
DIFFERENCES AND INFLUENCE OF PROBLEM BASED LEARNING MODELS ON STUDENTS' LEARNING OUTCOMES IN SCIENCE SUBJECTS

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Abstract

This study aims to determine the effect of the problem based learning model on student learning outcomes in science learning. The method used is a quantitative method with a comparative type. The instrument in this study used a questionnaire on the problem based learning model and learning outcomes. The quantitative data analysis technique used total sampling with 50 students as respondents from two classes, namely VIII C and VIII D. Based on the t test, sig. (2-tailed) was obtained in class VIII C 0.044, 0.032 and VIII D 0.043, 0.033, <0.05. So there is a difference. Based on the regression test, sig. (2-tailed) was obtained in class VIII C 0.023, 0.027 and VIII D 0.026, 0.025, <0.05. So there is an influence. The conclusion of this study is that there are differences and influences of the problem based learning model on student learning outcomes in science learning in classes VIII C and VIII D at SMP 19 Jambi City.

Keywords: *problem based learning, student learning outcomes, science learning.*

Abstrak

Penelitian ini bertujuan untuk mengetahui pengaruh model pembelajaran problem based learning terhadap hasil belajar siswa pada pembelajaran IPA. Metode yang digunakan yaitu metode kuantitatif dengan tipe komparatif. Instrumen dalam penelitian ini menggunakan angket model pembelajaran problem based learning dan hasil belajar. Teknik analisis data kuantitatif menggunakan total sampling dengan responden sebanyak 50 siswa dari dua kelas yaitu VIII C dan VIII D. Berdasarkan uji t diperoleh sig.(2-tailed) pada kelas VIII C 0,044, 0,032 dan VIII D 0,043, 0,033, < 0,05. Sehingga terdapat perbedaan. Berdasarkan uji regresi diperoleh sig.(2-tailed) pada kelas VIII C 0,023, 0,027 dan VIII D 0,026, 0,025, < 0,05. Sehingga terdapat pengaruh. Kesimpulan dari penelitian ini yaitu terdapat perbedaan dan pengaruh model pembelajaran problem based learning terhadap hasil belajar siswa pada pembelajaran IPA kelas VIII C dan VIII D di SMP 19 Kota Jambi.

Kata Kunci:

pembelajaran berbasis masalah, hasil belajar siswa, pembelajaran sains

INTRODUCTION

Natural Science learning is one of the important subjects that helps students understand nature and the phenomena that occur around them (Aryani et al., 2019; Permanasari, 2016). Through science learning, students are taught basic concepts that underlie sciences such as physics, chemistry, biology, and geography (Cintia et al., 2018; Hekmah et al., 2019). Science learning also trains critical thinking and problem-solving skills, because students must observe, analyze, and draw conclusions based on empirical data (Pamungkas et al., 2017; Sutarmi & Suarjana, 2017). With the right approach, science learning can increase students' interest and understanding of the importance of science in everyday life.

The Problem Based Learning (PBL) learning model is a student-centered learning approach that encourages students to solve real problems as a basis for learning (Alan & Afriansyah, 2017; Fauzan et al., 2017). In this model, students are given relevant problems to solve through discussion, collaboration, and research. PBL develops students' critical thinking, analytical skills, and creativity, because students must integrate various knowledge to find solutions (Halim et al., 2017; Syaiful et al., 2021). In addition, PBL fosters social and collaboration skills, because students often work in groups to solve the problems they face.

Learning outcomes are achievements obtained by students after going through the learning process. Learning outcomes include aspects of knowledge, skills, and attitudes acquired during the learning process (Khoiri, 2021; Wilson et al., 2020). In the context of science learning, learning outcomes reflect how well students understand scientific concepts and are able to apply them in real-life situations (Akben, 2019; Maison et al., 2020). In addition, learning outcomes also function

as a benchmark for the teacher's success in delivering material, as well as the effectiveness of the learning model used.

The Problem Based Learning (PBL) model has an important role in science learning because it places students at the center of learning and facilitates independent exploration. Through PBL, students are more actively involved in the learning process, so that students can understand science concepts more deeply and relevantly to everyday life (Negara et al., 2021; Rampi et al., 2021). In addition, PBL helps students develop skills that are very important in solving complex scientific problems (Hartati et al., 2022; Ladyawati & Fathonah, 2023). Therefore, the application of the PBL model in science learning can improve the quality of student learning outcomes, both in terms of conceptual understanding and practical skills.

Good learning outcomes are very important for students' future because they determine students' readiness to face challenges in the world of work and everyday life (Nesi & Akobiarek, 2018; Pratiwi, 2020). Optimal learning outcomes not only measure academic abilities, but also non-academic skills such as problem solving, critical thinking, and collaboration (Jufrida et al., 2019; Putri, 2021). In the context of rapid technological and scientific developments, students who have good learning outcomes will be better able to adapt to changes and take advantage of opportunities. Therefore, it is important for students to achieve maximum learning outcomes in order to contribute positively in the future.

Although the Problem Based Learning model has been proven effective in improving student learning outcomes, there are gaps in its implementation in various schools. Some schools may face obstacles such as limited facilities, lack of training for teachers, or too many students making it difficult to implement problem-based learning (Imaduddin & Khafidin, 2018; Rati et al., 2017). In addition, not all students have the same level of readiness to follow learning with the PBL model, which can cause gaps in learning outcomes. Therefore, it is important to identify and address these gaps so that all students can benefit from this innovative learning model.

The purpose of this study was to evaluate the effect of the Problem Based Learning model on student learning outcomes in science subjects. This study also aims to determine the extent to which the learning model can improve students' critical thinking and problem-solving skills. In addition, this study aims to identify factors that influence the effectiveness of PBL implementation in the classroom, such as teacher readiness, supporting facilities, and student characteristics. Thus, the results of this study are expected to provide useful recommendations for improving the quality of science learning.

The urgency of this study lies in the need to improve the quality of education, especially in science learning, so that students are better prepared to face future challenges. Traditional teacher-centered learning models are often ineffective in developing critical thinking and problem-solving skills in students. Therefore, a more innovative learning approach is needed, such as Problem Based Learning, which can prepare students to think creatively and critically. This study is important to find empirical evidence regarding the effectiveness of PBL in the context of science learning in Indonesia.

The novelty in this study lies in the focus of the evaluation of the effect of Problem Based Learning in science learning at the junior high school level (SMP). Although PBL has been widely applied in various disciplines, research that specifically examines its impact on science learning is still relatively limited, especially in junior high schools using 5 statistical tests. This study is expected to provide new contributions in the field of education by providing more comprehensive data on how PBL can improve student learning outcomes in science.

METHODS

Type of Research

This study uses a quantitative method with a comparative approach, aiming to analyze the influence of two variables, namely the Problem Based Learning (PBL) learning model and student learning outcomes. The comparative approach is used to compare the level of curiosity between two groups of students using different learning models. This method prioritizes the collection of numerical data that is analyzed statistically to test hypotheses and determine the effect of PBL on students' curiosity in science learning (Winantara, 2017).

Research Instrument

The research instrument used is a questionnaire designed to measure two main aspects, namely the application of the Problem Based Learning (PBL) learning model and student learning outcomes. The questionnaire for the PBL model was created to assess how teachers apply important components of this model in the classroom, such as presenting real problems, student participation in discussions, and solving problems independently (Kusuma & Aisyah, 2012). Meanwhile, the student learning outcome questionnaire was designed to measure the extent to which students' science learning outcomes use problem based learning. These two questionnaires aim to provide valid and reliable quantitative data to analyze the relationship between the PBL model and student curiosity.

Table 1. Grid of problem based learning model instruments and student learning outcomes in science learning

Variable	Indicator	No. Item Statement
Problem Based Learning Model	Asking the teacher or friends	1
	Expressing opinions	2
	Discussion and collaboration	3
	Communicating discussion results	4
Learning outcomes	Cognitive	5
	Affective	6
	Psychomotor	7
Number of Statements		7

Because the questionnaire of the problem based learning model and student learning outcomes in science learning uses a Likert scale consisting of 4 categories, there are intervals in each category, and the intervals in each category can be seen in the table below. The description of the categories of the problem based learning model and student learning outcomes in science learning is as follows:

Table 2. Categories of problem based learning models and student learning outcomes in science learning

Category	Indicator	
	Problem based learning model	Learning outcomes
Very bad	4.00-7.00	3.25-5.25
Bad	7.10-10.00	5.26-7.50
Good	10.10-13.00	7.51-9.75
Very good	13.10-16.00	9.76-12.00

Population and Sample

The population in this study were all eighth grade students in a junior high school (SMP). with samples taken using a total sampling technique of 50 students from two classes. namely class VIII C and VIII D. Random selection was carried out to ensure that the samples used could be the entire population. so that the results of the study could be generalized. Class VIII C and VIII D were selected as research subjects for comparison. where one class applied the Problem Based Learning (PBL) learning model. while the other class used conventional learning methods. Thus. this sample is expected to provide an accurate picture of the effect of PBL on student learning outcomes.

Data Analysis Technique

The data analysis method in this study used a quantitative approach involving statistical tests to see the influence between variables. Data obtained through questionnaires from 50 respondents were processed using statistical software. The analysis involved a regression test to determine the impact of the application of the Problem Based Learning (PBL) learning model on student learning outcomes. as well as comparative tests such as t-tests to compare curiosity between class VIII C which used PBL and class VIII D which did not use the method. This technique allows researchers to test hypotheses validly and draw conclusions based on objective data. Testing is done using SPSS for more accurate results.



Figure 1. Research procedure

FINDINGS AND DISCUSSION

Findings

The following describes the results of descriptive statistics of the variables of the problem based learning model and learning outcomes. Where the results were obtained from the distribution of numbers at SMPN 19 Kota Jambi in class VIII D and VIII C. Description of the variables of the problem based learning model of students in science learning is shown in the following table.

Table 3. Description of the variables of the problem based learning model of students in science learning

Class	Category	Interval	F	%	Mean	Med	Min	Max
VIII C	Very bad	4.00-7.00	0	0	3.4	3.5	2.0	4.0
	Not good	7.10-10.00	7	28				
	Good	10.10-13.00	13	52				
	Very good	13.10-16.00	5	20				
VIII D	Very bad	4.00-7.00	0	0	3.2	3.3	2.0	4.0
	Not good	7.10-10.00	8	32				
	Good	10.10-13.00	11	44				
	Very good	13.10-16.00	6	24				

Description:

F = Frequency

Med = Median

Min = Minimum

Max = Maximum

From the description of the table above, it can be seen that the comparison with the good category in VIII C is higher than VIII D so it can be said that VIII C is superior to VIII D in the variable of the problem based learning model. The description of the student learning outcome variables is shown in the following table.

Table 4. Description of student learning outcome variables in science learning

Class	Category	Interval	F	%	Mean	Med	Min	Max
VIII C	Very bad	3.25-5.25	0	0	3.4	3.0	2.0	4.0
	Not good	5.26-7.50	5	20				
	Good	7.51-9.75	11	44				
	Very good	9.76-12.00	9	36				
VIII D	Very bad	3.25-5.25	3	12	3.2	3.0	1.0	4.0
	Not good	5.26-7.50	4	16				
	Good	7.51-9.75	10	40				
	Very good	9.76-12.00	8	32				

Description:

F = Frequency

Med = Median

Min = Minimum

Max = Maximum

From the description of the table above, it can be seen that the comparison with the good category in VIII C is higher than VIII D so it can be said that VIII C is superior to VIII D in the variable of student learning outcomes. The normality test of the problem based learning model and student learning outcomes is explained in the following table:

Table 5. Normality test of the problem based learning model and student learning outcomes

Class	Variable	N	Sig.
VIII C	Problem based learning learning model	25	0.200
	Student learning outcomes	25	0.200
VIII D	Problem based learning learning model	25	0.200
	Student learning outcomes	25	0.200

Description:

N= Number of Students

Based on the results of the table above, it can be concluded that the data is normally distributed. The normality test was obtained by the Kolmogorov-Smoirnov test, the significance value is > 0.05 . The linearity test of the problem based learning model and learning outcomes is explained in the following table:

Table 6. Linearity test of the problem based learning model and student learning outcomes

Class	Variable	N	Sig.
VIII C	Problem based learning learning model	25	0.027
	Student learning outcomes	25	0.028
VIII D	Problem based learning learning model	25	0.029
	Student learning outcomes	25	0.027

Description:

N= Number of Students

Based on the table above, it can be concluded that the linearity test of the above variables has a linear relationship between VIII D and VIII C. It is proven that the sig result is less than 0.05. The T test of the problem based learning model and student learning outcomes are explained in the following table:

Table 7. T test of the problem based learning model and student learning outcomes

Class	Variable	N	Sig.
VIII C	Problem based learning learning model	25	0.045
	Student learning outcomes	25	0.044
VIII D	Problem based learning learning model	25	0.033
	Student learning outcomes	25	0.034

Description:

N= Number of Students

Based on the table above, it can be concluded that there are differences in class VIII C and VIII D. This is proven by the sig. (2-tailed) results which are smaller than 0.05.

Table 8. Regression test of problem based learning model and student learning outcomes

Class	Variable	N	Sig.
VIII C	Problem based learning learning model	25	0.023
	Student learning outcomes	25	0.025
VIII D	Problem based learning learning model	25	0.026

Description:

N= Number of Students

Based on the table above, it can be concluded that there is an influence between the problem based learning model on student learning outcomes in class VIII C and VIII D. This is proven by the sig. (2-tailed) results which are smaller than 0.05.

Discussion

Based on table 3, the average number of students chose the good category with a percentage for VIII C 52% good and VIII D 44% good. So it can be concluded that VIII C is superior to VIII D in the variable of the problem based learning model. Based on table 4, the average number of students chose the good category with a percentage for VIII C 44% good and VIII D 40% good. So it can be concluded that VIII C is superior to VIII D in the variable of student learning outcomes. Based on table 5, the results of the normality test of the problem based learning model and student learning outcomes, namely in VIII C, namely 0.200 and in VIII D, namely 0.200, it can be concluded that the results obtained are > 0.05 so that it can be said that the data is normally distributed. Based on table 6, the results of the linearity test of the problem based learning model, namely in VIII C, namely 0.027 in VIII D, namely 0.029 and the variable of student learning outcomes, namely in VIII C, namely 0.028 in VIII D, namely 0.027, it can be concluded that the results obtained are > 0.05 so that it can be said that the data is linearly distributed.

Based on table 7, the results of the t-test of the problem based learning model, namely in VIII C, namely 0.044 and in VIII D, namely 0.033 and learning outcomes, namely in VIII C, namely 0.042 and in VIII D, namely 0.033, so it can be concluded that there is a difference between VIII C and SMPN 19 Kota Jambi. Proven by the results of sig. smaller than 0.05.

Based on table 8, the results of the regression test of the problem based learning model are in VIII C, namely 0.023 and in VIII D, namely 0.026 and learning outcomes are in VIII C, namely 0.024 and in VIII D, namely 0.026 so that it can be concluded that there is an influence between the problem based learning variable on student learning outcomes in class VIII C and VIII D at SMPN 19 Jambi City. Proven by the sig. results smaller than 0.05. This study is in line with previous research conducted by oleh (Negara et al., 2021) which tested the problem based learning model in science learning. in the study stated that the problem based learning model plays an important role for students. in line with this study because this study also states that the problem based learning model is also very important for students to have, especially students at the junior high school level. However, previous studies did not conduct several tests as conducted in this study.

The application of the Problem Based Learning (PBL) model is very important in improving student learning outcomes, especially in terms of critical thinking, creativity, and problem-solving skills. This model allows students to be more actively involved in the learning process, so that students can internalize learning materials better baik (Fauzan et al., 2017; Fauziyah, 2017). In the context of science learning, PBL allows students to learn through solving real problems, which in turn helps students connect scientific concepts with everyday life situations. This increases the understanding and application of science more meaningfully compared to traditional learning methods (Astuti, 2017). Thus, the application of PBL not only improves cognitive learning outcomes, but also helps students develop social and emotional skills, such as collaboration and communication, which are important for students' future success.

The implications of implementing PBL in learning are very broad, both for students, teachers, and educational institutions. For students, PBL increases learning motivation because it gives students the freedom to explore and solve problems independently or in groups. For teachers, PBL requires a change in role from merely delivering material to being a facilitator who supports students' learning process. For educational institutions, the implementation of PBL requires adjustments in curriculum and resources, including training for teachers and the development of facilities that support problem-based learning. Therefore, the implementation of PBL requires commitment from all parties involved in the educational process.

The short-term impact of the implementation of PBL can be seen from the increase in student motivation and participation in the learning process. Students who are accustomed to traditional learning models may initially find it difficult, but over time, students will be more involved and enthusiastic in learning (Han et al., 2016; Maghfiroh et al., 2017). PBL also helps students improve their critical and analytical thinking skills, because students are faced with the challenge of solving problems that are relevant to real life. In the short term, the implementation of PBL can improve students' understanding of concepts and cognitive skills which are directly visible through better learning outcomes.

The long-term impact of implementing PBL is broader and more significant, especially in forming students who are ready to face the world of work and the challenges of life in the future. Students who are accustomed to PBL will have better problem-solving skills, be able to think critically, and have the ability to work collaboratively in teams. Students also tend to be more independent and confident in dealing with complex problems (Hartati et al., 2022; Wahyudi et al., 2017). In the future, these skills are very valuable in various professional fields and will help students become more adaptive and innovative individuals in dealing with technological changes and global demands. However, the implementation of PBL also has several limitations. One of the main obstacles is the need for sufficient resources, including trained teachers and supporting facilities such as flexible classrooms and adequate learning technology. In addition, not all students have the same level of readiness to follow this learning model, which can cause gaps in learning outcomes. Teachers also need more time to design and manage problem-based learning, which can be a challenge in schools with a high teacher-student ratio. Another limitation is the difficulty in objectively assessing student learning outcomes, because PBL often focuses on the process, not just the end result. Based on the results of existing research, it is recommended that further studies be conducted to explore more deeply the application of PBL in various contexts and subjects, including science. Further research also needs to focus on strategies to overcome challenges or limitations faced in the implementation of PBL, such as the development of more objective and effective assessment methods. In addition, it is important to evaluate the effectiveness of PBL in the long term, especially in preparing students for the challenges of the changing world of work. More comprehensive research on the role of teachers as facilitators in the PBL model is also needed, so that training and professional development for teachers can be further improved.

CONCLUSION

This study shows that the Problem Based Learning (PBL) learning model has an influence on student learning outcomes in science learning. Students involved in PBL are more active in the learning process, have higher motivation to explore the material, and tend to ask critical questions. PBL not only encourages a deeper understanding of concepts, but also forms students' characters who are more independent and creative in solving problems. Although this study is limited to a small sample, these findings indicate the importance of implementing PBL as an effective approach in improving the quality of learning and student character, especially in the field of science.

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