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THE PROBLEM-BASED LEARNING MODEL INTEGRATED WITH THE INTEGRATED LEARNING MODEL IN SCIENCE LEARNING: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

This study aims to identify and analyze publications on the Problem-Based Learning (PBL) model integrated with the integrated learning model in learning Natural Sciences (IPA) based on research journal articles from 2018 to 2023. The systematic literature review method followed the PRISMA diagram. Data were obtained from 476 national and international articles through Mendeley and Google Scholar. After the screening, 15 articles that met the inclusion criteria were found as samples. The analysis showed that integrated science learning with various models effectively improves student learning outcomes. The development of modules or learning tools can also improve students' abilities and religious characters through integration at every stage of learning. Integrated science learning models such as webbed, connected, nested, and shared have been tested and proved their effectiveness in improving student learning outcomes. However, further exploration is needed regarding integrating the PBL model with the integrated learning model to implement it with better innovation. This research is expected to contribute to the development of education in the future.

MODEL PROBLEM-BASED LEARNING TERINTEGRASI MODEL PEMBELAJARAN TERPADU PADA PEMBELAJARAN IPA: SYSTEMATIC LITERATURE REVIEW

Kata Kunci:

Model pembelajaran terpadu
Problem-based learning
Ilmu pengetahuan alam

ABSTRAK

Penelitian ini bertujuan untuk mengidentifikasi dan menganalisis publikasi tentang penggunaan model *Problem Based Learning* (PBL) yang terintegrasi dengan model pembelajaran terpadu dalam pembelajaran Ilmu Pengetahuan Alam (IPA) berdasarkan artikel jurnal penelitian dari tahun 2018 hingga 2023. Metode tinjauan literatur sistematis digunakan dengan panduan diagram PRISMA. Data diperoleh dari 476 artikel nasional dan internasional melalui Mendeley dan Google Scholar. Setelah penyaringan, ditemukan 15 artikel yang memenuhi kriteria inklusi sebagai sampel. Analisis menunjukkan bahwa pembelajaran IPA terpadu dengan berbagai model efektif meningkatkan hasil belajar siswa. Pengembangan modul atau perangkat pembelajaran juga dapat meningkatkan kemampuan siswa dan karakter religius melalui integrasi pada setiap tahap pembelajaran. Model pembelajaran IPA terpadu seperti *webbed, connected, nested, shared* telah diujicobakan dan membuktikan keefektifannya dalam

meningkatkan hasil belajar siswa. Untuk penelitian selanjutnya perlu eksplorasi lebih lanjut terkait integrasi model PBL dengan model pembelajaran terpadu agar dapat diimplementasikan dengan inovasi yang lebih baik.

1. INTRODUCTION

In recent decades, education methods in Indonesia have undergone significant changes [1]. Innovative learning models such as cooperative and collaborative learning, gamification, project-based learning, and other methods and procedures have replaced conventional learning models, allowing students to actively participate in teaching and learning [2], [3]. Also, Information and Communication Technology (ICT) in education has been actively and effectively used to improve teaching practices [4]. ICT can also help improve teaching efficiency, personalize learning according to individual needs, and provide students with faster and more accurate feedback. With ICT, the learning process can be more interesting, interactive, and relevant to the needs of the times.

Education is very important in creating qualified individuals who contribute positively to society [5]. To achieve this goal, students need to have the ability to think critically, creativity, cooperation, and communication, which are covered in the 4C talents [6], [7]. Qualified human resources will be an important asset for the nation, and education is a means to achieve this goal [5]. Educated humans have the potential to change their circumstances and make a positive contribution to society [8]. The knowledge and skills needed to succeed in the contemporary world have evolved [9]. Critical thinking, creativity, cooperation, and communication skills are part of the 4C talents [6], [7].

Science education is an example of a subject that cannot be taught in isolation. Students must develop their scientific abilities as an integral part of science education. Scientific thinking skills that can be applied in the 21st century are an important aspect of science education [10]. This is because students need to have critical, creative, collaborative, and communicative thinking skills to succeed in today's world. Therefore, creative thinking ability is considered one of the scientific skills acquired through exposure to the scientific method [11].

Creative problem-solving and idea generation require innovative thinking skills. Creative thinking skills can help children learn to think critically and ask deep questions [12]. Students who can think creatively have a higher creative mentality, demonstrate deeper understanding, and achieve optimal learning outcomes [13]. In brief, if we compare children with creative thinking talent with those without creative thinking talent, children without creative thinking tend to have a less developed mentality and lower understanding. Therefore, students need to have creative thinking skills, which is important for finding solutions to problems and generating new ideas as they learn [11].

However, students in Indonesia generally have low levels of creative thinking skills as reflected in the results of assessments such as TIMSS and PISA [14]. Countries to measure students' math and science skills at the primary to secondary school level. The findings indicate a challenge in developing students' creative potential in solving problems and designing new solutions in math and science. The results of the PISA assessment also show that students in Indonesia have low levels of creative thinking skills, an assessment conducted by the OECD (Organization for Economic Cooperation and Development) to measure students' literacy, mathematics, and science skills. The emphasis on complex problem-solving and applying knowledge in real-world contexts indicates the need to improve students' creative thinking skills in Indonesia. So it can be

concluded that both TIMSS and PISA assessment results show that students' creative thinking skills in Indonesia still need to be improved [14]. This is due to the lack of learning models to stimulate creativity, so students are less active in problem-solving and creative idea generation. Therefore, educators must choose learning models that foster critical thinking and creative problem-solving skills, especially in science subjects.

To address this issue, educators must carefully select learning models that foster critical thinking and, in particular, creative problem-solving. One of the appropriate learning models to improve students' creative thinking skills is the PBL model. In this model, students create groups to analyze and solve problems relevant to the real world, so they can develop their creative thinking skills [15].

Various studies have been conducted on applying PBL models to develop scientific, creative thinking skills. However, no Systematic Literature Review (SLR) study comprehensively discusses the PBL model integrated with the integrated learning model in Science Learning. This research aims to collect, describe, and analyze findings from several primary studies that have examined the PBL model integrated with the integrated learning model in science learning. It is expected that this research can make an important contribution to future education development. In practice, students' creative thinking skills can help them solve problems and generate new ideas as they learn [11]. Therefore, educators must choose learning models that foster critical thinking and creative problem-solving, especially in science subjects. One of the learning models that can be used is PBL which is integrated with an integrated learning model in science learning.

The PBL model engages students in solving problems relevant to real-life contexts. Students are given challenges or problems that require solving, and they then seek solutions through investigation and collaboration. This model can also be integrated with an integrated learning model, where learning materials from various subjects are brought together to provide a holistic learning experience. By applying the PBL model integrated with the integrated learning model in science learning, students are expected to actively develop critical thinking and problem-solving skills. They will learn to connect concepts from various subjects, understand the relationship between natural science and the context of everyday life, and generate innovative new ideas.

Many studies related to the PBL model have been carried out, including; PBL to develop creative thinking skills, problem-solving, and learning outcomes [11], [12], PBL to improve critical thinking skills [15], PBL models in integrated science lessons [16], PBL models to improve science process skills: a systematic literature review [17]. However, no research reviews the PBL model in integrated science learning with a systematic literature review. In previous research, a systematic literature review was carried out on the PBL model but implemented to improve science process skills, while this research was on integrated science learning.

This research aims to collect findings from previous primary studies regarding applying PBL models integrated with integrated learning models in science learning. By analyzing these findings, this research can provide deeper insights into the benefits and effectiveness of using this learning model to improve education quality. It is hoped that this research can make an important contribution to future education development by providing recommendations and guidelines for educators in choosing and applying appropriate learning models to improve students' creative thinking, problem-solving, and understanding of science learning.

2. METHOD

This study employed a qualitative approach with the systematic literature review method with PRISMA (Preferred Reporting Items for Systematic Review and Meta-analysis) technique. The research process was carried out to identify and analyze relevant research [18]. The results were used to answer research questions and provide guidelines for further research.

This technique consists of four stages: identification, screening, eligibility, and inclusion. The initial stage is identification, namely searching for articles using the Mendeley application and Google Scholar based on the keywords "PBL Model" and "integrated learning model" with article restrictions from 2018-2023. In the initial search with Mendeley and Google Scholar, 476 articles were obtained that matched the keywords, and then the screening stage was carried out. At this stage, all articles were filtered with criteria according to the limit year, namely 2018-2023, and the suitability of the title, abstract and related topics with predetermined keywords, namely "PBL Model" and "integrated learning model."

The third stage is checking the eligibility of the article content according to the research question, "How is the research of PBL model integrated with integrated learning model in science learning based on the source of journal articles published in 2018-2023?" and summarized in the data mapping table to be more effective in the analysis stage. In checking eligibility, 359 articles were obtained that met the research criteria so that they could proceed to the inclusion stage. The activities carried out at the inclusion stage are reviewing, analyzing the article's contents, and making a summary (synthesis) of the review results to describe the findings related to the PBL model integrated with the integrated learning model in science learning represented by 15 articles. The following PRISMA flowchart illustrates the article selection process.

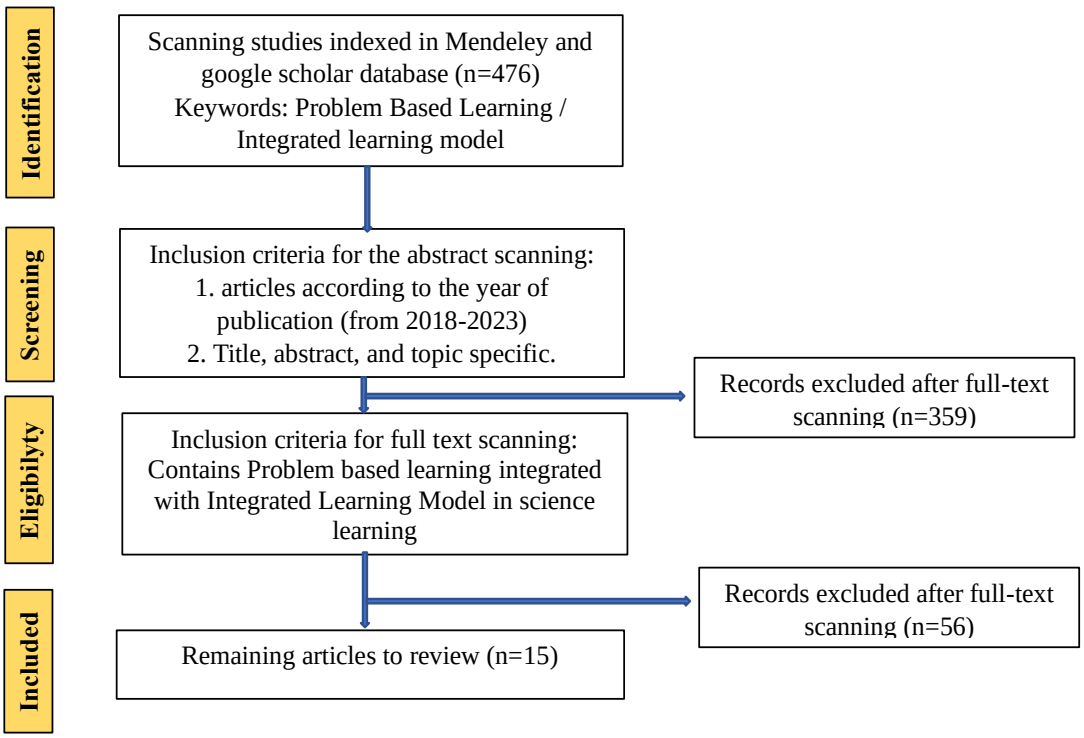

Figure 1. PRISMA Diagram Describing the Article Selection Process

3. RESULTS AND DISCUSSION

In this study, 15 articles were selected as research data after searching and identifying research articles that fit the criteria set by the researcher. The data shows that the publication of articles on PBL models integrated with integrated learning models in science learning from 2018-2023 is dominated by experimental research, followed by R&D research and literature review. The data discusses the PBL model integrated with the integrated learning model in tabular form and can be found in the Article Identity section (Table 1).

Table 1. Article Identity

No	Writer's Name	Journal / Index	Title	Year of Publication	Research Methods
1	(Efendi et al., 2022) [19]	Naturalistic; Journal of Research and Education and Learning Studies / Sinta 3	The Effectiveness of Webbed Type Thematic Learning Model Assisted by Technology Media on Learning Outcomes of Elementary School Students of Cluster 29 Campagaloe, Bantaeng Regency.	2022	Experiment
2	(Wibowo et al., 2021) [20]	Scientific Journal of Physics Education / Sinta 3	Development of Integrated Science Learning Devices Connected Type Material Concept of Light	2021	R&D
3	(Ramadita et al., 2021) [21]	Scientific Journal of Physics Education / Sinta 3	Implementation of STEM-Based Integrated Model Integrated Curriculum using Flipped Classroom to Improve Mastery of Concepts	2021	Experimental
4	(Nuraida et al., 2019) [22]	Quagga: Journal of Education and Biology / Sinta 3	Implementing Nested Integrated Learning By Integrating Excretory System Topics and Science Process Skills.	2019	Experimental
5	(Putri et al., 2022) [23]	Educative: Journal Of Educational Sciences / Sinta 4	Shared Model Analysis on Integrated Thematic Learning in Elementary Schools.	2022	Literature Review
6	(Suryadi et al., 2020) [24]	Integrated Science Journal / Sinta 4	Development of Contextual-Based Contextual-Based Webbed Type Integrated Science Learning Handout for Grade VIII Students Food Theme.	2020	R&D
7	(Priscylio & Anwar, 2019) [25]	Journal of Incandescent Mipa / Sinta 4	Integration of Science Teaching Materials Using the Robin	2019	Literature Review

			Fogarty Model for the Science Learning Process in Middle Schools		
8	(Indraningrum et al., 2018) [26]	Inkuiri: Science Education Journal / Sinta 4	-Based Iqra-Based Integrated IPA Module with Beach Environment Themes to Empower the Religious Character of Class V II Middle School/Mts Students Semester I I.	2018	R&D
9	(Oprasmani, 2019) [27]	Life Pedagogy / Sinta 3	IPA Worksheets Oriented PBL model Against Cognitive Grade V II Middle School Students.	2019	Experimental
10	(Reinita, 2020) [28]	Journal of Moral and Civic Education / Sinta 3	Increasing Integrated Thematic Learning Outcomes with PBL model in Elementary Schools	2020	Experimental
11	(Al Muhayani & Fatmariza, 2022) [29]	Pendas / Sinta Cakrawala Journal 3	Application of the PBL Model to Increase Opinion Creativity and Learning Outcomes in Integrated Thematic Learning	2022	Experimental
12	(Febrianti et al., 2019) [16]	Journal of Incandescent Mipa / Sinta 4	Differences in Student Learning Outcomes in the Use of PBL Learning Models with Guided Discovery Learning Learning Models in Integrated Science Subjects	2019	Experimental
13	(Irwansyah, 2018) [30]	Oryza (Journal Of Biology Education) / Sinta 4	Development of Integrated Science Learning Devices Oriented to the PBL Model with an Integrative Approach to Improve Students' Attitudes and Knowledge Competence.	2018	R&D
14	(Lestari et al., 2021) [31]	Journal Of Basic Education Nusantara / Sinta 4	The Effect of PBL Implementation on Achievement Motivation and Critical Thinking Ability in Integrated Thematic Learning Class IV SD Gugus IV, Mendoyo District.	2021	Experimental

15	(Suparno et al., 2019) [32]	Inkuiri: Science Education Journal / Sinta 4	Development of an Integrated Science Module for PBL Middle School / MTS with the theme of Photosynthesis to Improve Critical Thinking Ability.	2019	R&D

The results showed that the study of the PBL model integrated with the integrated learning model is still limited to two aspects, namely the PBL model in integrated science learning and the integrated learning model in science learning. This data is summarized in Table 2.

Table 2. Results of Article Analysis

No	Article	Level of Education	Type of Integrated Learning Model, Which is Integrated	Research Result
1	A2	Elementary School	Webbed	The integrated learning model is effective and can improve the quality of students
2	A3	Junior High School	Connected	The light concept material is feasible to use as an integrated science learning device of the connected type. This development product can be used as an alternative to learning the concept of light.
3	A4	Junior High School	Integrated	the implementation of an integrated STEM-based integrated curriculum model was able to improve students' mastery of the concept of global warming material.
4	A5	Junior High School	Nested	there are differences in the science process skills of students who use nested integrated learning and those who do not use nested integrated learning.
5	A6	Elementary School	Shared	learning Integrated Thematic learning in Elementary Schools has a positive and significant impact on understanding integrated thematic learning, being active in learning, mastering learning concepts, and improving three aspects of learning in students.
6	A7	Junior High School	Webbed	contextual-based webbed-type integrated science learning handout on the food theme is appropriate for learning science in schools.
7	A8	Junior High School	10 Robin Fogarty Models	The integrated learning model from Robin Fogarty is applied in developing science teaching materials. Research on developing science teaching materials includes the type of integration used.
8	A9	Junior High School	Connected	the integrated science module of the Connected type based on Iqra, the theme of the coastal environment to empower students' religious character has the characteristics that the learning steps in the module are adjusted to the Iqra learning steps and integrate religious characters at each stage, 2) the module is categorized as feasible because it has gone through several feasibility tests.
9	A10	Junior High School	PBL-Integrated	Integrated science worksheet oriented PBL model affects students' cognitive learning outcomes.
10	A11	Elementary School	PBL-Integrated	the PBL model can improve student outcomes in integrated thematic learning in elementary schools.

11	A12	Elementary School	PBL-Integrated	the PBL learning model can increase the creativity of opinion and student learning outcomes in integrated thematic learning in class V of Elementary School.
12	A13	Junior High School	PBL-Integrated	Integrated science learning outcomes using the PBL learning model are higher than those using the Guided Discovery Learning learning model.
13	A14	Islamic Junior High School	PBL-Integrated	Developing integrated science learning tools oriented to PBL models with an integrative approach can improve students' attitudes and knowledge competencies.
14	A15	Elementary School	PBL-Integrated	Using the PBL, learning model positively impacts students' achievement motivation and critical thinking skills. Students who engage in PBL tend to be more motivated to achieve high achievement and have better critical thinking skills than those who follow conventional learning.
15	A16	Junior High School	PBL-Integrated	(1) the problem-based integrated science module with the theme of photosynthesis was developed using a PBL component using a 4-D model covering Define, Design, Develop, and Disseminate, (2) the feasibility of the problem-based integrated science module with the theme of photosynthesis that was developed was in a good category based on the assessment of experts, practitioners, and student responses, and (3) students' critical thinking skills after participating in the learning process using the problem-based integrated science module with the theme of photosynthesis have increased

Based on the data analysis presented, it is evident that the integration between PBL and Integrated Learning Model in Science Learning significantly impacts students' quality. This is supported by several previous studies. The webbed integrated learning model effectively improves students' quality [19]. Furthermore, implementation of a STEM-based integrated curriculum can improve students' mastery of concepts on global warming material [21]. Integrated thematic learning in elementary schools has a positive impact on understanding integrated thematic learning, being active in learning, mastering learning concepts and improving three aspects of learning in students [33].

Learning tools are also an important aspect of integrated learning, and the development of learning tools has been shown to significantly impact science learning. Integrated science worksheets oriented to PBL models affect student cognitive learning outcomes [27]. Integrating integrated science learning tools with an integrative approach oriented to the PBL model can improve students' attitudes and knowledge competencies [30]. A problem-based integrated science module with the theme of photosynthesis was developed using PBL components using the 4-D model, and the module was feasible to use [32]. It could improve students' critical thinking skills. From these findings, it can be concluded that integrated science learning with different models effectively improves students' quality and learning outcomes [34]. These models include webbed, connected, nested, PBL, and integrated thematic learning. These models have advantages in helping students understand science concepts holistically, relate to the context of their lives, and gradually gain a deep understanding.

In addition, the integration between PBL and the integrated learning model positively impacts science process skills, cognitive learning outcomes, and student creativity [31]. Using the PBL approach, students are invited to be actively involved in solving real problems, working collaboratively, and making connections between science

concepts and real-world situations. This not only improves student understanding but also develops critical thinking skills, teamwork skills, and innovation.

The development of modules or learning tools can also be an important factor in improving student learning outcomes and empowering religious characters through integration at every stage of learning [26]. In the context of integrated science learning, well-designed learning modules can help students integrate science concepts with religious, ethical, and moral values.

Based on research and case studies that have been conducted, the use of PBL in integrated science learning has proven effective in improving the quality of learning and student learning outcomes [29], [16]. Students involved in integrated science learning with the PBL approach achieved higher levels of understanding, better critical thinking skills, and higher learning motivation than students who did not use the approach. Thus, it can be concluded that integrated science learning with different models, PBL integration, and learning module development are effective approaches to improving student learning outcomes, science process skills, creativity, and learning motivation [29], [30]-[32].

4. CONCLUSION

In the research results, it was found that the PBL model that focuses on students and is supported by teachers as facilitators and students actively participate in learning has a positive impact on the development of science process skills, cognitive learning outcomes, and student creativity, as well as achievement motivation and critical thinking ability. In addition, integrated science learning with different models effectively improves students' quality and learning outcomes.

Therefore, it can be concluded that integrating the PBL model and the integrated learning model is the right approach to achieving the goals and interests of integrated science learning, especially in developing students' critical and creative thinking skills. More extensive exploration of the PBL model integrated with the integrated learning model still needs to be done to implement it in the classroom with better innovations.

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