



Implementation Of Problem Based Learning Model In 21st Century Learning: Literature Review

Yuliyannah¹, Yosi Gumala², Yohamintin³

^{1,2,3} Elementary School Teacher Study Program, Bhayangkara University of Greater Jakarta, Indonesia

Article Info

Article history:

Received Oct 3, 2024
Revised Dec 22, 2024
Accepted Jan 2, 2025
OnlineFirst Jan 16, 2025

Keywords:

21 st Century Learning
Learning Model
Problem Based Learning
Primary School

ABSTRACT

Purpose of the study: Determine the improvement of the learning process in the 21st century by applying the Problem Based learning model. Learning in elementary school students

Methodology: The learning method used in this scientific work is a literature review or literature review with several stages, namely searching for materials or reference materials on Google Scholar accredited by DOAJ, Sinta, Google Scholar, and so on that are in accordance with the theme to be researched, collecting 30 references that have been obtained

Main Findings: shows that the Problem Based Learning learning learning model is effective in improving the quality of learning at various levels of education, including primary and secondary education

Novelty/Originality of this study: This study uses a literature review by analyzing several previous research results and combining them into one so that it becomes a new discovery

This is an open access article under the [CC BY](https://creativecommons.org/licenses/by/4.0/) license



Corresponding Author:

Yuliyannah,
Elementary School Teacher Study Program, Bhayangkara University of Greater Jakarta,
Jl. Raya Perjuangan No. 81, Marga Mulya Bekasi, Indonesia
Email: yuliyannah6231@gmail.com

1. INTRODUCTION

Education refers to one of the capable ways balancing between understanding to values traditional and ability For adapt with changes of the times [1]. The basics of education that serve as a reference for the implementation of education, starting from the Early Childhood Education stage to the tertiary level, include a learning process that takes place in stages and continuously. Learning is a process that teachers design for guide students so that they get desired knowledge, skills, and attitudes. The role of teachers in learning now shift from a the teacher who gives all answer become a a helpful mentor student Study in a way active. Students are also not Again only accept information , but participate active search and build knowledge together [2].

Along with the development of the times, teachers are asked to be creative and innovative in providing a varied learning process and can stimulate students' curiosity and student activity in the classroom, teachers must understand well the various learning models that are in accordance with the character of students in their class, because in the learning process several problems and obstacles are found, when a teacher is reluctant or lazy in applying a variety of learning models such as: Traditional and monotonous learning processes can make students feel bored and have no enthusiasm for learning, lack of critical thinking skills and problem solving in students can cause them difficulty in dealing with complex problems in real life, lack of awareness of the importance of learning and developing skills that are relevant to real life, lack of awareness of the importance of cooperation and collaboration in the learning process, lack of awareness of the importance of reflection and evaluation in the learning process [3]. Therefore, an effective and efficient learning process is needed to improve student learning outcomes. One of the learning models that is currently widely used is Problem- Based Learning (PBL). Problem

Based Learning is a learning model that focuses on students' learning experiences through solving problems that are relevant to real life[4]

PBL can not only improve students' learning outcomes but also critical thinking skills, problem solving, and collaboration. In addition, PBL also helps students develop critical and creative thinking skills when solving problems [5]. However, there are still some schools that have not implemented the Problem Based model Learning in their learning process. This study discusses Problem Based Implementation Learning (PBL) in the learning process is an approach that involves students in solving real problems as part of their learning activities. This model aims to improve critical thinking skills, creativity, and problem-solving abilities, which in turn can improve deep understanding of concepts.

However, the impact of not implementing the problem based model learning in the learning process can hinder the development of these skills. Without PBL, students may only rely on conventional learning methods that are more passive, so that their ability to think critically, innovate, and solve problems in real-world contexts can be hampered. This can affect the quality of learning and students' readiness to face challenges outside the school environment. Furthermore, the important solution to conducting literature review research in the application of PBL in the learning process is also discussed. This aims to improve the quality of education and improve student learning outcomes.

There are several studies that have been conducted that indicate that the application of the Problem Based learning model Learning (PBL) can improve students' learning outcomes and critical thinking skills. namely: Research conducted by the National Center for Biotechnology The information (NCBI) shows that Problem Based Learning (PBL) can improve student learning outcomes, improve critical thinking and problem solving skills. Research conducted by the University of Southern California showed that PBL can improve student learning outcomes and enhance critical thinking and problem-solving skills, especially in students from low-income families. Research conducted by Michigan State University showed that Problem Based Learning can improve student learning outcomes, improve critical thinking and problem-solving skills, especially for students from low-income families.

Some of the problems that occur in education today are that teachers still apply conventional learning models , for example: Lack of active student participation, low focus on contextual problems, lack of intrinsic motivation, low critical thinking skills , lack of cooperation and interpersonal communication [5]. Based on preliminary research that has been conducted, there are fundamental problems related to the learning process that is currently occurring, and there needs to be a paradigm shift in the learning process that is more effective and efficient. Therefore, this study aims to develop a Problem Based learning model Learning which can improve students' learning outcomes and critical thinking.

This study was carried out using a meta-analysis approach to various studies that examined the effect of PBL on the 21st century ability of elementary school students. The findings indicate that the implementation of PBL not only contributes to improving academic achievement but also develops critical thinking and cooperation skills, with the average pretest score increasing after the implementation of this approach.

2. RESEARCH METHOD

The method used in conducting this scientific work is by using a literature review or literature review. The process of writing this scientific work begins with searching for various sources of previous research, identifying the results of previous research and reviewing previous research with relevant theories according to the research topic to be studied [6]. The steps taken in this research include searching for material or reference materials on Google scholars who are accredited by Sinta and in accordance with the theme to be researched, collect 30 references that have been obtained, read and identify articles that have been selected and are relevant to the research topic, process data that has been obtained from the results of previous literature studies, write valid and reliable conclusions

3. RESULTS AND DISCUSSION

The results of the literature review on the implementation of problem based learning model in 21st century learning can be seen in table 1 below.

Table 1. Article *Review* Results.

No.	Author name	Title	Results
1	Umm aiman & Rizqy amelia ramadhaniyah ahmad [7]	Problem-based learning (PBL) model on the scientific literacy of class v primary school students	The t value obtained from results calculation we (4.30) more tall than specified t value based on table t distribution (2.00) at the level 5% significance . This indicates that the differences that we have observe in study this no happen in

			a way coincidence , but significant in a way statistics .
2	Ichsan, suhaimi [8]	Problem based learning model based learning tpack-based science literacy skills in science learning for elementary to high school students	Problem based learning model tpack-based learning is very relevant to be applied in science materials.
3	Ummu aiman, nyomandantes [9]	The effect of problem-based learning model on scientific literacy and critical thinking of elementary school students	There are differences in critical thinking of students between students who follow the problem-based learning model and students who follow the expository learning model.
4	Delia nurul fauziah [10]	Application of problem based learning model to improve students' learning outcomes in social studies learning in elementary schools	Every stages in the learning process , increasingly lots students who achieve the learning targets set . In particular , at the stage first , 35.3% of students succeed reach the target, then increase to 64.7% at the stage second , and all student successful at stage third
5	English: eko rahmad juniawan, vira hanisa salsabila [11]	Studies Literature: media analysis Science learning to improve students' science literacy	Animated video media has great potential in improving students' scientific literacy skills .
6	Denisa azura, sahrun nisa, ari suriani [12]	Literature study: implementation of model based learning (PBL) to improve elementary school students' mathematical problem solving skills	Based on various studies that have been conducted, it can be concluded that the problem based model learning (PBL) has significant potential in improving students' ability to solve mathematical problems.
7	Adiwiguna [13]	The effect of stem-oriented problem based learning (PBL) model on critical thinking ability and science literacy of grade v elementary school students in group i	Students who study material using the stem-based PBL method show better critical thinking skills compared to students who learn through conventional methods.
8	Novia cahyani putri, Sri budyartati, Lingga nico pradana [14]	Problem based learning model learning about science literacy of grade iv elementary school students	Problem based method learning (PBL) proven effective in improving students' scientific attitudes. This approach makes students more interested in science, more active in seeking information, and have a higher concern for the surrounding environment.
9	Fathiah alatas, Laili fauziah [14]	Problem based model learning to improve scientific literacy skills on the concept of global warming	Before experiment , value beginning the group that gets treatment special (experimental) no spread in a way evenly , whereas group normal (control) spread with regular pattern . However , after experiment , value end second group spread with regular pattern .
10.	Febyarni chemistry [15]	Development of science e-module based on problem based learning to improve students' science literacy	According to the experts' assessment, the developed problem-based science e-module received a good evaluation, with the scores obtained ranging from 10 to 14.
11	Ade novianti, alwen benti , Ahmad zikri [16]	The problem based learning model on the activities and outcomes of integrated thematic learning in elementary schools	The application of the PBL method in learning makes students more active in participating, which has an impact on increasing their grades in thematic subjects in grade 5.
12	Monika setiyaningrum [17]	Improving learning outcomes using problem based models learning (PBL) in grade 5 elementary school students	There was a significant increase in the percentage of student learning outcomes that met the minimum completion criteria (kkm) as well as in student learning activities between cycles i and ii.

13	Fitriyanti [18]	Improving students' scientific thinking attitudes and abilities through the PBL model in elementary schools	There was a significant increase in the percentage of students who showed success, namely from 76% in cycle 1 to 92% in the next cycle. In addition, students' scientific attitudes also increased, from 60% to 86%.
14	Bayu saputro [19]	Improving critical thinking abilities and mathematics learning outcomes using the PBL model in grade v students	Students' critical thinking skills showed an increase from one cycle to the next. In the first cycle, there were 13 students who experienced an increase, while in the second cycle, the number increased to 22 students.
15	Pratiwi [20]	Application of PBL model to improve students' understanding of science concepts in grade v elementary school	Problem based model learning is effective in improving students' understanding of the concepts in science taught to fifth grade students in elementary school.
16	Annisa mayasari, Opan arifudin, Eri juliawati [21]	The problem based learning (PBL) model in improving learning activity	Through learning problem based learning , students more enthusiastic in understand material temperature and heat .
17	Fatimatul khikmiyah [22]	Implementation of web live worksheet based on problem based learning in mathematics learning	Study this prove that web liveworksheet usage with PBL approach is successful increase participation active student in the learning process mathematics .
18	Ellyna hafizah, siti nurhaliza [23]	Implementation of problem based learning (PBL) on students' science literacy abilities	This study states that the problem-based learning (PBL) method is very effective in developing students' ability to solve problems in the field of science.
19	Muhammad ilham cahyo utomo, Rizqi nur hidayah, 3susilo tri widodo [24]	Implementation of the ran problem based learning model to improve learning outcomes of pancasila material in grade v of elementary schools	With thus , learning based on problem can become solution effective for increase ability think critical student in eye lesson mathematics of economics.
20	Radhiya rasyada [25]	Problem based implementation learning (PBL) in mathematics subjects	There was an increase in the individual learning completion of students from the initial stage of providing action to cycle ii, with the classical learning completion level reaching 85% in cycle ii.
21	Ahmad ali syihabuddin [26]	Problem based model learning (PBL) to improve student learning outcomes in fiqh subjects	Posttest results showed an increase in the average score to 73.68. In the second cycle, a more significant increase was observed , where the average pretest score which was originally 47.68 increased to 86 in the posttest.
22	Agus dede anggiana [27]	Implementation of problem based learning (PBL) model to improve students' mathematical problem solving abilities	The results of the study showed that students who used the problem based learning model learning (PBL) showed better problem solving abilities compared to students who learned using conventional methods based on the active fun curriculum (akm).
23	Tamariska febrina kristiana [30]	Meta analysis of the application of problem based models learning in improving elementary school students' science learning outcomes	Learning model problem based learning (PBL) has proven to be very effective in increase performance student in eye science lessons at school base .
24	Windy cahyanti [31]	Problem based model learning (PBL) to improve pancasila education learning outcomes of grade v students	In stage i, although happen increase , only 29% of participants education that meets criteria achievement . However , in stage ii, it occurs a huge improvement for participant education , namely 82%, shows very good result .

			Successful achieve target criteria achievement study .
25	Delfi febriani [32]	Improving the integrated thematic learning process using the problem based model learning in grade v of elementary school	Implementation of learning models problem based learning (PBL) is very effective for add quality learning thematic on theme 4 in class v of sdn 12 gunung here .
26	Aqila zahra latifa [33]	Implementation of PBL model to improve mathematics learning activities of students of gisikdro elementary school no 02 semarang	There is marked increase in activity study student class iv sdn gisikdrono 02 in all aspects , namely cognitive , affective , and psychomotor .
27	Rizka nur oktaviani [34]	Implementation of problem based learning (PBL) learning model based on lesson study to improve students' communication and collaboration skills in the learning planning course in elementary school	Evaluation results show significant increase in phase i to cycle ii. In cycle i, the percentage success is in the category good (84%), while in cycle 2 it increased to be very good (91%), namely increase by 7%.
28	Riries khairur rohmah [35]	Implementation of differential problem learning with PBL model in subtheme of class iii sdn sambirej o 02 to improve students' learning outcomes	The pretest results show mark highest of 78.85, while in the posttest, the value lowest just already reached 80.77 and the value highest reached 100. Significant improvement this is also supported by the n-gain score of 0.7159 which indicates category tall .
29	Marlita widyasari [36]	Implementation of PBL to improve problem solving skills , independence, and learning outcomes in mathematics learning	There is significant increase in the mean independence score study from precycle (50%) to cycle 1 (55%), then increase again to 70% in cycle 2.
30	The sun [37]	Based model learning to improve elementary school students' mathematical problem solving skills	There is a very significant increase in total revenue from precycle (37) to cycle i (114) and continue increase rapidly in cycle ii to 167.

Literature based research Review The purpose of this study is to analyze the impact of implementing the Problem Based learning model. Learning (PBL) towards learning that is in accordance with the demands of the 21st century, which was carried out by reviewing 30 research articles from Indonesian language journals and journals accredited by DOAJ, Sinta, Google Scholar and so on. Results The results show that the application of the PBL model can improve critical thinking, communicative, collaborative, and creativity skills. In addition to the 4C skills, Problem Based Learning in a way significant capable develop academic achievement and learning outcomes in students. Literature- based research review , to see the effect of using the Problem Based learning model Learning towards 21st century learning.

The research results below are the research context summarized as reference material for the writing that is done. In addition, related research can help researchers in developing an understanding of the research that has been carried out. The results of the journal analysis are presented as follows:

3.1 The skills needed for the 21st century

In the 21st century, students need special skills to face the challenges and changes that occur. Here are the skills that students need in the 21st century: Communication skills effective (communication), Ability communicative effective help student For express their ideas, discuss with friends, and finish problem together. *Problem Based Model Problem Based Learning* (PBL) is a learning method that focuses on solving everyday life problems. Problem Based Learning (PBL) has urgency tall in formation learning 21st century because can increase skills base like think critical, collaboration, communication, and thinking creative. Therefore that, the implementation of PBL in curriculum school base can become step strategic For prepare competitive and adaptive future generation to global challenges. In the 21st century, students need skills special For face challenges and changes that occur.

Think Critical and Solving Problems (critical thinking and problem solving), namely skills that enable student trained For evaluate complicated situation, taking the right decision, and finish problem with efficient way. Ability communicate effective (communication), Ability communicative effective help student For express their ideas, discuss with friends, and finish problem together [34]. Ability Work collaboration and teamwork, Ability creative and innovative allow student For develop idea new, adapt with perspective new, and create solution unique for problem complex [35]. Creativity and Innovation refers to the ability For generate new ideas that are original and valuable innovative [36].

3.2 Problem based learning

Learning Problem Based Learning (PBL) is accepted in a way wide as a student - centered learning model . In general general Problem Based Learning (PBL) is A learning approach that utilizes real-world problems as context. For develop skills student in breakdown problem, thinking critical, and collaboration [37].

Problem Based Learning (PBL) Model is a approach learning that emphasizes completion relevant issues with condition real.As for steps to be taken done by the teacher to his students in implementing the PBL model, namely: Orientation Student to Problem covers explanation about objective learning and presentation the problem that will studied. Organizing Student For Learning involving distribution student to in groups For discuss and identify relevant issues with assignments. In addition , guidance done in The process of investigation both individually and in groups, and providing support to students in collecting information and conducting experiments [38]. Problem Based Learning syntax focuses on involvement active student in the learning process through breakdown problem real , which involves collaboration, research, and reflection. Approach This No only increase skills breakdown problem but also encourage development skills think critical important for student in face real world challenges .

The urgency of problem based learning for improvement or formation learning 21st century in students school base Implementation of Problem-Based Learning (PBL) in students school base own urgency positive and negative in improvement or formation learning 21st century. Increase Ability Think Critical PBL trains students to think logically and systematically in dealing with problems and evaluating complex information [39]. With give example associated problems with material learning and life real students. Students can Study For think critical and solving the problem with Good.

Interactive and related PBL model with daily life Motivate student in Study Because feel involved direct in the learning process [40] . Because the PBL model is interactive and student - centered make student become more enthusiastic in the learning process [41]. PBL facilitates access to supporting curriculum learning 21st century, including a comprehensive and interdisciplinary Science Technology Engineering Math STEM curriculum. Availability equipment and resources adequate power Still become constraint in implementation of PBL, especially in the regions left behind [42].

Work - focused PBL process field or study independent can eat time longer than method traditional If No designed with true [25]. This Problem Based Learning (PBL) own urgency tall in formation 21st century learning because it can improve basic skills such as critical thinking, collaboration , communication , and thinking. creative . Therefore that , the implementation of PBL in curriculum school base can become step strategic For prepare competitive and adaptive future generation to global challenges. Problem Based Learning (PBL) has urgency tall in formation learning 21st century because can develop skills base like think critical , collaboration, communication, and thinking creative. Therefore that, the implementation of Problem Based Learning in curriculum school base can become step strategic For prepare competitive and adaptive future generation to global challenges. In overall with the data that has been obtained from researches previously Shows that the Problem Based learning model Learning is effective in improving quality learning in various level education, including education elementary and secondary, with emphasis on development essential skills For 21st century.

One of the few studies that conducted a meta-analysis of the impact of PBL on 21st century skills at the primary school level, provided a comprehensive overview of the effectiveness of this model in various contexts, one of which was that this study showed that the impact of the implementation of the Problem Based Learning learning model can significantly improve students' 21st century skills, including critical thinking, creativity, collaboration, and communication. The results of the meta-analysis of 40 articles showed an increase in the average pretest score from 54.13 to 74.33 after the implementation of PBL, with an Effect Size value of 0.717 which showed a large influence ($p < 0.000$) on the skill [14]. In educational practice, teachers still need to plan lessons with the Problem Based Learning model to improve students' 21st century skills. This recommendation includes teacher training in the implementation of Problem Based Learning and curriculum development that supports this method. However, further research is still needed to explore the long-term impact of the application of Problem Based Learning on students' 21st century skills and how the context of student characteristics affects the effectiveness of this model in primary education.

4. CONCLUSION

In the 21st century, students need special skills to face the challenges and changes that occur. Here are the skills that students need in the 21st century : Ability communicate effective (communication), Ability communicative effective help student For express their ideas , discuss with friends , and finish problem together . Problem Based Model Learning (PBL) is a learning approach that focuses on solving real problems. PBL syntax focuses on involvement active student in the learning process through breakdown problem real , which involves collaboration , research , and reflection . Problem Based Learning (PBL) has urgency tall in formation learning 21st century because can increase skills base like think critical, collaboration, communication, and thinking creative. Therefore that, the implementation of PBL in curriculum school base can become step strategic For prepare competitive and adaptive future generation to global challenges[43]. Based on the results of this literature review, the researcher suggests that elementary schools can improve the implementation of problem-based learning through continuous teacher training, relevant curriculum development, and adequate resource support. and It is hoped that further research can be conducted to explore the application of PBL to specific subjects or groups of students with special characteristics.

ACKNOWLEDGEMENTS

Thank you to all parties who have contributed to this research, for your support and cooperation.

REFERENCES

- [1] A. D. Septiana, "Pengaruh lingkungan sekolah terhadap prestasi belajar mata pelajaran kewirausahaan siswa kelas X jurusan administrasi Perkantoran di SMK Dharma karya jakarta," *Al-Bahra bin Ladjamudin*, vol. 12, no. 1, pp. 13–36, 2016. doi: 10.46773/muaddib.v7i1.1448
- [2] F. N. Sarie, "Implementasi pembelajaran berdiferensiasi dengan model problem based learning pada siswa sekolah dasar kelas VI," *Tunas Nusant.*, vol. 4, no. 2, pp. 492–498, 2022. doi: 10.34001/jtn.v4i2.3782.
- [3] Syamsidah and H. Suryani, "Buku Model Peoblem Based Learning (PBL)," *Buku*, pp. 1–92, 2018.
- [4] T. Taher, "Penerapan model pembelajaran problem based learning (pbl) untuk meningkatkan hasil belajar siswa di smp negeri 2 mangoli tengah," *J. Ilm. Wahana Pendidik.*, vol. 8, no. 24, pp. 776–781, 2022.
- [5] U. SUSWATI, "Penerapan Problem Based Learning (PBL) meningkatkan hasil belajar kimia," *Teach. J. Inov. Kegur. dan Ilmu Pendidik.*, vol. 1, no. 3, pp. 127–136, 2021. doi: 10.51878/teaching.v1i3.444.
- [6] W. A. Sartono, "Pengaruh penggunaan Model Problem Based Learning (PBL) terhadap aktivitas belajar pelajaran pendidikan kewarganegaraan siswa kelas VII di SMP negeri 16 yogyakarta," *J. Ilmu Pendidik.*, vol. 7, no. 2, pp. 809–820, 2020.
- [7] U. Aiman and R. A. R. Ahmad, "Model Pembelajaran Berbasis Masalah (PBL) terhadap literasi sains siswa kelas v sekolah dasar," *J. Pendidik. Dasar Flobamorata*, vol. 1, no. 1, pp. 1–5, 2020. doi: 10.51494/jpdf.v1i1.195.
- [8] O. A. Putri, "Analisis tingkat perilaku anak usia sekolah dalam pencegahan penyalahgunaan narkoba di kelurahan sukabumi utara, jakarta barat," *J. Pendidik. dan Konseling*, vol. 4, no. 20, pp. 1349–1358, 2022. doi:10.31004/jpdk.v4i4.6352
- [9] U. Aiman, N. Dantes, and K. Suma, "Pengaruh model pembelajaran berbasis masalah terhadap literasi sains dan berpikir kritis siswa sekolah dasar," *Pendidik. Citra Bakti*, vol. 6, no. September, pp. 196–209, 2019. doi: 10.5281/zenodo.3551978.
- [10] Elfrida Fitriani, L. O. S. Arihi, and Iman Ashari, "Penerapan model pembelajaran problem based learning untuk meningkatkan hasil belajar siswa pada pembelajaran ips di kelas IV," *J. Ilm. Pembelajaran Sekol. Dasar*, vol. 6, no. 1, pp. 68–79, 2024. doi: 10.36709/jipsd.v6i1.53.
- [11] E. R. Juniawan, V. H. Salsabila, A. T. Prasetya, and W. D. P. Rengga, "Studi literatur: analisis media pembelajaran IPA untuk meningkatkan literasi sains siswa sekolah dasar," *Cokroaminoto J. Prim. Educ.*, vol. 6, no. 2, pp. 82–94, 2023. doi: 10.30605/cjpe.622023.2608.
- [12] P. S. Adiwiguna, N. Dantes, and I. M. Gunamantha, "The influence of the STEM-Oriented problem based learning model on the critical thinking ability and scientific literacy of class v elementary school students in gugus i gusti ketut pudja," *Indones. J. Basic Educ.*, vol. 3, no. 2, pp. 94–103, 2019.
- [13] F. Alatas and L. Fauziah, "Model problem based learning untuk meningkatkan kemampuan literasi sains pada konsep pemanasan global," *JIPVA (Jurnal Pendidik. IPA Veteran)*, vol. 4, no. 2, p. 102, 2020. doi: 10.31331/jipva.v4i2.862.
- [14] E. D. Chairunisa and A. Zamhari, "Pengembangan e-modul strategi pembelajaran sejarah dalam upaya peningkatan literasi digital mahasiswa," *Criksetra J. Pendidik. Sej.*, vol. 11, no. 1, pp. 84–96, 2022. doi: 10.36706/jc.v11i1.16047.
- [15] A. Novianti, A. Benti, and A. Zikri, "Pengaruh penerapan Model Problem Based Learning (PBL) terhadap aktivitas dan hasil belajar siswa pada pembelajaran tematik terpadu di sekolah dasar," *J. Basicedu*, vol. 4, no. 1, pp. 194–202, 2020. doi: 10.31004/basicedu.v4i1.323.
- [16] M. Setyaningrum, "Peningkatan hasil belajar menggunakan model Problem Based Learning (PBL) pada siswa kelas 5 SD" *Jurnal Riset Teknologi Dan Inovasi Pendidikan, Jartika*, vol. 1, no. 2, pp. 99–108, 2018.
- [17] B. Saputro, B. S. Sulasmono, and E. W. Setyaningtyas, "Peningkatan kemampuan berpikir kritis dan hasil belajar matematika menggunakan model PBL pada kelas V," *J. Pendidik. Tambusa*, vol. 3, no. 2, pp. 621–631, 2019.
- [18] D. A. Pratiwi, N. Djumhana, and A. Hendriani, "Penerapan model PBL untuk meningkatkan pemahaman konsep IPA siswa kelas V SD," *J. Pendidik. Guru Sekol. Dasar*, vol. 5, no. 1, pp. 11–18, 2020. <https://doi.org/10.17509/jpgsd.v5i1.30045>

- [19] A. Mayasari, O. Arifudin, and E. Juliawati, "Implementasi model Problem Based Learning (PBL) dalam meningkatkan keaktifan pembelajaran," *J. Tahsinia*, vol. 3, no. 2, pp. 167–175, 2022, doi: 10.57171/jt.v3i2.335.
- [20] F. Khikmiyah, "Implementasi web live worksheet berbasis problem based learning dalam pembelajaran matematika," *Pedagog. J. Pendidik. Mat.*, vol. 6, no. 1, pp. 1–12, 2021, doi: 10.30605/pedagogy.v6i1.1193.
- [21] E. Hafizah and S. Nurhaliza, "Implementasi Problem Based Learning (PBL) terhadap kemampuan literasi sains siswa," *Quantum J. Inov. Pendidik. Sains*, vol. 12, no. 1, p. 1, 2021, doi: 10.20527/quantum.v12i1.9497.
- [22] M. I. C. Utomo, R. Nur Hidayah, S. T. Widodo, W. A. Azizah, and S. Rahmawati, "Implementasi model pembelajaran problem based learning guna meningkatkan hasil belajar materi pancasila pada kelas V sekolah dasar," *Alpen J. Pendidik. Dasar*, vol. 7, no. 2, pp. 138–148, 2023, doi: 10.24929/alpen.v7i2.292.
- [23] R. Rasyada, "Implementasi Problem Based Learning (PBL) pada mata pelajaran matematika," *BASICA J. Arts Sci. Prim. Educ.*, vol. 3, no. 1, pp. 151–162, 2023, doi: 10.37680/basic.v3i1.3943.
- [24] A. A. Syihabuddin, S. Nursyamsiyah, and D. W. Putra, "Implementasi model Problem Based Learning (PBL) untuk meningkatkan hasil belajar siswa pada mata pelajaran fikih," *J. Pendidik. Islam*, vol. 1, no. 1, pp. 1–9, 2023, doi: 10.47134/pjpi.v1i1.28.
- [25] R. Rifa'i, D. Pratidiana, and S. D. Arifiyanti, "Penerapan model problem based learning untuk meningkatkan kemampuan pemecahan masalah matematis siswa," *JKPM (Jurnal Kaji. Pendidik. Mat.)*, vol. 5, no. 1, p. 109, 2019, doi: 10.30998/jkpm.v5i1.5179.
- [26] T. F. Kristiana and E. H. Radia, "Meta analisis penerapan model problem based learning dalam meningkatkan hasil belajar ipa siswa sekolah dasar," *J. Basicedu*, vol. 5, no. 2, pp. 818–826, 2021, doi: 10.31004/basicedu.v5i2.828.
- [27] D. Febriani, "Peningkatan proses pembelajaran tematik terpadu dengan menggunakan model problem based learning di kelas V sekolah dasar," *J. Pendidik. Tambusai*, vol. 4, no. 3, pp. 2354–2359, 2020.
- [28] S. Pokhrel, "Analisis penggunaan teknologi informasi sebagai sumber belajar," *Jurnal Ilmiah Informatika dan Komputer*, vol. 15, no. 1, pp. 37–48, 2024. <https://doi.org/10.69533/nkz3218>
- [29] R. N. Oktaviani, "Implementasi model pembelajaran problem based learning (pbl) berbasis lesson study untuk meningkatkan keterampilan komunikasi dan kolaborasi mahasiswa pada mata kuliah perencanaan pembelajaran di SD," *ELSE (Elementary Sch. Educ. Journal) J. Pendidik. dan Pembelajaran Sekol. Dasar*, vol. 6, no. 2, p. 257, 2022, doi: 10.30651/else.v6i2.11095.
- [30] R. K. Rohmah, Arfilia Wijayanti, and Filia Prima A, "Implementasi pembelajaran berdiferensiasi dengan model pbl pada subtema kelas iii sdn sambirejo 02 untuk meningkatkan hasil belajar siswa," *Didakt. J. Ilm. PGSD STKIP Subang*, vol. 9, no. 04, pp. 1722–1738, 2023, doi: 10.36989/didaktik.v9i04.1753.
- [31] M. Widyasari, A. H. D. Hadiyanti, and Y. B. Kriswanto, "Implementasi PBL untuk meningkatkan kemampuan problem solving, kemandirian, dan hasil belajar pada pembelajaran matematika," *Ideguru J. Karya Ilm. Guru*, vol. 8, no. 3, pp. 509–516, 2023, doi: 10.51169/ideguru.v8i3.574.
- [32] A. D. Anggiana, "Implementasi model Problem Based Learning (PBL) untuk meningkatkan kemampuan pemecahan masalah matematis siswa," *Symmetry Pas. J. Res. Math. Learn. Educ.*, vol. 4, no. volume 4, pp. 886–894, 2019, doi: 10.23969/symmetry.v4i2.2061.
- [33] D. Mahrunnisa, "Keterampilan pembelajar di abad ke-21," *JUPENJI J. Pendidik. Jompa Indones.*, vol. 2, no. 1, pp. 101–109, 2023, doi: 10.57218/jupenji.vol2.iss1.598.
- [34] M. Mashudi, "Pembelajaran modern: membekali peserta didik keterampilan abad ke-21," *Al-Mudarris (Jurnal Ilm. Pendidik. Islam)*, vol. 4, no. 1, pp. 93–114, 2021, doi: 10.23971/mdr.v4i1.3187.
- [35] M. Taufiqurrahman, "Pembelajaran abad 21 berbasis kompetensi 4C di perguruan tinggi," *PROGRESSA J. Islam. Relig. Instr.*, vol. 7, no. 1, pp. 78–90, 2023, doi: 10.32616/pgr.v7.1.441.78-90.
- [36] R. Ardianti, E. Sujarwanto, and E. Surahman, "Diffraction: journal for physics education and applied physics problem-based learning: apa dan bagaimana," *Diffr. J. Phys. Educ. Appl. Phys.*, vol. 3, no. 1, pp. 27–35, 2021.
- [37] P. Pramudyanti, W. O. Pratiwi, A. Armansyah, F. Rohman, I. Y. Putri, D. Ariani, "PBL-based student worksheet to improve critical thinking ability in science learning in elementary schools," *Cendikia Media J. Ilm. Pendidik.*, pp. 1–23, 2016. <https://dx.doi.org/10.24042/ij sme.v6i1.17187>
- [38] T. Brahim, A. Sarirete, and R. M. Ibrahim, "The impact of accreditation on student learning outcomes," *Int. J. Knowl. Soc. Res.*, vol. 7, no. 4, pp. 51–62, 2016, doi: 10.4018/ijksr.2016100105.
- [39] H. S. Arief and A. Sudin, "Meningkatkan motivasi belajar melalui pendekatan Problem-Based Learning (PBL)," *J. Pena Ilm.*, vol. 1, no. 1, pp. 141–150, 2016. <https://doi.org/10.23819/pi.v1i1.2945>
- [40] Muzakki and Putri, "Peningkatan skill abad 21 melalui play based learning (PBL) stem dengan media robotics di sekolah dasar: peningkatan skill abad 21 melalui Play Based Learning (PBL) stem dengan media robotics di sekolah dasar," *Jurnal Pendidik. Dasar Junal Tunas Nusant.*, vol. 5, no. 1, pp. 547–555, 2023. <https://doi.org/10.34001/jtn.v5i1.4975>
- [41] L. Zhang and Y. Ma, "A study of the impact of project-based learning on student learning effects: a meta-analysis study," *Front. Psychol.*, vol. 14, no. July, pp. 1–14, 2023, doi: 10.3389/fpsyg.2023.1202728.
- [42] E. Indarini, "Dampak model problem based learning terhadap keterampilan abad 21 (4 c) di sekolah dasar," *Satya Widya*, vol. 40, no. 1, pp. 73–87, 2024, doi: 10.24246/j.sw.2024.v40.i1.p73-87