The Effect of the Problem-Based Learning Model on Student Activeness in Science Learning

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Abstract: This research aims to determine student activeness by implementing the problem-based learning model in elementary school science education. It is a quantitative research study with the entire 5B class population. The design used in this study is a one-shot case study, and data collection involved using observation sheets to measure student activeness. The subjects of this research are 31 students from class 5B at SDN Oro-Oro Ombo Wetan 1. Data collection utilized validity tests, reliability tests, tests for prerequisite analysis of normality, and the results of the T-test (One-Sample Statistics) with a significance level of 5% (0.05), yielding a significant t-value (2-tailed) of 0.004. Based on the validity results, all 30 observation items and 31 student responses were deemed valid. The reliability test indicated reliability, and the normality test confirmed that the residual values were normally distributed. The t-test result showed that the significance value of student activeness was 0.004, less than 0.05. Therefore, the null hypothesis (H0) was rejected, and the alternative hypothesis (Ha) was accepted. This means that there is an influence of the problem-based learning model on student activeness in science learning. If this model is implemented in elementary schools, it will positively impact student activeness and engagement in the learning process.

Abstrak: Tujuan penelitian adalah untuk mengetahui keaktifan siswa dengan menerapkan model problem based learning dengan pembelajaran IPA SD. Jenis penelitian kuantitatif dengan jumlah populasi seluruh kelas 5B. Desain ini menggunakan one shot case study, pada pengumpulan data ini menggunakan lembar observasi digunakan untuk mengukur keaktifan siswa. Subyek penelitian ini kelas 5B SDN Oro-Oro Ombo Wetan 1 berjumlah 31 siswa. Pengumpulan data penelitian menggunakan instrument uji validitas, uji reabilitas, uji prasyarat analisis uji normalitas serta hasil uji T-test (One-Sample Statistics) dengan taraf signifikan 5% (0,05) diperoleh nilai signifikan t (2-tailed) = 0,004. Berdasarkan hasil validitas, observasi 30 butir dan jumlah siswa 31 seluruhnya valid. Uji reabilitas dinyatakan reliabel, uji normalitas maka dapat disimpulkan nilai residual berdistribusi normal. Dan hasil uji t berarti nilai signifikansi keaktifan siswa 0,004 < 0,05 sehingga H0 ditolak dan Ha diterima. Dikatakan bahwa terdapat pengaruh model pembelajaran *Problem-Based Learning* terhadap kekatifan siswa dalam pembelajaran IPA. Apabila model ini diterapkan di SD, maka akan medapatkan dampak yang dirasakan oleh siswa yaitu kekatifan dalam pembelajaran yang meningkat.

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A. Introduction

Education is an organized and planned effort that takes place continuously throughout life to foster students to become mature, mature, and cultured individuals (Sari, 2019). The development of education is essential in various disciplines because quality education can enhance a nation's intelligence and contribute to its economic growth (Nurvitasari et al., 2022). A learning model is a systematic procedure for organizing learning experiences to achieve learning objectives (Putri, 2018). Learning involves two mutually sustainable activities: teaching and learning. Learning can be understood as a series of activities that aim to stimulate students' desire to learn through teaching or instructional methods (Utami, 2020). Learning encompasses several interconnected components: (1) learning objectives, (2) learning subjects, (3) learning materials, (4) learning strategies, (5) learning media, and (6) support (Kurniasih, 2014).

Problem-based learning (PBL) is a learning model that presents intellectual problems to stimulate students' engagement in PBL (Problem Based Learning) (Paradina et al., 2019). PBL involves initially presenting students with a problem, followed by a student-centered process of information-seeking (Imron & Aka, 2018). It is acknowledged that PBL may involve a general conceptual fog. PBL revolves around students and focuses on problem-solving. The purpose of PBL is to efficiently form and acquire knowledge. PBL predominantly takes the form of small group learning with an organized system (Paradina et al., 2019). Learning models play a crucial role in the learning process (Asyafah, 2019). Regarding learning models, problem-based learning is discussed in several opinions, including the importance of selecting learning materials that contain problems for optimal implementation of PBL (Koto et al, 2021). PBL is a problem-solving approach that promotes innovative learning and provides an active learning environment for students in real-world contexts (Imron & Aka, 2018). By employing learning models such as Problem Based Learning, teachers can make learning enjoyable and achieve learning objectives, thus enhancing student engagement in real-life problem-solving (Utami, 2021). The syntax of Problem Based Learning, according to Arends, includes the following steps: (1) orienting students to the problem by presenting the problems to be solved in groups, allowing students to observe and comprehend the presented problems, (2) organizing student learning individually or in groups by ensuring that the entire group understands each problem or task, encouraging students to discuss and share tasks to find materials, answers, or tools to solve the problem, (3) guiding individual and group investigations by monitoring students' involvement in data or material collection during the investigation process and engaging them in activities such as conducting investigations and seeking data, references, or sources for group discussions, (4) developing and presenting work results by monitoring student discussions, aiding their understanding of the presented problem, and assisting them in compiling reports for each group, which will be presented and discussed by students to find problem-solving results, and (5) analyzing and evaluating the problem-solving process through guiding presentations, providing feedback and input to each group, and allowing students and teachers to conclude the activities, make presentations, and

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provide feedback to other groups to summarize or draw conclusions based on the input given (Ariyana, 2018).

PBL offers several advantages: (1) it enhances students' understanding of lessons, (2) it tests students' abilities and provides satisfaction in discovering new knowledge, (3) it increases learning activities, (4) it covers various subjects such as math and science, promoting comprehensive learning, (5) it is considered enjoyable and well-liked by students, (6) it develops critical thinking skills, (7) it provides opportunities for students to apply their knowledge in real-world contexts, and (8) it fosters students' interest in lifelong learning beyond formal education. However, the PBL model also has weaknesses, including students' lack of interest or feeling insecure when confronted with challenging problems, the requirement for adequate preparation for successful implementation, and the necessity of understanding the purpose behind solving the studied problem to achieve effective learning outcomes (Nuraini, 2017; Purwanto et al., 2016). The incorporation of visual media in problem-based learning can stimulate student creativity, curiosity, critical thinking, and logical reasoning. Visual images facilitate better understanding and longer retention of material. Despite innovative learning models and creative learning environments, elementary school students still exhibit weak critical thinking skills, which may affect their learning outcomes in subsequent levels (Devi & Bayu, 2020).

Activeness is a fundamental principle in learning, encompassing various activities ranging from easily observable physical actions such as reading, listening, writing, demonstrating, and measuring to more challenging psychological activities. Both teachers and students engage in activities during classroom learning. Activeness plays a crucial role in students' learning success and the attainment of optimal learning outcomes (Retnaningsih et al., 2019). In an active learning environment, students actively inquire, explore, and express their thoughts, while teachers create an atmosphere that encourages questioning, inquisitiveness, and the expression of opinions (Anggela, 2018). Student activeness in learning is an important aspect that educators need to address. Activeness entails students' acceptance and understanding of the learning process, the development of their talents, critical thinking, and problem-solving abilities in everyday life. The Problem Based Learning model promotes student curiosity in tackling problems, enabling them to understand and grasp conceptual material, find solutions to the problems they face, and draw accurate conclusions (Mucharom, 2022). Active students exhibit characteristics such as actively seeking clarification or solutions for unclear material, expressing their opinions openly, completing tasks through critical thinking and analysis, problem-solving, and applying scientific knowledge to real-life situations. Active learning is driven by enthusiasm and enjoyment, and student involvement is crucial in science education as it involves students in the process of searching for information, leading to meaningful learning experiences and positive effects on learning outcomes (Evitasari & Aulia, 2022). Student activeness can be observed in various activities, including daring to ask questions while working on assignments, engaging in problem-solving processes, seeking assistance from peers or

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teachers when facing difficulties, participating in group discussions as directed by the teacher, and presenting their work (Hasanah & Himami, 2021).

Direct student involvement in the learning process intensifies their level of activity. In such situations, students not only actively listen and observe but also directly participate in experiments and demonstrations. Direct involvement allows students to experience and take ownership of their learning process. Continuity in action can lead to habitual engagement when supported by motivation or a strong desire to persist (Tanjung, 2019). Student activeness can be observed through actions such as confidently seeking to understand a topic, independently learning, experimenting, and discovering knowledge, experiencing and fulfilling tasks assigned by the teacher, participating in group learning, independently testing concepts, and effectively communicating thoughts, discoveries, and value appreciation through oral or visual means (Pratiwi et al., 2020).

By enhancing student activeness, students can explore their abilities and actively engage in interesting lessons. The Problem Based Learning model is expected to stimulate student problem-solving in science learning and promote activeness. This aligns with the notion that group collaboration helps students overcome weaknesses and leverage strengths in a supportive environment (Liliyana et al., 2021).

Natural Science (IPA) focuses on systematically understanding nature, aiming to move beyond managing factual information and encompassing the process of discovery. In elementary schools (SD/MI), the objectives of science education include developing students' confidence in the greatness of God Almighty through appreciating the existence, beauty, and order of God's natural creation, fostering knowledge and understanding of scientific concepts applicable to everyday life, nurturing curiosity and a positive attitude towards the interaction between science, environment, technology, and society (Septi, 2019). Science encompasses both the products and processes of inquiry, including concepts, facts, principles, theories, and laws (Khotimah, 2018).

Based on previous research by Ristiyaningsih, the use of problem-based learning models has been shown to influence student activity (Ristiyaningsih, 2017). While there are variations in research materials, locations, classes, and methodologies, similarities exist in terms of employing problem-based learning models to promote student activeness. This study aims to investigate the impact of problem-based learning models on student activeness in science learning and determine the degree of influence these models have on student engagement in the learning process.

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B. Method

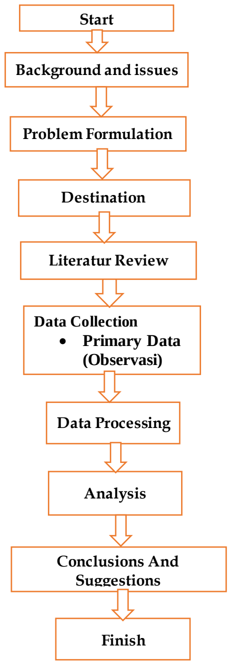

Figure 1. Research Flowchart

The type of research used in this study is quantitative research employing experimental methods. The experimental design utilized in this study is a type of pre-experimental design. This research approach used a single experimental class without a control group. It is referred to as a pre-experiment because it did not involve a simple experiment due to external variables that could potentially impact the formation of the dependent variable (Sugiyono, 2019). The research design employed to measure student activeness in this study is a one-shot case study, adhering to the following design paradigm:

Figure 2. One-Shot Case Study Design

Description:

X : Treatment in Experimental Class

O : Observation of Results

The paradigm can be understood as follows: a group is given treatment or intervention, and the results are observed. The population for this study consists of all fifth-grade students at SDN Oro-Oro Ombo Wetan 1 in the 2022/2023 school year. The sampling technique employed in this study is purposive sampling, which involves selecting samples based on specific considerations. Therefore, a sample was taken from class V B for this study.

The variables utilized in this study are as follows:

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a. Independent variables: These variables have an impact or cause changes. In this study, the independent variable is the use of a problem-based learning model (Problem-Based Learning).
b. Dependent variable: This variable is affected by the independent variable. In this study, the dependent variable is student learning motivation.

The research instruments employed in this study include observation (Wati, 2019). The observation collected information sheets regarding student learning activeness during the learning process, utilizing a Likert scale. The data collection techniques used in this research involve observation and documentation. Researchers will test the data validity through triangulation, comparing the data obtained from observation to determine its appropriateness. Data collection techniques are necessary for researchers to gather information related to the research data, which is subsequently used for analysis.

Instrument validation testing aims to ensure that the instrument can measure what it intends to measure. An instrument is considered valid when it successfully measures the variables under study. In this study, construct validity was employed to test the instrument's validity, using the product-moment correlation formula (r-value), with a significance level of 5%. This test was assisted by SPSS software version 26.

To decide validity, if the calculated r-value is greater than the critical r-value, the data is considered valid. Conversely, if the calculated r-value is smaller than the critical r-value, the resulting data is considered invalid (r-value > critical r-value = invalid).

In instrument reliability testing, reliability is assessed by measuring if the instrument produces consistent results when used multiple times to measure the same object. To determine the level of reliability in this study, Cronbach's alpha formula was employed, assisted by SPSS software version 26.

The data is considered reliable if Cronbach's alpha value is greater than the critical r-value (0.355) at a significance level of 5%. Conversely, if Cronbach's alpha value is less than 0.355, the data is considered unreliable (Cronbach's alpha > 0.355 = reliable, Cronbach's alpha < 0.355 = unreliable).

The data analysis technique employed in this study involves conducting a normality test followed by hypothesis testing. Hypothesis testing allows for determining the validity of events in the study and is based on quick answers that draw upon relevant theories. Hypothesis testing uses the t-test with a significance level of t < 0.05. If the t-value is less than 0.05, H0 (null hypothesis) is rejected, and H1 (alternative hypothesis) is accepted, indicating a significant effect between the independent and dependent variables. If the t-value is greater than 0.05, H0 is accepted, and Ha is rejected, indicating no significant effect between the independent and dependent variables.

SPSS software version 26 is employed to calculate the extent of the influence of the problem-based learning model on student activeness in learning science. The hypotheses proposed are based on cognitive learning theory, which asserts that the success of a learning process should be evaluated based on the learning process itself rather than just the final results or student scores. The hypotheses can be validated through established testing

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criteria. Ha is rejected if the calculated t-value is less than the critical t-value. Ha is accepted if the calculated t-value is greater than or equal to the critical t-value.

C. Results and Discussion

Results

The data collection results were obtained from the SDN Oro-Oro Ombo Wetan 1 Pasuruan research, specifically in class 5B. For this study, data collection was carried out using an observation sheet consisting of 30 questions related to a science lesson. The research utilized the Problem-Based Learning (PBL) learning model. The researchers administered the observation sheet and recorded the responses during the ongoing learning process.

Validity testing was conducted to determine the validity of the collected data. The SPSS software version 26 was employed for this purpose, using the product-moment correlation. The critical r-value (r_{table}) with a significance level of 5% and N = 31 is 0.355. Data is considered valid if the calculated correlation coefficient (r_{count}) is greater than the critical r-value. In the validity test conducted, all the obtained data met the validity criteria and were deemed valid. Observation items are considered valid if $r_{count} > t_{table}$. The validity test table is presented below:

Table 1. Validity Test Analysis Results

Point of Observation	Correlation	Description
1	-0,388*	Valid
2	0,645**	Valid
3	0,711**	Valid
4	0,649**	Valid
5	0,704**	Valid
6	0,769**	Valid
7	0,694**	Valid
8	0,464**	Valid
9	0,704**	Valid
10	0,656**	Valid
11	0,694**	Valid
12	0,682**	Valid
13	0,664**	Valid
14	0,597**	Valid
15	0,547**	Valid
16	0,752**	Valid
17	0,757**	Valid
18	0,618**	Valid
19	0,768**	Valid
20	0,656**	Valid
21	0,487**	Valid
22	0,769**	Valid
23	0,603**	Valid

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Point of Observation	Correlation	Description
24	0,694**	Valid
25	0,734**	Valid
26	0,623**	Valid
27	0,626**	Valid
28	0,620**	Valid
29	0,579**	Valid
30	0,633**	Valid
31	0,601**	Valid

Based on the validity test results presented in the table above, all observation items related to student activeness were found to be entirely valid. This conclusion is drawn as the r_{table} value for each observation item is lower than the r_{count} value. Furthermore, the reliability test was conducted using the Cronbach alpha formula with the assistance of SPSS software version 26. The data is considered unreliable if the Cronbach alpha value is less than 0.355. Conversely, the data is deemed reliable if the Cronbach alpha value is greater than 0.355.

Out of the 31 respondents, it was determined that the instrument used to measure the student activeness scale is reliable, indicating that the measurement results are consistent. The reliability test ensures that each observation item consistently yields the same measurement outcomes. The results of the reliability test are presented below:

Table 2. Reliability Test Results

		N	%
C	Valid	31	100,0
a	Excluded[a]	0	,0
s	Total	31	100,0
e			
s			

a. Listwise deletion based on allvariables in the procedure

Reliability Statistics

Cronbach's Alpha	N of Items
,689	31

Based on the results obtained from the reliability test presented in Table 2, the Cronbach alpha value is 0.689. Considering the sought value on the r_{table} at a significance level of 5% (0.05), which is 0.355, it can be concluded that $r_{count} > r_{table}$ or 0.689 > 0.355. Thus, the observation items are reliable and can be utilized as a data collection tool in this study.

After establishing the reliability of the data, the normality test was conducted using the Kolmogorov-Smirnov test. This test aims to determine whether the data follows a normal distribution based on the criteria of sig > 0.05. The data on student activeness

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obtained from the normality test will be processed and analyzed using SPSS software version 26. The following are the results of the normality test conducted with the assistance of SPSS software version 26 using the Kolmogorov-Smirnov test.

Table 3. Normality Test Results

One-Sample Kolmogorov-Smirnov Test

		Nilai
N		31
Normal Parameters[a,b]	Mean	152,7742
	Std. Deviation	29,87497
Most Extreme Differences	Absolute	,134
	Positive	,134
	Negative	-,132
Test Statistic		,134
Asymp. Sig. (2-tailed)		,163[c]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction

Based on the results of the normality test presented in the table above, it is evident that the significance value is 0.163, which is greater than 0.05. Therefore, it can be concluded that the residual values follow a normal distribution. Subsequently, hypothesis testing is conducted using the t-test, with the assistance of SPSS software version 26. A summary of the t-test results is provided in the following table:

Table 4. One sample T-Test Results

	N		**Mean**		**Std. Deviation**	**Std. Error Mean**
Nilai		32	112,8065		23,14796	4,15750
				Test Value = 100		
					95% Confidence Interval of the Difference	
	t	Df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Nilai	3,060	30	,004	12,80645	4,3157	21,2972

Based on the hypothesis, the validity of the predetermined testing criteria can be proven. If the significance value of t is less than 0.05, then H0 is rejected, and Ha is accepted, indicating a significant influence between the independent and dependent variables. Conversely, if the significance value of t is greater than 0.05, then H0 is accepted, and Ha is rejected, suggesting no significant effect between the independent and dependent variables.

Referring to the table above, the significance value (sig. (2-tailed)) in the t-test one sample test is 0.004. This result is compared with the significance level of 0.05. Since the significance value of student activeness is 0.004, which is less than 0.05, H0 is rejected, and

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H1 is accepted. Therefore, there is an effect of the problem-based learning model on student activeness in learning science.

Discussion

The research conducted by this researcher used quantitative, namely quasi-experimentation, which aims to know the effect of using the Problem-Based Learning model on student activeness in learning science. This research was conducted on grade 5B students at SDN Oro-Oro ombo wetan 1 sub-district Rembang Pasuruan district. This study was conducted with a sample of 31 students in class 5B who were used as experimental subjects. This study had no control class because it used a one-shot case study. The experimental class conducted by this researcher used direct learning with the Problem-Based Learning model, with the researcher filling out the student observation sheet in the classroom after being given the treatment.

The experimental class showed a significant increase in student activeness based on the study results. Before receiving the treatment, the average score for student activeness was only 51%. However, after implementing the problem-based learning model, the average score increased to 94%. This indicates a considerable improvement of 43% in student activeness. Using the problem-based learning model has positively influenced and enhanced student activeness in learning science.

In the experimental class, students received better attention and care during the learning process. The problem-based learning approach encouraged students to actively engage in learning activities in group discussions and individual tasks. Students felt more comfortable asking questions to their peers or the teacher, which fostered a supportive learning environment. Throughout the research period, students showed genuine interest in the ongoing learning activities, actively participating from start to finish.

The learning materials focused on object properties and changes in their forms. Comparatively, the problem-based learning model increased student activeness compared to traditional lecture-based learning.

D. Conclusion

Based on the research and discussions conducted, it can be concluded that the problem-based learning model significantly affects student activeness in science learning in class 5B at SDN Oro-Oro Ombo Wetan 1. The research employed a quantitative approach with 31 students, following the steps of problem-based learning, including orienting students to the problem, organizing learning activities, guiding individual and group investigations, developing and presenting work, and analyzing and evaluating the problem-solving process.

The problem-based learning model adopted in this study promotes student-centered learning. Students engaged with real-world science-related problems, conducting independent and group-based research to gather information and solve the identified

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problems collaboratively. The teacher and other students provided guidance and support throughout the process.

Based on the average student activeness scores, there was a significant increase in the experimental class after implementing the problem-based learning model. The average score improved from 51% before the treatment to 94% after, resulting in a remarkable increase of 43%. This demonstrates the positive influence of the problem-based learning model on student activeness in science learning.

The increase in student activeness in the experimental class can be attributed to the guidance provided by the problem-based learning model, which encouraged students to pay close attention to instructions and engage actively in the learning process. As a result, students demonstrated a higher level of activeness, participating happily, regularly, and orderly.

The findings suggest that the problem-based learning model effectively enhances student activeness and positively impacts both students and teachers during the learning process. Incorporating the problem-based learning model as a traditional teaching approach is recommended, especially for less active students in traditional learning settings. Further research is also suggested to explore the effectiveness of the problem-based learning model in different contexts.

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