JURNAL ADMINISTRASI PENDIDIKAN INDONESIA
VOL. 16 No. 1, Th. 2025 (91-102)

(Print ISSN 2613-9561 Online ISSN 2686-245X)
Tersedia online di http://ejournal2.undiksha.ac.id/index.php/jurnal_ap

PROBLEM BASED LEARNING MODEL ON LEARNING MOTIVATION AND SCIENCE LEARNING ACHIEVEMENT OF GRADE IV

Diterima: 10 Februari 2025; Direvisi: 20 Maret 2025; Disetujui; 18 April 2025
Permalink/DOI: https://doi.org/10.23887/jurnal_ap.v16i1.6049

Ni Nyoman Adi Indradewi[1], I Nyoman Jampel[2], I Wayan Suastra[3]
[1,2,3] Pendidikan Dasar, Universitas Pendidikan Ganesha, Singaraja
e-mail: adi.indradewi@student.undiksha.ac.id, jampel@undiksha.ac.id, wayan.suastra@undiksha.ac.id

Abstrak

Permasalahan dalam penelitian ini berangkat dari rendahnya motivasi dan prestasi belajar siswa pada mata pelajaran Ilmu Pengetahuan Alam (IPA) di tingkat sekolah dasar, yang disebabkan oleh penggunaan model pembelajaran konvensional yang masih berpusat pada guru. Penelitian ini bertujuan untuk menganalisis pengaruh model Problem Based Learning (PBL) terhadap motivasi belajar dan prestasi belajar IPA siswa kelas IV SD. Subjek penelitian terdiri atas dua kelompok, yaitu kelas eksperimen yang menggunakan model PBL dan kelas kontrol yang menggunakan metode pembelajaran konvensional. Penelitian ini menggunakan pendekatan kuantitatif dengan desain eksperimen semu (quasi experiment) berbentuk posttest-only control group design. Teknik pengumpulan data dilakukan melalui angket motivasi belajar dan tes prestasi belajar IPA yang telah divalidasi oleh ahli. Data dianalisis menggunakan teknik statistik deskriptif dan inferensial, meliputi uji prasyarat analisis (uji normalitas, homogenitas, dan kolinearitas) serta pengujian hipotesis dengan Analisis Varian (ANOVA) dan Analisis Multivariat (MANOVA) menggunakan bantuan perangkat lunak SPSS 26.0 for Windows. Hasil penelitian menunjukkan bahwa terdapat perbedaan yang signifikan dalam motivasi belajar dan prestasi belajar IPA antara siswa yang dibelajarkan dengan model Problem Based Learning dan siswa yang dibelajarkan dengan model pembelajaran konvensional. Penerapan PBL terbukti mampu meningkatkan motivasi belajar siswa melalui pembelajaran kontekstual yang berpusat pada siswa, serta meningkatkan prestasi belajar IPA melalui proses berpikir kritis, pemecahan masalah, dan kolaborasi kelompok. Dengan demikian, model Problem Based Learning dapat direkomendasikan sebagai alternatif strategi pembelajaran yang efektif dalam meningkatkan kualitas pembelajaran IPA di sekolah dasar.

Kata kunci: *Problem Based Learning, Motivasi Belajar, Prestasi Belajar, Pembelajaran IPA, Sekolah Dasar*

Abstract

The problem in this study departs from the low motivation and learning achievement of students in Natural Sciences (IPA) subjects at the elementary school level, which is caused by the use of conventional learning models that are still teacher-centered. This study aims to analyze the influence of the Problem Based Learning (PBL) model on the learning motivation and learning achievement of science students in grade IV of elementary school. The research subjects consisted of two groups, namely the experimental class that used the PBL model and the control class that used conventional learning methods. This study uses a quantitative approach with a quasi-experiment design in the form of a posttest-only control group design. The data collection technique is carried out through a learning motivation questionnaire and a science learning achievement test that has been validated by experts. Data were analyzed using descriptive and inferential statistical techniques, including analysis prerequisite tests (normality, homogeneity, and collinearity tests) and hypothesis testing with Variance Analysis (ANOVA) and Multivariate Analysis (MANOVA) using the help of SPSS 26.0 for Windows software. The results showed that there was a significant difference in learning motivation and science learning achievement between students who were taught with the Problem Based Learning model and students who were taught with the conventional learning model. The application of PBL has been proven to be able to increase student learning motivation through student-centered contextual learning, as well as improve science learning achievement through critical thinking processes, problem-solving, and group collaboration. Thus, the Problem Based Learning model can be recommended as an alternative to an effective learning strategy in improving the quality of science learning in elementary schools

Keywords: *Problem Based Learning, Learning Motivation, Learning Achievement, Science Learning, Elementary School*

INTRODUCTION

Ideally, education in elementary school not only aims to instill academic knowledge, but also to develop students' full potential, including learning motivation and academic achievement (Abdillah, 2021; Sundari & Fauziati, 2021). In the context of Natural Sciences (IPA) learning, students are expected to be able to think scientifically, actively seek, discover, and apply concepts independently through exploratory and experimental activities(Sinta et al., 2022; Wahyuni, 2022). Science learning should be able to foster high motivation for learning, where students are encouraged to understand natural phenomena through curiosity and hands-on experience. Strong learning motivation theoretically has a significant effect on learning achievement, because motivated students will show perseverance, active involvement, and the ability to solve problems well (Ariyanti & Yusro, 2023; Atta et al., 2020). Therefore, teachers should ideally carry out student-centered learning-oriented learning, using models and media that are able to foster intrinsic and extrinsic motivation so that it has a positive impact on improving science learning achievement (Andini & Agung, 2022; Jannah et al., 2021).

But in reality, the conditions of science learning in elementary schools are still far from ideal. Based on the results of observations and interviews at SD Gugus II, Kuta District, it was found that students' motivation to learn science subjects is still low. Many students show a passive attitude and lack of enthusiasm in participating in learning activities, which is characterized by low participation in discussions and a tendency to wait only for the teacher's instructions. The completeness of students' science knowledge skills is also still not optimal, as can be seen from the low percentage of achievement of the Learning Objective Completeness Criteria (KKTP). This is exacerbated by the habit of teachers who are still dominant in using conventional lecture methods without the support of innovative learning models or interactive media(Budiarto & Jazuli, 2022; Jayadiningrat et al., 2022). The teacher-centered learning process does not have the opportunity to discover their own concepts or apply the knowledge learned in a real context. As a result, students have difficulty understanding abstract concepts of science and experience a decrease in learning motivation which has a direct impact on their low academic achievement (Adnyani et al., 2020; Arifin et al., 2023). These findings are in line with the results of international surveys such as those that show the low science achievement of Indonesian students compared to other countries, indicating the need to update science learning strategies in elementary schools(Fatra et al., 2022; Mejía-Rodríguez et al., 2021).

From the description above, there is a real gap between the ideal conditions of science learning (das sollen) and the practice that occurs in the field (das sein). Normatively, science learning should be active, contextual, and discovery-based that is able to foster motivation and improve student learning achievement. However, reality shows that students actually experience boredom and low interest in learning due to the dominance of lecture methods and the lack of implementation of challenging problem-based learning. This gap indicates that the learning approach used has not been able to meet the psychological and cognitive needs of elementary school students who tend to learn effectively through hands-on experience and problem-solving. Therefore, learning model innovations are needed that can foster students' intrinsic motivation while improving their learning achievement through the process of critical and exploratory thinking.

The Problem Based Learning (PBL) model has a number of advantages that make it effective in increasing student motivation and learning achievement(Ariyanti & Yusro, 2023; Wibawa et al., 2024). Through the stages of problem-based learning starting from orientation, identification, information collection, discussion, to the preparation of PBL Solutions, students are placed as active subjects who are directly involved in the learning process(Nurmasari, 2023; Zulfa et al., 2023). Learning becomes more meaningful because students face real problems that are relevant to daily life, thus fostering curiosity and responsibility for their learning process. PBL is also able to increase intrinsic motivation, because students learn not because of external motivation, but because of the need to solve interesting problems (Andriyani & Suniasih, 2021a; Mareti & Hadiyanti, 2021)

In addition, PBL has been proven to be effective in developing critical, creative, and collaborative thinking skills. Through group discussion activities and presentation of problem-solving results, students are trained to express opinions, respect other people's ideas, and work together to achieve the best solution(Mareti & Hadiyanti, 2021; Wibawa et al., 2024; Zulfa et al., 2023). This model is in line with the demands of the Independent Curriculum, which emphasizes active, contextual, and oriented learning to strengthen scientific character. Thus, the application of PBL not only improves students' cognitive learning outcomes in science subjects, but also shapes scientific attitudes, confidence, and social skills needed in 21st century life (Andriyani & Suniasih, 2021b; Anggreni et al., 2021; Zulfa et al., 2023).

Several previous studies have shown the effectiveness of PBL in increasing motivation and learning achievement. For example, research shows that PBL can develop students' critical thinking skills and learning motivation in science learning (Indriani et al., 2022; Salombe & Harjono, 2022) Similar findings were also revealed that PBL is able to improve learning outcomes through collaborative processes and real problem-solving (D. P. S. Putri & Wiarta, 2023; Zulfa et al., 2023). However, most of the research focuses on the junior high or high school level, while its application in elementary schools, especially in the local context of SD Cluster II in Kuta District, is still very limited.

This research has an element of novelty because it empirically examines the influence of the Problem Based Learning (PBL) model on the motivation and learning achievement of elementary school students in the context of learning that is still dominated by conventional methods. This innovation is in line with the direction of the Independent Curriculum which emphasizes active, contextual, and student-centered learning. The purpose of this study is to analyze the influence of the application of the PBL model on the motivation and learning achievement of science students in grade IV of SD Cluster II, Kuta District for the 2024/2025 Academic Year, and compare it with learning outcomes using the lecture method. The results of the research are expected to make an empirical contribution to the application of innovative learning models that are able to improve student engagement and learning outcomes in elementary schools.

METHOD

This study uses a quantitative approach with a quasi-experiment method, because it involves a control group but does not allow researchers to randomize individuals in full (Pellas, 2024; A. S. Putri et al., 2023) The research design used is a post-test only non-equivalent control group design, which aims to determine the effect of the application of the Problem Based Learning (PBL) model on the learning motivation and learning achievement of elementary school students. This design involved two groups, namely the experimental group that was given treatment using the PBL model and the control group that used conventional learning methods in the form of lectures and questions and answers(Liu et al., 2020; Yang et al., 2023)

This research was carried out at SD Gugus II, Kuta District in the even semester of the 2024/2025 Academic Year. The research population is all grade IV students from five elementary schools that are members of Cluster II of Kuta District. Sampling is carried out using a class-based random sampling technique (cluster random sampling) because classes have been formed naturally. The selection of experimental classes and control classes is carried out through a lottery process. Furthermore, each class received different treatment, but with the same duration, time, and material so that the results could be compared fairly.

This research consists of three main stages, namely the pre-experimental stage, the experimental implementation stage, and the post-experiment stage. In the pre-experiment stage, the researcher prepares all research needs, such as learning tools in the form of teaching modules, Student Worksheets (LKPD), and learning media, as well as data collection instruments in the form of learning achievement tests and learning motivation questionnaires. The instrument is validated first by experts before being used in the field. In addition, perception equalization was carried out with grade IV teachers who are research collaborators so that the implementation of learning in the classroom runs according to procedures.

The experimental implementation stage was carried out for eight meetings with a time allocation of 2 × 40 minutes per meeting, as well as one meeting for the implementation of the post-test. In the experimental group, learning was carried out by applying the Problem Based Learning model which consisted of several steps, namely: (1) student orientation to the problem; (2) the organization of students to learn; (3) individual and group investigation guidance; (4) the development and presentation of works; and (5) analysis and evaluation of the problem-solving process. Teachers act as facilitators who help students find solutions through discussion and exploration activities. Meanwhile, in the control group, teachers carried out learning by lecture, question and answer, and assignment methods as usual in conventional teaching and learning activities.

The post-experimental stage is carried out after the entire learning series is completed. At this stage, the researcher gave a post-test in the form of a science learning achievement test and a learning motivation questionnaire to both groups to find out the results after treatment. The data that has been collected is then processed using descriptive and inferential statistical analysis to test the influence of the PBL model on student motivation and learning achievement. Before the hypothesis test is carried out, an analysis prerequisite test is first carried out which includes a normality test, a homogeneity test, and a correlation test between bound variables.

During the implementation of the research, the researcher maintained treatment fidelity by ensuring that each stage of learning in the experimental class was carried out according to the PBL syntax. The teachers involved are given directions and implementation guidelines so that there are no deviations in the application of the model. In addition, research ethics are also considered through the granting of official permits to school principals and teachers, as well as the submission of information to parents of students related to the implementation of research. With these steps, this study is expected to provide a valid and reliable picture of the effect of the application of the Problem Based Learning model on the learning motivation and learning achievement of elementary school students. The grid of the test instrument can be seen in Table 1.

Table 1. Learning Achievement Instrument Grid

Learning Outcomes (CP)	Indicator	Cognitive Dimension	Item Number	Number of Items
Explain the source and form of energy and explain the process of changing the form of energy in daily life.	Explaining energy sources	C2K2	21, 28	2
	Explaining the forms of energy	C2K2	1,2,18	3
	Explain changes in energy forms in daily life	C2K2	4,3,20,29	4
	Distinguishing the change in the form of energy in daily life	C2K2	5,6	2
	Exemplify the process of changing the form of energy in daily life	C2K2	7,30	2
	Exemplify the energy included in the form of potential energy	C2K2	8,22,23,27	4
	Explain kinetic energy	C2K2	9,24	2
	Exemplify the energy included in kinetic energy	C2K2	11,12	2
	Discuss changes in the form of chemical energy in daily life	C2K2	15,19,26	4

Learning Outcomes (CP)	Indicator	Cognitive Dimension	Item Number	Number of Items
	Discuss the changes in the form of light energy that exist in everyday life	C2K2	10,13,17	3
	Explain how to save energy in everyday life	C2K2	14,16,25	4
Sum				30

Before collecting data on student learning motivation, a grid of science learning motivation instruments was first compiled as a reference in the preparation of statement items on the questionnaire. The preparation of this grid aims to ensure that each statement item made truly represents the aspects and indicators of learning motivation that are to be measured. This instrument uses a Likert scale with five alternative answers that describe the level of approval of respondents to each statement. The grid is compiled based on the theory of learning motivation which includes two main aspects, namely intrinsic motivation and extrinsic motivation, each of which consists of several indicators and sub-indicators. The grid of learning motivation instruments can be seen in Table 2.

Table 2**.** Learning Motivation Instrument Grid

Aspects	Indicator	Sub Indicator	No Item		Number of Items
			Positive	**Negative**	
Intrinsic	The existence of Desire and desire to succeed	Work on tasks on time	1,2	3	8
		Not satisfied with the results achieved	4,5	6	
		Challenged to work on difficult problems	7,8		
	The existence of encouragement and need in learning	Curiosity	9,10	11	4
		Interest in learning	12		
	The existence of hopes and ideals	Efforts to achieve goals	13,14		4
		Perseverance in learning	15	16	
Extrinsic	Learning rewards	Rewards and punishments	17	18	3
		Getting praise	19		
	The existence of interesting activities in learning	Creative in the delivery of material	29,21	22	3
	The existence of a conducive learning environment	The atmosphere of the study place	23,24	25	3
Sum			**18**	**7**	**25**

RESULTS AND DISCUSSION

Result

The description of the data in this study includes four groups of variables, namely: student learning motivation learned with the *Problem Based Learning* model, student learning motivation learned with the conventional learning model, science learning achievement of students learned with the *Problem Based Learning* model, and the science learning achievement of students who are taught with conventional learning models. The data of this study was analyzed using mean values, median, mode, standard deviation, minimum score, and maximum score. The research was carried out for eight meetings by applying the *Problem Based Learning* model in experimental classes to increase student motivation and learning achievement through learning based on real problem solving. At the end of the learning cycle, *a post test is carried out* to measure the level of learning motivation and science learning achievement of students. In order for the implementation *of the Problem Based Learning model* to be in accordance with the research objectives, the Learning Implementation Plan (RPP) is prepared and discussed with the teacher before the learning activity. The results of the Descriptive Analysis can be seen in Table 3.

Table 3. Descriptive Analysis Results

Descriptive Statistics								
	N	Range	Minimum	Maximum	Mean		Hours of deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
A1Y1	27	35.00	111.00	146.00	128.1111	1.80639	9.38630	88.103
A1Y2	29	39.00	95.00	134.00	113.4483	1.71962	9.26046	85.756
A2Y1	27	20.00	75.00	95.00	87.5926	1.01170	5.25693	27.635
A2Y2	29	15.00	65.00	80.00	71.7241	.66934	3.60453	12.993
Valid N (listwise)	27							

Information:
A1Y1 : Students' learning motivation in experimental classes
A1Y2 : Student learning motivation in the control class
A2Y1 : Student learning achievement in experimental classes
A2Y2 : Student learning achievement in the control class

Before hypothesis testing with the ANAVA and MANOVA methods, a prerequisite test analysis was first carried out to ensure that the data met the necessary assumptions. Prerequisite tests include normality tests, homogeneity tests, and intervariable correlation tests. The normality test aims to ensure that the data comes from a normally distributed population. Testing was carried out on the variables of learning motivation and science learning achievement between the group taught using the Problem Based Learning model and the conventional learning group, using the Kolmogorov-Smirnov and Shapiro-Wilk methods at a significance level of 0.05 through the help of SPSS 25.0 for Windows software. The results of the normality test of the distribution of effectiveness test data in the study can be seen in Table 4.

Table 4. Normality Test Results

		Kolmogorov-Smirnova		
		Statistic	df	Itself.
Data	Motivation to learn in experimental classes	.075	27	.200*
	Motivation to learn in the control class	.101	29	.200*
	Learning performance in experimental classes	.091	27	.200*
	Learning achievement in the control class	.109	29	.200*

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Normality tests are performed to ensure that the data comes from a normally distributed population. The test used the Kolmogorov-Smirnov method with the help of SPSS 25.0 for Windows on the variables of learning motivation and science learning achievement, both in the experimental and control groups. The test results showed that the overall significance value was greater than 0.05, so the data were declared to be normally distributed and met the assumptions for follow-up analysis using ANOVA and MANOVA.

Furthermore, the variance homogeneity test was carried out with the Box's M test at a significance level of 0.05 using SPSS. The results showed a significance value greater than 0.05, which means that the data had homogeneous variance between groups, making them eligible for a hypothesis test. The results of the homogeneity test can be seen in Table 5.

Table 5. Homogeneity Test Results

Test Results		
Box's M		4.703
F	Approx.	1.544
	df1	3

df2	20933.811
Itself.	.201
Tests null hypothesis of equal population covariance matrices.	

It can be understood that the results of the analysis show that the resulting significance number is significantly greater than 0.05. Thus, it can be concluded that the variables of learning motivation and science learning achievement are homogeneous. The Collinearity Test aims to find a relationship or correlation between *the Problem Based Learning model* and students' learning motivation and science learning achievement. This variable collinearity test was carried out with a product moment correlation test using the help of SPSS 26.0 *for Windows*. If two or more related variables have a high correlation (> 0.8), then these variables are used as covariates (Candiasa, 2020). The data from the collinearity test can be seen in Table 6.

Table 6. Collinearity Test Results

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Hours deviation	ofStd. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Grades - Classes	55,95	12,32	1,11	53,75	58,16	50,16	121	<0.001

Based on the data presented in Table 6, it is known that the correlation value between the variable of learning motivation and science learning achievement is 0.318. The correlation value is less than 0.800, which indicates that the relationship between the two variables is very weak. Therefore, the analysis can be continued with the MANOVA test. Based on the results of the normality test, the data was declared to be normally distributed both univariate and multivariate. In addition, the variance homogeneity test showed that the variance between groups was homogeneous, the results of the variance-covariance matrix test showed the nature of homogeneity, and the collinearity test stated that the correlation between the related variables was very weak. With all these assumptions being fulfilled, the next step is to test the hypothesis using the One Way Multivariate Analysis of Variance (MANOVA) method. The results of the MANOVA test can be seen in Table 7.

Table 7. Hypothesis Test Results with MANOVA

Multivariate Testsa							
Effect		Value	F	Hypothesis df	Error df	Itself.	Partial Eta Squared
Intercept	Pillai's Trace	.997	8833.319b	2.000	53.000	.000	.997
	Wilks' Lambda	.003	8833.319b	2.000	53.000	.000	.997
	Hotelling's Trace	333.333	8833.319b	2.000	53.000	.000	.997
	Roy's Largest Root	333.333	8833.319b	2.000	53.000	.000	.997
X	Pillai's Trace	.465	23.071b	2.000	53.000	.000	.465
	Wilks' Lambda	.535	23.071b	2.000	53.000	.000	.465
	Hotelling's Trace	.871	23.071b	2.000	53.000	.000	.465
	Roy's Largest Root	.871	23.071b	2.000	53.000	.000	.465
a. Design: Intercept + X							
b. Statistically accurate							

Based on the results of the analysis, the Fcal value was obtained at 53,000 for the four statistical indicators, with a significance value of 0.000 which is smaller than 0.05. In addition, the Ftabel value used as a comparison is 3.16. Since the value of Fcal > Ftable, the decision taken is to reject H_0 and accept H_1. These results show that there is a significant simultaneous difference between the learning motivation and learning achievement of science students who are taught using *the Problem Based Learning* model compared to students who are taught using the conventional learning model. This means that *the Problem Based learning* model has a more effective impact on increasing students' learning motivation and science learning achievement. The significant F-value in the four statistical indicators, namely *Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root*, shows the strength of the influence of the learning model used on the two variables analyzed.

Discussion

The Problem Based Learning (PBL) model is theoretically and empirically proven to be able to increase learning motivation and learning achievement because it has learning characteristics that directly meet the psychological, cognitive, and social needs of students in the learning process. PBL functions not only as a material delivery strategy, but as a learning system that stimulates students to think, interact, and solve real problems independently and collaboratively (Khakim et al., 2022; Tanjung et al., 2020). In the context of science learning in primary school, this model is able to relate theory to the practice of daily life so that learning becomes relevant, meaningful, and challenging (Šliogerienė et al., 2025; Wardhani et al., 2024) Such a learning process not only enriches conceptual knowledge, but also fosters students' internal interest and drive to continue learning (Indarini, 2024; Masruroh & Arif, 2021)

From the perspective of learning motivation, PBL operates on the principle of Self-Determination Theory which emphasizes the importance of three basic psychological needs: autonomy, competence, and relatability. In the PBL model, these three aspects are fulfilled naturally. Students feel autonomous because they are directly involved in the decision-making process when identifying problems and determining how to solve them. They also develop a sense of competence when successfully understanding and solving complex problems through analysis, experimentation, or group discussions (Ardithayasa et al., 2022; Octaviana et al., 2023). Meanwhile, social interaction during group work strengthens the sense of relatedness between students. When these three psychological needs are met, the intrinsic motivation of students to learn is significantly increased not by compulsion, but by awareness and the desire to understand. In contrast to conventional methods that are more oriented towards teacher instruction, PBL fosters a sense of ownership of learning, where students feel that the learning process is their own. This explains why PBL has a strong positive correlation with increased learning motivation (Khakim et al., 2022; Simbolon & Koeswanti, 2020)

Furthermore, in terms of science learning achievement, the positive relationship between the application of the PBL model and the improvement of learning outcomes can be explained through the theory of constructivism(Salsabila & Muqowim, 2024; Sugrah, 2020) In PBL, students do not just receive ready-made knowledge from the teacher, but construct their own knowledge through the process of investigation and reflection on the problems faced. This process trains students to think critically, analyze information, and draw conclusions based on their own data and learning experiences. When students actively build their knowledge, comprehension retention increases because they not only memorize facts, but understand concepts and their relationships in depth. Thus, the learning process becomes more meaningful learning than just rote learning (learning memorization) (Ariyanti & Yusro, 2023; Nirwana et al., 2024)

In addition, PBL provides space for students to develop higher order thinking skills (HOTS), which include analysis, synthesis, evaluation, and problem-solving skills. Through the stages in PBL such as problem identification, self-investigation, group discussions, and reflection, students practice connecting old knowledge with new knowledge, testing hypotheses, and applying concepts in different contexts (Aryadi & Margunayasa, 2022; Julianti et al., 2021). This is very important in science learning which emphasizes scientific skills and understanding of natural phenomena. In other words, PBL increases the transfer of learning, which is the ability of students to apply what they have learned in new situations outside the classroom(Ariyanti & Yusro, 2023; Zulfa et al., 2023).

In terms of affective and cognitive aspects, PBL has a synergistic effect. Increasing learning motivation will strengthen students' efforts in understanding and mastering the material, so that it indirectly also increases learning achievement. Motivated students will be more diligent, more focused, and faster to find effective study strategies. Thus, PBL has a direct influence on learning achievement, as well as an indirect influence through learning motivation. This relationship is a dual causality, where increased motivation to learn accelerates improved learning outcomes, and conversely, success in learning strengthens students' motivation to continue learning.

This study has several limitations, including the limited implementation of one elementary school cluster so that the results cannot be generalized widely, and the relatively short learning duration so that it does not fully describe the long-term impact of the application of the Problem Based Learning (PBL) model. However, this study has the advantage of successfully providing empirical evidence that PBL is able to significantly increase motivation and achievement in science learning compared to conventional learning. As for the implications, the results of this study can be a reference for teachers to implement PBL as an alternative active learning model that is relevant to the demands of the Independent Curriculum, as well as for curriculum developers in designing learning strategies that are more contextual, collaborative, and student-centered.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the application of the Problem Based Learning (PBL) model has a significant effect on increasing the learning motivation and learning achievement of science students in elementary school. This model is able to create an active, collaborative, and contextual learning process so that students not only understand concepts in depth, but also engage emotionally and intellectually in learning activities. PBL provides space for students to think critically, solve real problems, and develop a sense of responsibility and confidence in their learning process. Thus, compared to conventional learning, the PBL model has been proven to be more effective in fostering the spirit of learning while improving students' academic outcomes. These results confirm that the implementation of PBL is in line with the Independent Curriculum paradigm, which emphasizes meaningful and student-centered learning, so it is worthy of being used as a reference in the development of science learning strategies in elementary schools.

REFERENCES

Abdillah, E. R. (2021). *Analisis Motivasi Belajar Siswa dalam Penggunaan Media Komik Pembelajaran Ipa pada Siswa Kelas V Sdn 2 Sirnoboyo Tahun Pelajaran 2020/2021.* 1–23.

Adnyani, N. K. M., Pudjawan, K., & Japa, I. G. N. (2020). Motivasi dan Hasil Belajar IPA dalam Pembelajaran Scramble Berbantuan Kartu Pertanyaan. *Jurnal Ilmiah Sekolah Dasar*, *4*(2), 270. https://doi.org/10.23887/jisd.v4i2.25622

Andini, N. P. M., & Agung, A. A. G. (2022). Multimedia Interaktif Berbasis Pendekatan Saintifik dalam Pembelajaran Sistem Pencernaan Manusia Kelas V SD. *Jurnal Media Dan Teknologi Pendidikan*, *2*(1). https://doi.org/10.23887/JMT.V2I1.44839

Andriyani, N. L., & Suniasih, N. W. (2021a). Development of Learning Videos Based on Problem-Solving Characteristics of Animals and Their Habitats Contain in Ipa Subjects on 6th-Grade. *Journal of Education Technology*, *1*(1), 37–47. https://doi.org/10.23887/jet.v5i1.32314

Andriyani, N. L., & Suniasih, N. W. (2021b). Development of Learning Videos Based On Problem-Solving Characteristics of Animals And Their Habitats Contain in Science Subjects on 6th-Grade. *Journal of Education Technology*, *5*(1), 37–47. https://doi.org/10.23887/jet.v5i1.32314

Anggreni, N. L., Jayanta, I. N. L., & Mahadewi, L. P. P. (2021). Multimedia Interaktif

Berorientasi Model Problem Based Learning (PBL) Pada Muatan IPA. *Mimbar Ilmu*, *26*(2), 214–224. https://doi.org/10.23887/mi.v26i2.35715

Ardithayasa, I. W., Gading, I. K., & Widiana, I. W. (2022). Project Based Learning Modules to Improve Scientific Literacy and Problem-Solving Skill. *Journal for Lesson and Learning Studies*, *5*(2), 316–325. https://doi.org/10.23887/jlls.v5i2.52607

Arifin, I. N., Arif, R. M., Arifin, V. M., Juniarti, Y., & Sutisna, I. (2023). Desain Pengembangan E-Modul IPA Materi Kalor Berbasis Flipbook Maker Dalam Meningkatkan Motivasi Belajar Siswa Kelas V Di Sekolah Dasar. *PEDAGOGIKA*, 99–111. https://doi.org/10.37411/pedagogika.v14i1.2192

Ariyanti, Y. E., & Yusro, A. C. (2023). Peningkatan Aktivitas dan Hasil Belajar Siswa Menggunakan Model Problem Based Learning (PBL) Dengan Menggunakan Media Pembelajaran Video Mata Pelajaran IPAS Kelas IV SD Negeri 2 Tegalombo. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *8*(2), 2543–2559. https://doi.org/10.23969/jp.v8i2.8435

Aryadi, K. S., & Margunayasa, I. G. (2022). Instrumen Penilaian High Order Thinking Skills (HOTS) pada Pembelajaran IPA. *Indonesian Journal of Instruction*, *3*(1), 34–41. https://doi.org/10.23887/iji.v3i1.44761

Atta, H. B., Vlorensius, V., & Hidayat, R. (2020). Mengukur keefektifan penggunaan model pembelajaran terhadap pemahaman konsep dan keaktifan siswa smp pada pelajaran ipa. *JP3M: Jurnal Pendidikan, Pembelajaran Dan Pemberdayaan Masyarakat*, *2*(1), 93–101. https://doi.org/10.37577/jp3m.v2i1.194

Budiarto, F., & Jazuli, A. (2022). Pengembangan Multimedia Pembelajaran Interaktif Berbasis Articulate Storyline 3 Sebagai Upaya Peningkatan Motivasi Dan Prestasi Belajar IPA Siswa Kelas VI Sekolah Dasar. *MUST: Journal of Mathematics Education, Science and Technology*, *7*(1), 50–61. https://doi.org/10.30651/must.v7i1.13919

Fatra, M., Jatmiko, M. A., Sihombing, A. A., & Zahroh, U. (2022). Keterampilan Berpikir Tingkat Tinggi (Hots) Siswa Madrasah Tsanawiyah. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(2), 1146. https://doi.org/10.24127/ajpm.v11i2.4909

Indarini, E. (2024). Dampak Model Problem Based Learning Terhadap Keterampilan Abad 21 (4 C) di Sekolah Dasar. *Satya Widya*, *40*(1), 73–87. https://doi.org/10.24246/j.sw.2024.v40.i1.p73-87

Indriani, L., Haryanto, H., & Gularso, D. (2022). Dampak Model Pembelajaran Problem Based Learning Berbantuan Media Quizizz terhadap Kemampuan Berpikir Kritis Mahasiswa. *Jurnal Penelitian Dan Pengembangan Pendidikan*, *6*(2), 214–222. https://doi.org/10.23887/jppp.v6i2.48139

Jannah, D. M., Hidayat, M. T., Ibrahim, M., & Kasiyun, S. (2021). Pengaruh Kebiasaan Belajar dan Motivasi Belajar terhadap Prestasi Belajar Siswa di Sekolah Dasar. *Jurnal Basicedu*, *5*(5), 3378–3384. https://doi.org/10.31004/basicedu.v5i5.1350

Jayadiningrat, M. G., Widiana, I. W., Tria Ariani, N. W., & Widiani, N. K. (2022). Model Pembelajaran Sains Teknologi Masyarakat (STM) dan Penilaian Autentik terhadap Hasil Belajar Siswa. *Jurnal Pedagogi Dan Pembelajaran*, *5*(3), 394–402. https://doi.org/10.23887/jp2.v5i3.50268

Julianti, N. L., I Wayan Lasmawan, & Putu Budi Adnyana. (2021). Pengembangan Instrumen Penilaian Berbasis Higher Order Thinking Skills (Hots) Pada Pembelajaran Ipa Tema Selamatkan Makhluk Hidup Kelas Vi Sd. *PENDASI: Jurnal Pendidikan Dasar Indonesia*, *5*(2), 281–290. https://doi.org/10.23887/jurnal_pendas.v5i2.473

Khakim, N., Santi, N. M., US, A. B., Putri, E., & Fauzi, A. (2022). Penerapan Model Pembelajaran Problem Based Learning Dalam Meningkatkan Motivasi Belajar PPKn Di SMP YAKPI 1 DKI Jaya. *Jurnal Citizenship Virtues*, *2*(2), 347–358. https://doi.org/10.37640/jcv.v2i2.1506

Liu, Y., Chou, P. L., & Lee, B. O. (2020). Effect of an interactive e-book on nursing students' electrocardiogram-related learning achievement: A quasi-experimental design. *Nurse Education Today*, *90*, 104427. https://doi.org/10.1016/j.nedt.2020.104427

Mareti, J. W., & Hadiyanti, A. H. D. (2021). Model Problem Based Learning Untuk Meningkatkan Kemampuan Berpikir Kritis dan Hasil Belajar IPA Siswa. *Jurnal Elementaria Edukasia*, *4*(1). https://doi.org/10.31949/jee.v4i1.3047

Masruroh, L., & Arif, S. (2021). Efektivitas model problem based learning melalui pendekatan science education for sustainability dalam meningkatkan kemampuan kolaborasi. *Jurnal Tadris IPA Indonesia*, *1*(2), 179–188.

Mejía-Rodríguez, A. M., Luyten, H., & Meelissen, M. R. M. (2021). Gender Differences in Mathematics Self-concept Across the World: an Exploration of Student and Parent Data of TIMSS 2015. *International Journal of Science and Mathematics Education*, *19*(6), 1229–1250. https://doi.org/10.1007/s10763-020-10100-x

Nirwana, S., Azizah, M., & Hartati, H. (2024). Analisis Penerapan Problem Based Learning berbantu Quizizz pada Pembelajaran IPAS Kelas V Sekolah Dasar. *Jurnal Inovasi, Evaluasi Dan Pengembangan Pembelajaran (JIEPP)*, *4*(1), 155–164. https://doi.org/10.54371/jiepp.v4i1.396

Nurmasari, I. (2023). Penerapan Model Problem-based Learning Berbantu Media Video Pembelajaran untuk Meningkatkan Hasil Belajar IPA Siswa Kelas IV Sekolah Dasar. *Satya Widya*, *39*(1), 21–30. https://doi.org/10.24246/j.sw.2023.v39.i1.p21-30

Octaviana, A., Marlina, D., & Kusumawati, N. (2023). Penerapan Model Pembelajaran Problem Based Learning (PBL) Berbantuan Media Wordwall Untuk Meningkatkan Hasil Belajar IPA Siswa Kelas V SDN Grudo 3 Ngawi. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *8*(1), 6752–6760. https://doi.org/https://doi.org/10.23969/jp.v8i1.9047

Pellas, N. (2024). Enhancing Computational Thinking, Spatial Reasoning, and Executive Function Skills: The Impact of Tangible Programming Tools in Early Childhood and Across Different Learner Stages. *Journal of Educational Computing Research*, *0*(0), 1–30. https://doi.org/10.1177/07356331241292767

Putri, A. S., Prasetyo, Z. K., Purwastuti, L. A., Prodjosantoso, A. K., & Putranta, H. (2023). Effectiveness of STEAM-based blended learning on students' critical and creative thinking skills. *International Journal of Evaluation and Research in Education*, *12*(1), 44–52. https://doi.org/10.11591/ijere.v12i1.22506

Putri, D. P. S., & Wiarta, I. W. (2023). E-Book Interaktif Berbasis Problem Based Learning Materi Sejarah Kerajaan di Nusantara pada Mata Pelajaran IPAS Kelas IV Sekolah Dasar. *Jurnal Ilmiah Pendidikan Profesi Guru*, *5*(3), 502–513. https://doi.org/10.23887/jippg.v5i3.57747

Salombe, Y. S., & Harjono, N. (2022). Efektivitas Model Problem Based Learning dan Discovery Learning dalam Meningkatkan Kemampuan Berpikir Kritis Siswa Kelas 5 SD pada Pembelajaran Tematik. *JIIP - Jurnal Ilmiah Ilmu Pendidikan*, *5*(11), 4597–4702. https://doi.org/10.54371/jiip.v5i11.1110

Salsabila, Y. R., & Muqowim, M. (2024). Korelasi Antara Teori Belajar Konstruktivisme Lev Vygotsky Dengan Model Pembelajaran Problem Based Learning (Pbl. *Learning : Jurnal Inovasi Penelitian Pendidikan Dan Pembelajaran*, *4*(3), 813–827. https://doi.org/10.51878/learning.v4i3.3185

Simbolon, R., & Koeswanti, H. D. (2020). Comparison Of Pbl (Project Based Learning) Models With Pbl (Problem Based Learning) Models To Determine Student Learning Outcomes And Motivation. *International Journal of Elementary Education*, *4*(4), 519–529. https://doi.org/10.23887/ijee.v4i4.30087

Sinta, Disurya, R., & Ayu, I. R. (2022). Pengaruh Media Animasi terhadap Hasil Belajar Siswa

Kelas V SD. *Journal on Teacher Education*, *4*(2), 731–744. https://doi.org/10.31004/jote.v4i2.8928

Šliogerienė, J., Darginavičienė, I., Suchanova, J., Gulbinskienė, D., & Jakučionytė, V. (2025). Problem-based learning in developing students' communicative skills and creativity in teaching English for specific purposes. *Creativity Studies*, *18*(1), 30–42. https://doi.org/10.3846/cs.2025.22343

Sugrah, N. U. (2020). Implementasi teori belajar konstruktivisme dalam pembelajaran sains. *Humanika*, *19*(2), 121–138. https://doi.org/10.21831/hum.v19i2.29274

Sundari, S., & Fauziati, E. (2021). Implikasi Teori Belajar Bruner dalam Model Pembelajaran Kurikulum 2013. *Jurnal Papeda: Jurnal Publikasi Pendidikan Dasar*, *3*(2), 128–136. https://doi.org/10.36232/jurnalpendidikandasar.v3i2.1206

Tanjung, D. F., Syahputra, E., & Irvan, I. (2020). Problem Based Learning, Discovery Learning, and Open Ended Models: An experiment On Mathematical Problem Solving Ability. *JTAM | Jurnal Teori Dan Aplikasi Matematika*, *4*(1), 9. https://doi.org/10.31764/jtam.v4i1.1736

Wahyuni, A. S. (2022). Literature Review: Pendekatan Berdiferensiasi Dalam Pembelajaran IPA. *JURNAL PENDIDIKAN MIPA*, *12*(2), 118–126. https://doi.org/10.37630/jpm.v12i2.562

Wardhani, N. K. S. K., Mahendradhani, G. A. A. R., & Wiradnyana, I. G. A. (2024). The Impact of the Problem-Based Learning Model by Tri Kaya Parisudha on Primary School Students' Character. *International Journal of Education Research and Development*, *4*(2), 93–102. https://doi.org/10.52760/ijerd.v4i2.73

Wibawa, I. M. C., Rati, N. W., Werang, B. R., & Deng, J. B. (2024). Increasing Science Learning Motivation in Elementary Schools: Innovation With Interactive Learning Videos Based on Problem Based Learning. *Jurnal Pendidikan IPA Indonesia*, *13*(3), 504–513. https://doi.org/10.15294/jrn6jh97

Yang, W., Ng, D. T. K., & Su, J. (2023). The impact of story-inspired programming on preschool children's computational thinking: A multi-group experiment. *Thinking Skills and Creativity*, *47*(1), 1–12. https://doi.org/10.1016/j.tsc.2022.101218

Zulfa, T., Tursinawati, T., & Darnius, S. (2023). Pengaruh Model Problem Based Learning (PBL) terhadap Hasil Belajar IPA Siswa di Sekolah Dasar. *Jurnal Basicedu*, *7*(4), 2111–2120. https://doi.org/10.31004/basicedu.v7i4.5451