percentages and categorized (Zulkhi et al., 2024). The data analysis technique used in this research involves testing student learning outcomes. Data collection is done using tests, observations, interviews, and documentation.

Results and Discussion

Results of Cycle I Research

Based on observations and interviews at SD Negeri 2 Banyu Lencir, initial condition data were found as follows: 1) the learning process appeared to be one-way and teacher-centered, 2) during the learning activities, the teacher used only one method, which was the lecture method, and did not develop other methods that encourage students to actively participate in learning, 3) looking at how students worked on the questions, students still had difficulty analyzing and solving the problems presented in the questions, meaning their critical thinking skills were not yet at a sufficiently critical or advanced level, 4) the students' learning outcomes were lacking, as evidenced by the low student completion rate in the final test, which was only 11%. This percentage is far below the success indicator of 75%. To improve students' learning outcomes, the researcher conducted Classroom Action Research. This research, using the PBL (Problem-Based Learning) method, is expected to improve students' critical thinking skills and learning outcomes in the material of matter and its states.

The planning activity began with the development of a teaching module for two cycles, with each cycle consisting of three meetings. In the implementation of Cycle I, during meetings 1, 2, and 3, the teacher began the lesson by greeting the students, leading them in a prayer, and taking attendance. This was followed by an activity to assess students' prior knowledge of the material that would be taught. The teacher then explained the learning objectives and goals to be achieved in each meeting. The teacher also explained the classroom rules, such as raising hands before asking questions or expressing opinions.

The teacher then began presenting the material by showing students several example images. Students were invited to discuss the activities in the pictures, determining whether they reflected living in harmony or not. Students were then asked to summarize the definition of matter and its states and provide examples of matter and its states in their surroundings. The teacher then explained the learning activities that would be carried out. The teacher chose and assigned students to form learning groups and guided them through the learning activities. The teacher also assisted students who had difficulty with their learning activities. When the problem-based activity reached its climax, the teacher paused the lesson and asked the students to discuss the course of the learning activities related to matter and its changes. At the end of the lesson, the teacher and students reflected on the day's learning. On the third day, the core learning activity was used as an evaluation through a written test.

After completing Cycle I, a reflection was held to assess the strengths and weaknesses that occurred during Cycle I, based on the results of observations of the teacher's activities conducted by an observer. This activity aimed to find solutions to the shortcomings that occurred during Cycle I and address them in Cycle II. The shortcomings in Cycle I were as follows: 1) Lack of time management by the teacher, which caused one stage to be missed in the third meeting, namely discussing the questions that students found difficult, 2) Some students did not follow the rules in class, such as walking around while other students were at the front of the class, 3) The students' learning completion in Cycle I was 66.7%, which was an improvement compared to the completion rate before the action was implemented, which was 11%. However, the learning outcomes of Cycle I did not meet the success indicator of 75% of students completing the learning, so a Cycle II is necessary. Similarly, the critical thinking results did not meet the expected indicators. The results are as follows:

Table 1. Data from Observation of Students' CriticalThinking Skills in Cycle I

Indicator	Cycle I	Category
Analyzing definitions	40	Less
		critical
Assessing behaviors that are	61	Critical
already or not yet reflected		
in a person's attitude.		
Drawing conclusions about	42	Quite critical
the changes in matter and		
how the state of matter		
changes.		
Identifying how matter and	64	Critical
its states can change.		
Evaluating by providing	38	Less
suggestions		critical
Overall average	49	Quite
		critical

Cycle II

After analyzing the results of Cycle I, several solutions were implemented to improve the learning process in Cycle II: 1). Improving the teacher's time management by allocating time for answering evaluation questions and still collecting the students' work sheets after the time has ended. 2). Improving the existing rules by engaging students in a discussion about the rules to be followed during the learning process, along with consequences for violations. 3). Improving

students' learning outcomes by continuing to Cycle II to achieve learning results that meet the success indicators. Based on the solutions, changes were made in the implementation of Cycle II, but with the same learning syntax as in Cycle I.

By providing more motivation to the students, they became more active in answering during the discussion. Students also became more active in analyzing definitions, sharing, and helping each other. Students were able to explain the definitions of matter and its states and changes using their own words. By sharing, students appeared more orderly in expressing their opinions because classroom rules had been improved in Cycle II. Students also began to evaluate the material on matter and its changes, as well as the learning process itself. Some students were even able to provide suggestions to their peers who were participating in role-playing activities. The students' learning completion in Cycle II was 83%, an increase from 66.7% in Cycle I. Meanwhile, critical thinking skills improved to a score of 63, which falls under the "critical" category.

Data on students' critical thinking skills were obtained from the observations conducted by the observer using the critical thinking activity sheet. The observation sheet consisted of five indicators based on several experts, which are: 1) Analyzing definitions, 2) Assessing behaviors that have or have not yet understood matter and its changes, 3) Drawing conclusions about the changes in matter and its states in everyday life, 4) Identifying examples of how the states of matter change, and 5) Evaluating by providing suggestions. The data were obtained by dividing the total score of the critical thinking skill indicators by the maximum possible score and then multiplying by 100. Below is the table of students' critical thinking skills.

Table 2. Data from Observation of Students' CriticalThinking Skills in Cycle II

Indicator	Cycle II	Categoyi
Analyzing definitions	57	Quite critical
Assessing behaviors that	75	Critical
have or have not yet		
understood matter and its		
changes		
Drawing conclusions about	61	Critical
the changes in matter and its		
states in everyday life		
Identifying examples of how	72	Critical
the states of matter change		
Evaluating by providing	50	Quite critical
suggestions		
Overall average	63	Critical

Based on the results of the research and discussion, the conclusion of this study is as follows: The application of the PBL (Problem Based Learning) learning model can improve critical thinking skills and learning outcomes of students in the material of matter and its states in the IPAS learning for grade IV at SD Negeri 02 Banyu Lincir. Below is the summary of critical thinking results from Cycle I and Cycle II as a whole.

Table '	3 Data fro	om Ohser	vation of 9	Students' (Critical	Thinking	Skills in	Cycle	I and (vcle II
I avic .	J. Data II	JIII ODSEI	valion or c	nuuems v	Cincar	TIMIKING	JAIIIS III		$1 and \sqrt{1}$	

Indicator	Cycle I	Category	Cycles II	Cetegory
Analyzing definitions	40	Less critical	57	Quite critical
Assessing behaviors that have or have not yet	61	Critical	75	Critical
understood matter and its changes.				
Drawing conclusions about the changes in	42	Quite critical	61	Critical
matter and its states in everyday life.				
Identifying examples of how the states of	64	Critical	72	Critical
matter change.				
Evaluating by providing suggestions	38	Less critical	50	Quite critical
Overall average	49	Quite critical	63	Critical

On the indicator of identifying examples of a person's behavior and comparing opposing behaviors, there was also an increase from a score of 64 in cycle I to 72 in cycle II, with the category remaining "critical." In the final indicator, "evaluating by giving suggestions," there was an improvement from a score of 38 with a "less critical" category in cycle I to 50 with a "sufficiently critical" category in cycle II. Overall, the average score for each indicator also improved from a score of 49 with

a "sufficiently critical" category in cycle I to a score of 63 with a "critical" category in cycle II.

As for the students' learning outcomes, these were obtained from the evaluation scores at the end of each cycle. Data on the students' learning outcomes in the pre-cycle was taken from the test scores before any classroom actions were implemented. Below is a comparison of student learning outcomes in the precycle, cycle I, and cycle II.

Learning Mastery	KKM		Pre-Cycle		Cycle I		Cycle II	
		F	Percentage	F	Percentage	F	Percentage	
Completed	≥75	2	11	12	66.7	15	83.3	
Not Completed	<75	16	89	6	33.3	5	16.7	
Total		18	100	16	100	18	100	

Based on the table above, it can be seen that there was an improvement in the indicator of analyzing definitions, which initially in cycle I was 40 with a "less critical" category, increasing to 57 with a "sufficiently critical" category in cycle II. In the second indicator, assessing behaviors that have or have not been reflected in a person's attitude, there was also an increase from a score of 61 to 75, with the "critical" category. From the table above, it can also be observed that the learning outcomes of the students in the matter and states of matter before the actions were implemented showed that 2 students (11%) were declared to have completed, and 16 students (89%) were declared incomplete. After the actions were taken, the learning outcomes for the students in grade IV SD Negeri 2 Banyu Lencir improved, with 12 students (66.7%) completing and 6 students (33.3%) remaining incomplete. After the implementation of cycle II, 15 students (83.3%) were declared completed and 3 students (16.7%) remained incomplete.

This is supported by previous research from (Pujiastuti, 2023), where it was demonstrated that the learning percentage reached 95% with the PBL method for learning outcomes. The same research conducted by (Wulandari et al., 2020) also showed that PBL learning activities enhanced learning outcomes and improved students' critical thinking skills, as evidenced by the T-test result with a significance of 0.00 < 0.05.

Based on the data analysis presented in the research findings, it is clear that the PBL (Problem Based Learning) method can improve critical thinking skills and learning outcomes for students in grade IV at SD Negeri 2 Banyu Lencir in the material of matter and states of matter. This success is evident from the comparison of IPAS scores in the pre-cycle, cycle I, and cycle II, where there was an increase from a score of 42 with a "sufficiently critical" category in the first cycle.

Conclusion

Based on the research results and discussion, it can be concluded that the use of the PBL (Problem Based Learning) method in the material of matter and states of matter can improve critical thinking skills and learning outcomes of grade IV students at SD Negeri 2 Banyu Lencir. The improvement in students' critical thinking skills also impacts their learning outcomes. As students' ability to analyze and solve the problems given increases, their learning outcomes also improve.

Acknowledgments

I would like to express my gratitude to everyone who has been involved in this research, both from the educational institutions, my university (Universitas Jambi), and my workplace. I would also like to thank my two supervising lecturers, Prof. Dr. Drs. Sukendro, M.Kes AIFO, and Dr. Indryani, M.Pd. My heartfelt thanks also go to my parents, family, and friends who have supported me with their prayers and encouragement.

Author Contributions

The research team contributed to the writing of this scientific work as follows: idea, conception, data collection, analysis and interpretation of results, manuscript preparation (DP); article writing supervision (ZKP and JJ); funding acquisition (DP and ANS).

Funding

Funding for this research comes from the independent funds of each researcher.

Conflicts of Interest

The authors declare that there is no conflict of interest in the publication of this article.

References

- Afelia, Y. D., Prasetyo, A., & Henik, U. (2023). Implementasi Model Problem Based Learning (PBL) Berbasis Pembelajaran Berdiferensiasi untuk Meningkatkan Keterampilan Kolaborasi pada Mata Pelajaran Biologi di Kelas X SMA. Jurnal Biologo, 1(2), 1–11. https://doi.org/10.47134/biology.v1i2.1963
- Agus, J., Agusalim, & Irwan. (2022). Pendidikan Penerapan Model Pembelajaran Problem Based Learning (PBL) untuk Meningkatkan Hasil Belajar Siswa pada Pelajaran IPS Sekolah Dasar. *Edukatif*: *Jurnal Ilmu Pendidikan*, 4(5), 6963–6972. Retrieved from

https://www.edukatif.org/index.php/edukatif/ article/view/3845

Alfajri, A., Sulistyarini, S., & Ulfah, M. (2023). Pengaruh Komunikasi Efektif Terhadap Kemampuan Berpikir Kritis Siswa Pelajaran Ekonomi Sman 2 Sungai Raya. Jurnal Pendidikan Dan Pembelajaran Khatulistiwa (JPPK), 8(3). https://doi.org/10.26418/jppk.v8i3.32271

- Burhana, A., Octavianti, D., Meilinda, L., Anggraheni, R., Ashariyanti, N. D., Ayudha, P., & Mardani, A. (2021). Model Problem Based Learning (PBL) Untuk Meningkatkan Cara Berpikir Kritis Siswa di Sekolah Dasar. Seminar Nasional Hasil Riset Dan Pengabdian Ke-III, 302–307.
- Halifah, S. (2020). Pentingnya Bermain Peran Dalam Proses Pembelajaran Anak. *JISIP (Jurnal Ilmu Sosial Dan Pendidikan)*, 4(3).
- Hermawan, A. (2018). Pengembangan instrumen asesmen berpikir kritis pada pembelajaran tematik Kelas IV sekolah dasar di Kecamatan Tumijajar. UNIVERSITAS LAMPUNG.
- Kiska, N. D., Haryanto, E., & Indryani, I. (2024). Improving Students' Collaboration Skills Using the RADEC Learning Model in Elementary School Science Learning. *Jurnal Pijar Mipa*, 19(2), 240–247. https://doi.org/10.29303/jpm.v19i2.6606
- Pujiastuti, W. (2023). Penerapan Model Pembelajaran Based Learning Problem (PBL) Untuk Meningkatkan Hasil Belajar IPAS (Ilmu Pengetahuan Alam dan Sosial) Pada Siswa Kelas IV SD Negeri Sekardoja Mengenai Perubahan Wujud Zat. Jurnal Penelitian Guru, 2, 56-65. Retrieved from https://journal.fkip.uniku.ac.id/JGuruku/article /view/150
- Roviati, E., & Widodo, A. (2019). Kontribusi argumentasi ilmiah dalam pengembangan keterampilan berpikir kritis. *Titian Ilmu: Jurnal Ilmiah Multi Sciences*, *11*(2). Retreved from https://journal.unuha.ac.id/index.php/JTI/articl e/view/454
- Sakti, N. C., & Luthfiyah, A. (2024). Implementasi Pembelajaran Berdiferensiasi dengan Metode Problem Based Learning (PBL) dalam Meningkatkan Hasil Belajar. Jurnal Ilmiah Profesi Pendidikan, 9(2), 694–698. https://doi.org/10.29303/jipp.v9i2.1935
- Syahrial, S., Asria, A., Sabil, H., Kurniawan, D. A., Perdana, R., & Kiska, N. D. (2022). Development of E-Module Based on the Traditional Puyuh Game on the Cooperation Character and the Tolerance of Elementary School Students. *Journal of Innovation in Educational and Cultural Research*, 3(3), 478–486. https://doi.org/10.46843/jiecr.v3i3.154
- Wulandari, R., Wardhani, S., & Nawawi, S. (2020). Pengaruh Model Problem Based Learning Terhadap Keterampilan Berpikir Kritis Siswa Materi Keanekaragaman Hayati. BEST Journal (Biology Education, Sains and Technology), 3(1), 45– 53. https://doi.org/10.30743/best.v3i1.2435
- Yanti, T. D. (2020). Pengembangan Instrumen Tes Berpikir Kritis pada Materi Kelistrikan Fisika SMA. *Jurnal Abdidas*, 1(2).

Zulkhi, M. D., Kiska, N. D., Lestari, R. E., Ul'hak, D., & Pratiwi, N. Q. E. (2024). Comparative Analysis Of The Use Of Electronic Modules In Ipas Learning To Improve Communication Skills In Students. *In The Third International Conference on Government Education Management and Tourism*, *3*, 033–033. Retrieved from https://conference.loupiasconference.org/index.

php/ICoGEMT-3/article/view/466