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Improving learning outcomes through problem-based learning: A literature review

Peningkatan hasil belajar melalui pembelajaran berbasis masalah: Sebuah kajian literatur

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Abstract
The increasingly complex dynamics of the times, characterized by rapid advances in science and technology, require the education system to proactively make adjustments. One response to the demands of the times is the development of 21st century competencies in learners. The six competencies, namely communication, character, citizenship, critical thinking and creativity, are essential assets for individuals to face future challenges. The ability to think critically to solve problems is an ability that is currently being developed. Teacher-centered learning practices often hinder the development of students' critical thinking skills that are needed to overcome the complexity of problems in everyday life. Problem-based learning comes as a promising solution, by encouraging learners to actively develop their cognitive abilities in solving problems, thus having a positive impact on their learning achievement. This research uses the PRISMA diagram to conduct a systematic literature review with the aim of illustrating how problem-based learning affects student learning outcomes. In an effort to identify relevant literature, this research utilized Google Scholar using the keywords “learning outcomes” and “problem-based learning”. From the search process, 20 scientific articles were obtained which were then analyzed in depth. The results showed a positive correlation between the implementation of problem-based learning and the improvement of students' academic performance.

Keyword: improving, learning outcome, problem based learning

Abstrak. *Dinamika zaman yang kian kompleks, ditandai dengan kemajuan pesat dalam bidang ilmu pengetahuan dan teknologi, mengharuskan sistem pendidikan untuk secara proaktif melakukan penyesuaian. Salah satu respons terhadap tuntutan zaman adalah pengembangan kompetensi abad ke-21 pada peserta didik. Keenam kompetensi tersebut, yakni komunikasi, karakter, kewarganegaraan, berpikir kritis, dan kreativitas, menjadi modal esensial bagi individu untuk menghadapi tantangan masa depan. Kemampuan berpikir kritis untuk memecahkan masalah adalah kemampuan yang sedang dikembangkan saat ini. Praktik pembelajaran yang masih berpusat pada guru seringkali menghambat pengembangan kemampuan berpikir kritis siswa yang sangat dibutuhkan untuk mengatasi kompleksitas permasalahan dalam kehidupan sehari-hari. Pembelajaran berbasis masalah hadir sebagai sebuah solusi yang menjanjikan, dengan mendorong peserta didik untuk secara aktif mengembangkan kemampuan kognitif mereka dalam memecahkan masalah, sehingga berdampak positif pada prestasi belajar mereka. Penelitian ini menggunakan diagram PRISMA untuk melakukan tinjauan literatur yang sistematis dengan tujuan untuk menggambarkan bagaimana pembelajaran berbasis masalah mempengaruhi hasil belajar siswa. Sebagai upaya untuk mengidentifikasi literatur relevan, penelitian ini memanfaatkan Google Scholar dengan menggunakan kata kunci "hasil belajar" dan "pembelajaran berbasis masalah". Dari proses pencarian tersebut, diperoleh 20 artikel ilmiah yang kemudian dianalisis secara mendalam. Hasil kajian menunjukkan adanya korelasi positif antara penerapan pembelajaran berbasis masalah dengan peningkatan prestasi akademik siswa. Kata kunci: meningkatkan; hasil belajar; pembelajaran berbasis masalah.*

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INTRODUCTION

Science and technology have evolved with the times. This development requires adjustments in the field of education. For this reason, curriculum changes are needed that can adapt to the demands of the times (Fatmawati, 2021). Character, Communication, Critical Thinking, Collaboration, Creativity, and Citizenship are the six Cs that students must possess in 21st-century education, according to Candrikaningtyas et al. (2024). The use of technology in the classroom is the hallmark of education in this day and age (Ramadani, 2023). To be able to generate a generation with superior knowledge and abilities, education is necessary. Giving this generation problem-solving skills is one method to prepare them. Solving difficulties is a crucial skill for pupils to have in order to face the future (Mulyani, 2020).

The nature of science education necessitates that students actively participate in order to comprehend difficult ideas. According to Mulyani's study (2020), teaching science basically encourages students to think. Four components make up this ability: attitude, procedure, product, and application. It is intended that direct experience activities, such as gathering data, developing concepts and principles, and creating theories and laws, would help students, particularly those studying biology, improve their curiosity. Sukardi (2019) asserts that the quality of learning—in this instance, learning planning—is one factor that determines learning success.

The reality on the ground differs somewhat from the ideal circumstances anticipated. The issue that often arises is the way in which instructors present the content, which is still theoretical in nature and is done via lectures (Ilmi, 2019). There are three primary issues with learning, according the findings of a study conducted by Aryani et al. in 2022. The first is that kids are not motivated to learn since there is a lack of diversity among the lecturers. where a lot of instructors still choose to teach a variety of ideas using the teacher-centered lecture style. The second issue that often arises while studying science is that some of the things are hard to grasp if you merely hear the instructor explain them. For instance, the immune system is a challenging subject that students can only imagine after hearing the instructor explain it. Lastly, not every person actively participates in the learning process. This is a result of their inability to comprehend the information that the instructor has presented, which eventually impacts the students' learning results. Students' critical thinking abilities must be strengthened in order to enhance learning results.

The integration of problem-based learning (PBL) into science education may stimulate the development of students' critical thinking skills. PBL is an instructional strategy that empowers students to tackle complex challenges. Through the PBL phases, students may carry out investigations that are anticipated to be educational experiences for them as they attempt to resolve the issues that are put forward, which should ultimately improve learning outcomes (Mulyani, 2020). One benefit of PBL, according to study findings by Azura et al. (2023), is that students actively participate in resolving learning challenges. Where they can be trained to think critically to identify problems, analyze information or events, and practice making decisions with the knowledge they have. The problems presented are close to the learners' daily lives, which increases their motivation and involvement in learning. PBL implemented in groups makes learners practice to work together, communicate and respect each other's opinions in discussions. According to Putra (2019), with PBL teachers focus on guiding learners to learn independently by being directly involved in learning.

PBL has been the subject of several published studies, including those that suggest it may increase students' learning results in the cognitive and psychomotor domains (Darmayanti et al., 2022) and that PBL adoption has enhanced students' motivation and learning outcomes (Mulyani, 2020). Study by Darmayanti et al. (2022) suggests that PBL can improve both students' thinking skills and practical abilities. This is because PBL provides students with scenarios that are comparable to their daily lives, which makes it easier for them to learn and then work through the challenges. To delve deeper into the effects of problem-based learning (PBL) on student learning, further research is warranted. This paper synthesizes twenty studies published in the last five years that examined the implementation of PBL in high school science education. The objective of this review is to elucidate the relationship between PBL and student learning outcomes.

RESEARCH METHOD

This study employs a particular kind of literature review in which information is gathered via literature research. A literature review is a study of the literature that is carried out by reading books, journals, and other publications that are pertinent to the research issue in order to generate writing on the subject under discussion (Syofian & Gazali, 2021). The study was carried out during October and November of 2024.

The study's population consisted of dozens of papers that were sourced from Google Scholar. Twenty studies that address the impact of PBL on high school science learning outcomes make up the study's sample. A Google Scholar search was undertaken using the terms "learning outcomes" and "problem-based learning" to identify relevant studies. From the pool of articles, 20 studies were selected based on their focus on the impact of PBL on high school science learning outcomes. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed to ensure a systematic approach to data collection. Journal analysis was used to conduct the research, and summaries pertaining to the study's questions and goals were subsequently created. Figure 1 illustrates how the PRISMA principles are adapted in this study's phases.

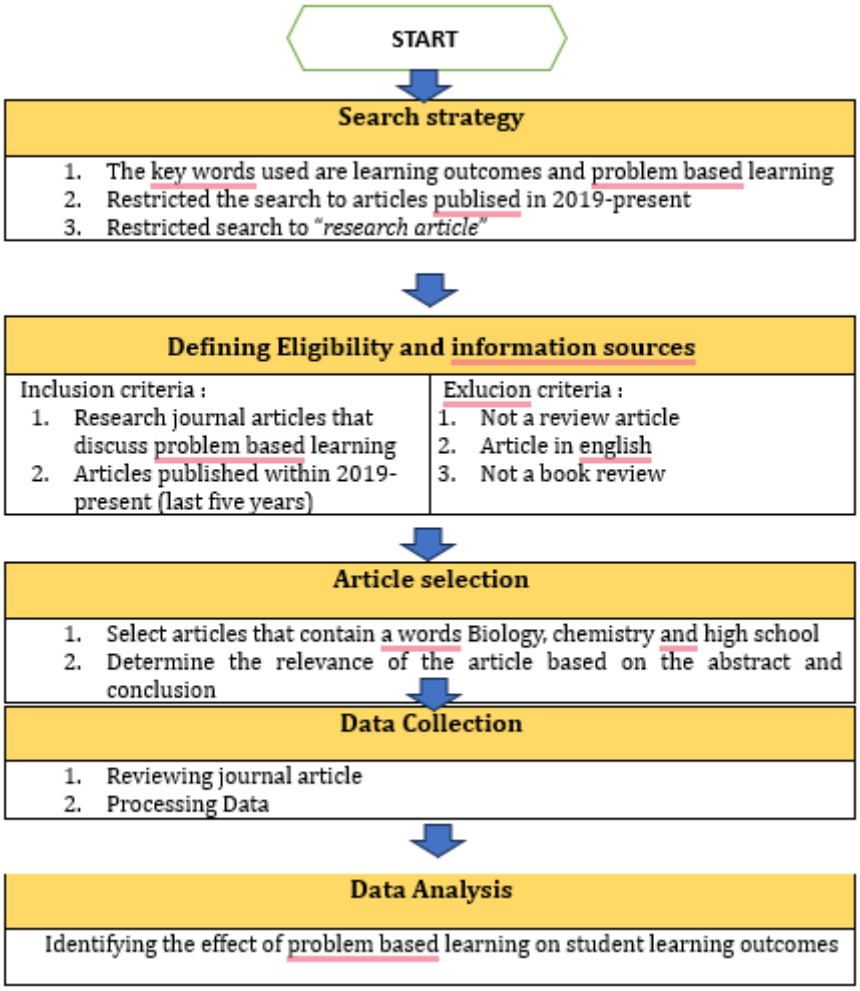

Figure 1 Stages of research

The research stages as in Figure 1 begin with a search using the keywords “learning outcomes and problem-based learning”. Then filtering or filtering only articles from 2019 to 2024 were taken. The articles obtained were analyzed whether they were in accordance with the research objectives. Articles with the terms biology, chemistry, and high school students' learning objectives were chosen. Twenty articles were chosen for study out of many. The objective of this analysis is to elucidate the relationship between problem-based learning and student learning outcomes.

RESULTS AND DISCUSSION

There were 20 articles in the search results that met the requirements for discussion. The articles used were from national journals in Indonesian. The articles were systematically analyzed to determine the effects of PBL on high school science learning outcomes. The results of this analysis are summarized in Table 1.

Table 1 Results of Research Article Analysis

Kode	Article Title	Analysis result
A1	"The Effect of Problem Based Learning (PBL) on Problem Solving Ability and Cognitive Learning Outcomes of Students of SMA Negeri 10 Kota Bengkulu"	Problem-Based Learning (PBL) has significantly improved students' cognitive learning outcomes and problem-solving skills at SMA Negeri 10 Bengkulu City. According to the empirical results, pupils in the PBL-exposed experimental group had better cognitive learning outcomes than those in the control group, which was given conventional teaching.
A2	"Improving Biology Learning Outcomes of Respiratory System Material Through Problem Based Learning Model for Students of Class XI MIPA 6 SMA Negeri 1 Tawangsari 2nd Semester 2017/2018 Academic Year"	Implementing the Problem-Based Learning (PBL) model in the second semester to teach the biology of the respiratory system concept to eleventh-grade science students at SMA Negeri 1 Tawangsari could significantly enhance the quality of the learning experience and student achievement. This is evidenced by a substantial increase in student engagement, as measured by their completeness, motivation, and active participation, which rose from 68.42% to 86.84%, 71.05% to 92.11%, and 65.79% to 89.47%, respectively, across the two cycles of the study.
A3	"The Effect of Problem Based Learning (PBL) Learning Model on Student Learning Outcomes at SMA Negeri 2 Tondano"	Learning results may be impacted by experimental learning employing a problem-based learning methodology at SMA Negeri 2 Tondano. According to the study's post-test findings, students who use problem-based learning models often achieve better learning outcomes than those who adhere to conventional learning methods.
A4	"Implementation of Problem Based Learning (PBL) on Students' Learning Outcomes in Biology Class X at SMA Negeri 1 Palembang"	A significant proportion of students, 85%, achieved scores below the proficiency threshold of 70 in the initial cycle of the study, suggesting a lack of substantial impact on student learning outcomes when the PBL approach was implemented. While the learning outcomes in the second cycle demonstrated a positive trend, with a reduction in the number of students scoring below 70 to 56%, the overall impact remained limited. Moreover, 85.39% of students achieved the traditional completion threshold of 85% in the third cycle, with 85% of students achieving a score of at least 70.
A5	"The Effect of PBL Learning Model Using Audia Visual Media on Interest and Learning Outcomes in Biology"	A comparison of the experimental and control groups' learning results shows a significant difference. The control group's mean score was 71.6, whereas the experimental group, which used audio-visual materials in a Problem-Based Learning (PBL) framework, had a mean score of 77.59. These findings suggest a potential positive correlation between the integration of audio-visual materials into PBL and enhanced student learning outcomes.
A6	"The Effect of Problem Based Learning Model on Cognitive Learning Outcomes and Critical Thinking of Class X MIA Students of SMAN 2 Kandangan On the Concept of Ecosystem"	Students' critical thinking abilities may be greatly enhanced when biology is taught utilizing the PBL methodology, which was used in the experimental class. Following their instruction using the PBL paradigm, students' average scores on critical thinking tests increased. A comparative analysis of critical thinking scores revealed a significant disparity between the experimental and control groups. The experimental group, exposed to the intervention, exhibited a mean critical thinking

Kode	Article Title	Analysis result
		score of 80.46, while the control group, receiving traditional instruction, attained a lower mean score of 65.09.
A7	"Application of Problem Based Learning Model to Increase Students' Motivation and Biology Learning Outcomes"	The implementation of the Problem-Based Learning (PBL) model has led to significant improvements in various aspects of the learning process. Specifically, the percentage of students actively engaged in learning increased from 72.73% to 86.36% between cycles I and II, representing a 13.64% increase. Similarly, student motivation saw a notable 7.95% rise, from 73.83% to 81.78%. Most notably, the most substantial improvement was observed in learning outcomes, which surged by 64.29%, from 17.86% to 82.29%. These empirical findings strongly suggest that the PBL approach is an effective strategy for enhancing both student motivation and biology learning outcomes.
A8	"Increasing Biology Learning Activities and Results through Problem Based Learning (PBL) Model on Environmental Pollution Material for Class X Students of SMA Negeri 1 Jatisrono"	The Problem-Based Learning (PBL) approach has the potential to significantly enhance students' cognitive learning outcomes in biology. An analysis of the data reveals a progressive increase in student learning completeness across the three cycles of implementation. In cycle I, 65.38% of students achieved the desired learning outcomes. This figure rose to 76.92% in cycle II and further increased to 92.30% in cycle III. These results demonstrate that the PBL approach effectively facilitated student learning, surpassing the established performance indicator of success (≥ 88.46%) and meeting the minimum competency standards.
A9	"Comparison of Learning Outcomes Applying Problem-Based Learning Models and Guided Inquiry"	The statistical study showed that the guided inquiry and problem-based learning models significantly differed in the learning results of the students. The essential t-value of 2.00 was surpassed by the computed t-value of 4.972, suggesting that the problem-based learning model performed noticeably better than the guided inquiry model.
A10	"The Effect of Problem Based Learning Model Learning Outcomes of Biology Virus Concepts in Participants Class X MIA Students at SMA 1 MAROS"	Class X MIA students at SMA 1 Maros' biology learning results with relation to the idea of viruses were greatly improved by the application of Problem-Based Learning (PBL). With a p-value of 0.000, significantly below the significance threshold of 0.05, an independent t-test demonstrated a significant difference in learning outcomes. The alternative hypothesis was accepted and the null hypothesis was rejected as a result of this statistical data, demonstrating the beneficial effects of PBL on student learning.
A11	"Application of Differentiated Problem-Based Learning (PBL) Model to Improve Biology Learning Outcomes"	Student learning outcomes were shown to improve when the Problem-Based Learning (PBL) paradigm was put into practice. In cycles I and II, the class average score increased significantly from 51.5 to 71.8. Furthermore, the proportion of students achieving exceptionally high scores rose from 8.2% to 21.6%, while the proportion of students with low scores decreased significantly from 45.9% to 18.9%. Notably, the percentage of students attaining a score of 76 or higher (the minimum competency level) increased from 37.8% to 75.7% between the two cycles. These findings collectively suggest that the PBL approach has the potential to enhance student learning outcomes.
A12	"Effectiveness of Problem Based Learning Model Provided with Learner Worksheet on Chemistry	Experimental class 1 commenced with a mean pre-test score of 33.235, while experimental class 2 began with a slightly higher mean pre-test score of 37.352. But after the intervention,

Kode	Article Title	Analysis result
	Learning Outcomes and Critical Thinking Ability of High School Learners"	experimental class 1 had a higher mean post-test score (82.058) than experimental class 2, which had a mean score of 76.029.
A13	"Efforts to Increase Student Activity and Learning Outcomes on Human Reproductive System Material with a Problem-Based Learning Model in Class XI IPA1 SMA IT INDAH MEDAN T.P 2020/2021"	The percentage chart shows the post-test findings, which show that cycle I student learning outcomes fell short of the accepted classical requirement of 85%. A significant proportion of students, 77%, failed to achieve the required level of understanding, while only 23% were deemed complete. It is important to note that IT Indah Medan Private High School sets a minimum competency level (KKM) of 76 for student learning outcomes.
A14	"Differences in Metacognition Ability and Cognitive Learning Outcomes of Students Learning with Problem-Based Learning Models and Discovery Learning Models in Biology Lessons at SMA Negeri 1 Utan in 2016/2017 Academic Year"	The mean post-test score in experimental class 1 clearly exceeds its equivalent pre-test score, even if there is a difference between the two experimental classes. Conversely, while experimental class 2's mean post-test score was better than its pre-test score, it was still lower than experimental class 1's.
A15	"Application of Problem-Based Learning Model to Improve Chemistry Learning Outcomes of Class X Students on the Subject of Electrolyte and Nonelectrolyte Solutions of Raya"	Class X students at SMAN 1 Talaga Raya have shown improved learning results when Problem-Based Learning (PBL) approaches are used in the context of electrolyte and non-electrolyte solutions. This is shown by a notable rise in the proportion of students who achieve learning completeness as well as the average student learning score. With an average score of 80.6 and a completion percentage of 89.28%, the second cycle significantly outperformed the first, which had an average score of 61.1 and a completion rate of 28.57%. According to these results, the PBL technique may successfully raise students' comprehension and interest in this topic.
A16	"Application of Problem Based Learning Model to Improve Biology Student Learning Outcomes at SMA Negeri 2 Langowan"	Biology students in the eleventh grade at SMA N 2 Langowan saw a considerable improvement in their learning outcomes when Problem-Based Learning (PBL) was implemented, especially when it came to the study of plant tissues. The average scores for the pre-cycle, cycle I, and cycle II increased gradually from 5.7 to 7.3 and then to 8.4, demonstrating this. PBL improved student attitudes and involvement in the learning process by creating a more dynamic and engaged learning environment.
A17	"Efforts to Improve Biology Learning Outcomes Through the Application of Problem Based Learning Model with Differentiated Learning Approach in Class X IPA 2 SMA Negeri 7 Mataram Academic Year 2022/2023"	The learning completeness percentage of students in cycle I was 48.4%, which was still far below the success indicator of the actions taken, which was at least 75%. As a result, cycle I was unsuccessful, and activities were carried out in the following cycle by paying more attention to the aspects of learning implementation by both teachers and students. The improvement in student learning outcomes indicates that the implemented activities were successful and satisfied the minimal performance criteria. In Cycle II, the proportion of students who met the necessary learning objectives increased to 77.4%.
A18	"Improving Student Learning Outcomes Through the Application of Problem Based Learning in Biology Subjects (Case Study of SMA Negeri 5 Palu Model)"	Student learning results have been shown to be significantly impacted by the use of problem-based learning. Between cycles I and II, there was a discernible rise in both absorption and classical completeness. While classical absorption climbed from 71.66% to 88.09%, classical completeness increased from

Kode	Article Title	Analysis result
		62.16% to 91.89%. These findings suggest that the problem-based learning strategy improves student learning in an efficient manner.
A19	"Application of Problem Based Learning (PBL) Learning Model with Teaching at the Right Level (TaRL) Approach in Improving Cognitive Learning Outcomes of Grade X Students on the Material of Biological Technology Innovation in Senior High Schools"	Throughout the trial, a discernible improvement in the cognitive functioning of the pupils was seen. The average class score for the pre-cycle was 66, and only 22% (8 out of 36) of the pupils met the learning goals. The number of students who met the learning goals grew to 58% (21 out of 36) in cycle I, while the average class score increased to 75. With an average class score of 82 and a significant 83% (30 out of 36) of students effectively meeting the learning goals, cycle II showed even more development.
A20	"Application of Problem Based Learning (PBL) Model accompanied by Mind Mapping to Improve Learning Outcomes in Class X Students of SMA Negeri 1 Tawangsari"	In the domain of environmental transformation, the study's findings indicate that integrating Problem-Based Learning (PBL) with mind mapping may significantly enhance the cognitive, affective, and psychomotor learning outcomes of Class X IPA 6 students at SMA Negeri 1 Tawangsari.

The analysis of 20 research papers in Table 1 shows that Problem-Based Learning (PBL) greatly enhances student learning outcomes. According to Annida et al. (2022), learning outcomes show how well students understood the material and are the consequence of their participation in the learning process. Safitri et al. (2022) further elaborates that learning outcomes encompass the ability of learners to apply theories and concepts, as assessed through pre- and post-tests. The findings align with Djonomiarjo's study (2019), which confirms the positive impact of PBL implementation on student learning outcomes.

Based on the table, it can be concluded in general that the application of PBL improves student learning outcomes. Learning outcomes are the achievements that students get after participating in learning which describes the quality of students in understanding learning (Annida et al., 2022). The learning model used is Problem Based Learning (PBL). In another study published by Safitri et al. (2022), it was stated that learning outcomes are a general description of learners ability to apply the theories and concepts taught with the results of pre and post tests. The improvement in student learning outcomes after learning using PBL is in line with Djonomiarjo's research (2019) which states that applying PBL greatly affects the improvement of student learning outcomes.

The above conclusion is in line with several relevant studies including a literature review by Anggraini et al. (2022) stated that the application of PBL in biology learning has an influence on student learning outcomes. This is reflected through an increase in student learning outcomes in various aspects, namely cognitive, affective, and psychomotor. This fact is in line with the results of this study that after using PBL in learning the learning outcomes of students increased as seen from the pre test and post test. Another literature study on the effect of PBL on student learning outcomes published by Darmayanti el al. (2022) concluded that PBL can increase student learning activities. Learners are presented with problems that are close to their daily lives which make it easier for learners to obtain and collect information to solve problems. In the end, their learning outcomes will improve. The literature review by Azura & Selaras (2023) states that from the results of the analysis of articles on PBL reviewed, it can be concluded that there is a positive effect of PBL on learning outcomes and critical thinking skills of student participants.

The results of the analysis of the 20 articles above answer the purpose of this study which is to describe how the effect of using PBL on student learning outcomes. PBL has a positive effect on learning with an increase in learning outcomes such as the data in table 1 above. According to Ratnasari et al. (2020) the use of PBL in learning can increase students' learning motivation. Activities carried out by students in learning can trigger external motivation which ultimately has a positive impact on learning outcomes. Increased learning outcomes are related to creative thinking skills, problem-based learning can improve creative thinking skills which ultimately have an impact on learning outcomes which also increase (Hartati et al., 2021). In PBL, there is a learning process that initially students are still lacking in problem solving skills

to be more trained because in PBL the problems presented are close to the daily lives of students (Wicaksono & Iswan, 2019).

Only publications published between 2019 and 2024 were included in the literature evaluation. The goal is to get the most recent information about how problem-based learning affects high school science students' learning results. Table 2 shows information related to this.

Table 2 Name of Researcher and Year of Publication

No	Researcher name	Publication year
1	Asiyah, Adrian Topano, Ahmad Walid	2021
2	Sri Mulyani	2020
3	Egita Zachawerus, Dintje F. Pendong2, Meity Tanor	2020
4	Asri Arumsari, Yuli Andravia Falensi, Didi Jaya Santri	2023
5	Mety Herlina, Jayanti Syahfitri, Yeni Oktariani	2020
6	Muhammad Ilmi, Lagiono	2019
7	Muhammad Wahyu Setiyadi	2019
8	Evin Hangesti Pradita Dewi, Siti Akbari, Anwari Adi Nugroho	2019
9	Fransiska Kolo Mauk, Faderina Komisia, Maria B. Tukan	2022
10	M Natsir, Edi Hasan, Muhammad Wajdi, Bahruddi	2022
11	Nuria Imamah Thurrodliyah 1, Ali Usman 2, Suciati	2023
12	Ramlan Silaban; Freddy Tua Musa Panggabean; Esrida Hutahaean; Felia Mutiara Hutapea; Irving Josafat Alexander	2021
13	Dita Putri Iskandar Nasution	2021
14	Wiwi Widia Astuti, A. Wahab Jufri, Afriana Azizah	2019
15	Selfi, D., Yuniati Tewa 2., Maysara	2020
16	Vilia Emor, Meity Tanor, Danny Ch. Posuma	2024
17	Baiq Intan Gina Maulani*, Haminatul Hardiana, Jamaluddin	2023
18	Irawaty Andi Pana	2020
19	Muhammad Cholil As'ad, Ani Sulistyarsi, Juli Sukirmawati	2024
20	Bety Wulansari *, Nur Rokimah Hanik, Anwari Adi Nugroho	2019

To get the latest data, this research collects the latest articles in the last 5 years that discuss the effect of problem-based learning on student learning outcomes. Based on Table 2, articles about PBL learning models are published in the last 5 years, namely 2019 to 2024. For articles that are most discussed are articles published in 2019 and 2020 which amounted to five pieces. Furthermore, in the second place, the most articles are articles published in 2021 and 2023, totaling three articles. For 2022 only two articles were discussed. While the latest article, which was published in 2024, amounted to two articles.
Data on the number of articles along with the year of publication is also presented in the form of a graph which can be seen in Figure 2

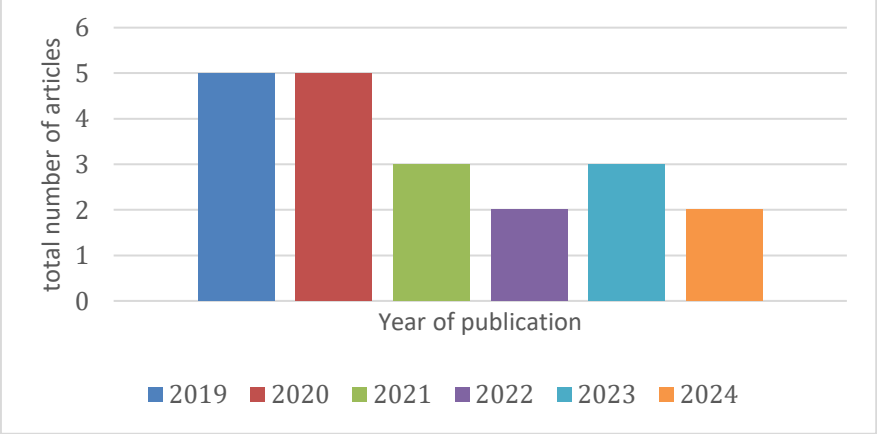

Figure 2 Graph of number of articles by year of publication

It is evident from Figure 2 that the five studies published in 2019 and 2020 received the greatest discussion in our literature review. Meanwhile, in second place are articles from 2021 and 2023, namely three articles. Finally, the fewest are articles published in 2022 and 2024, namely 2 articles. For this investigation, twenty articles were gathered and examined. To get the data, this quantity was regrouped according to the kind of investigation, as shown in Figure 3.

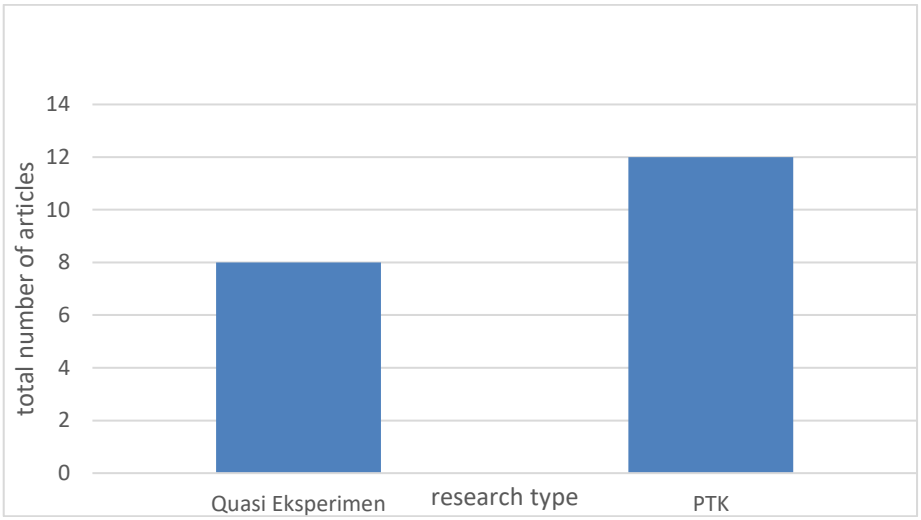

Figure 3 Graph of the number of articles by research type

Figure 3 above shows that 8 articles use quasi-experimental research methods. While articles using research methods of class action research type amounted to 12 articles. Learning outcomes improved for students who used a problem-based learning approach. This is shown by the mean learning outcomes from the pre-test and post-test. The increase in learning outcomes is seen in Figure 4.

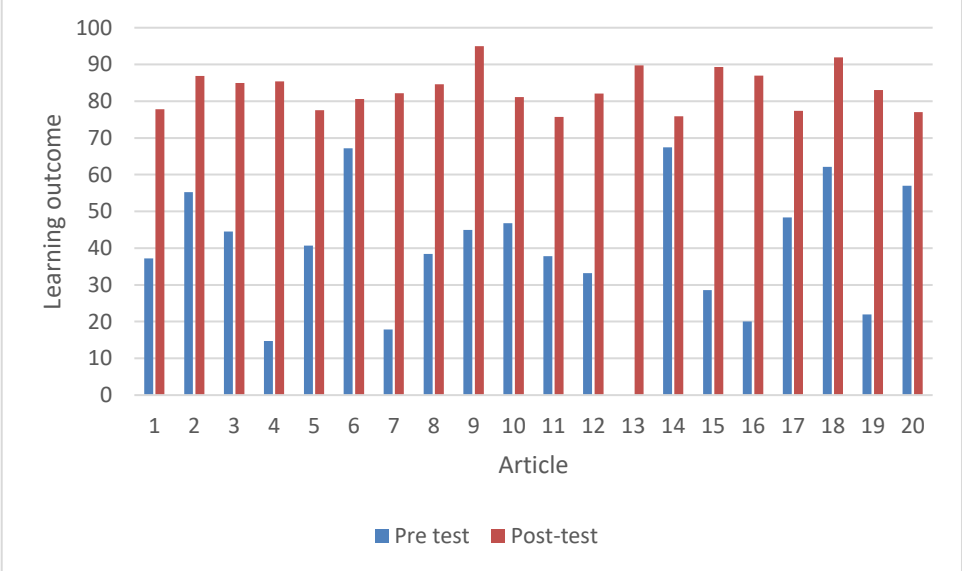

Figure 4 Comparison of pre and post test results

It is evident from Figure 4, which looks at learning outcomes in the cognitive domain, that student learning outcomes significantly improved from the pre-test to the post-test. This supports the findings of Handayani's study, which shows that PBL may enhance cognitive learning outcomes by encouraging students to think critically, which in turn influences the information they acquire. According to Rizki & Adlini (2022) and Kusuma et al. (2024), PBL employs real-world challenges that encourage students to acquire

their own expertise in order to tackle the difficulties. The findings of the literature study on PBL's impact on students' learning outcomes from the 20 chosen publications should outline PBL's learning impact.

CONCLUSION

There is evidence that problem-based learning may significantly enhance student learning results, according to the study review "Improving Learning Outcomes through Problem-Based Learning". The substantial discrepancy between the pre-test and post-test scores serves as evidence for this. Based on these findings, educators and educational institutions are encouraged to incorporate more problem-based learning techniques into their teaching and learning practices. PBL outperforms conventional teaching strategies in developing students' conceptual knowledge, critical thinking, and problem-solving skills, according to research. Furthermore, regular PBL use may foster cooperation and independence, two qualities that are critical for success in both the classroom and the workplace.

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