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Effect of Problem-Based Learning Model on Improving Student Learning Outcomes in the Classification of Living Things Material

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Abstract: Learning outcomes are very important as a benchmark for success in the learning process. This study aims to determine the effect of the Problem-Based Learning (PBL) model on improving student learning outcomes in the material of classification of living things at SMP Negeri 1 Suwawa. The method used is Quasi-experimental with a pretest-posttest control group design. The sample consisted of two classes, namely class VII A as the experimental class and class VII C as the control class, which were selected by random sampling. The instrument used was a multiple-choice test of 15 questions. The pretest results showed an average learning outcome of students in the experimental class of 49.8 and the control class of 50.2. After learning, the posttest results increased to 84.3 for the experimental class and 72.1 for the control class. The N-gain value of the experimental class was in the medium-high category with an average of 0.68, while the control class was in the medium category with an average of 0.44. The t-test results showed t-table, namely 5.62 > 2.00 (at a significance level of 0.05), which means that there is a significant difference between the learning outcomes of students using the PBL model and those using the Discovery Learning model. Thus, it can be concluded that the PBL model-based learning has a positive and significant influence on student learning outcomes in the material on the classification of living things.

Keywords: Classification of Living Things; Learning Outcomes; Problem-Based Learning.

Introduction

Education is a planned effort to help individuals hone their potential through the learning process in various environments, both formal and non-formal. Education is a comprehensive process that continues without being hindered by place and time, because it always occurs in human life throughout the world [1]. Education includes all learning experiences that individuals go through throughout their lives, without any time or age limits, from childhood to adulthood. In a broader view, education is a learning process that is not limited by time [2].

In the field of education, an important aspect that students must achieve is mastery of concepts. Concept mastery is the ability of students to explain part of or define learning material using their own sentences [3].

In science subjects, there is a lot of discussion about the environment, living things, and their characteristics. Science learning includes the Classification of Living Things. Classification of Living Things is the process of grouping and categorizing organisms based on their characteristics. A good understanding of this classification is very important for developing students' scientific knowledge [4].

Learning outcomes in this material are very important because the ability to classify living things based on characteristics is the basis for developing analytical and critical thinking skills in science learning. Students who master the concept are able to provide responses to various variations of questions that are able to connect concepts with everyday life.

According to the results of interviews conducted with the science teachers of grade VII of SMP Negeri 1 Suwawa, the main challenge in learning is the level of Learning Outcomes for science materials. The low Learning Outcomes are caused by several factors. For example, the implementation of practical activities has not been able to run optimally due to the limited tools and materials available in the school laboratory. In addition, the learning approach used is still dominated by a teacher-centered model and is monotonous, resulting in reduced active involvement of students in the learning process. The absence of variation in learning methods that can invite students to be directly involved causes learning to be less interesting and does not foster a high sense of curiosity. Learning activities that can foster students' scientific attitudes, such as solving problems, observing, or experimenting independently, are also still very limited.

Learning is considered successful if students succeed in achieving the desired competencies. This is because it shows students' skills in mastering the material and their activity both inside and outside the classroom. learning model of problem-based ones can improve student success in improving learning outcomes, then the teaching and learning process is also closely related to choosing and using interactive models [5]. Many students have difficulty understanding the concept of classifying living things because the learning approach used is often theoretical and non-contextual, which results in low learning outcomes

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among students. One learning model that can be applied to encourage students to think critically is problem-based learning (PBL). Problem-Based Learning is a learning model that leads students to face real problems as the starting point of teaching, where the learning process begins with the presentation of practical and relevant problems [6].

Model Problem-Based Learning is an interactive learning model because it involves students in solving factual problems. This learning model is able to increase learning motivation and foster students' interest in learning [7]. PBL is also considered an effective example in the development of constructivism-based learning. A number of empirical studies show that the influence of the PBL model has a positive impact on improving critical thinking skills, which are part of the cognitive aspect. However, the influence of PBL on overall concept mastery cannot yet be clearly concluded [8].

There are similarities in previous research that can prove that the learning model obtained that the problem-based learning model can improve learning outcomes for students in junior high schools [9]. Problem-Based Learning is a learning method that addresses problems in student learning, to foster a desire to learn in class or with peers, to solve problems in learning, to be able to think critically, and to be able to use appropriate learning resources. Learning outcomes in classes using the PBL learning model were higher than in classes using the Conventional learning model [10].

The selection of problem-based learning models in this study is based on the ability to encourage students to think critically and actively participate in the learning process in class. Through this opportunity, researchers are interested in conducting research entitled The Influence of Problem-Based Learning Models on Improving Learning Outcome of Classification of Living Things at SMP Negeri 1 Suwawa

Research methods

This study uses a quantitative method with a quasi-experimental design approach. The design of this study uses a pretest-posttest control group design, where the first group (experimental group) is treated with the PBL model, while the second group uses a conventional model.

This research was conducted at SMP Negeri 1 Suwawa, located at Jl. Suwawa No. 56, Bone Bolango Regency, Gorontalo. The population in this study were all class VII. This sample used two classes, namely class VII A and VII C, as samples, which were randomly selected from three classes at SMP Negeri 1 Suwawa. The sampling technique used was probability sampling. Students of class VII A are the Experimental class, and class VII is the Control.

The instrument used in this study was a test, consisting of an initial ability test (pretest) and a final ability test (posttest) to measure the extent of student learning outcomes after studying the test. The instrument had previously been validated by a validator lecturer and tested using the Validity and Reliability test.

Data analysis was conducted using a comparison of average values to measure student learning outcomes. In addition, a Normality Test was conducted to determine whether it was normally distributed or not using the TestKolmogrov Smirnovcontinued with the Homogeneity test to find out the experimental and control groups with the same or different variance conditions of the two groups. The next test is the Hypothesis Test to find out whether there is an influence of the PBL model on student learning outcomes. The last test, the N-Gain Test, is used to see the difference in values post-test and pre-test.

Results and Discussion

Researchers use the average value of each sample group to see the distribution of quantitative data and to observe any increase in concept mastery after using the Problem-based learning (PBL) model. The results of the calculation of the average value in the experimental and control classes were carried out with the help of the Microsoft Excel application to facilitate the data analysis process.

Table 1. Calculation Results

Class	Average	
	Pretest	Posttest
Experiment	38.97	88.21
Control	45.60	57.33

Based on the results of the analysis of the average pretest and posttest values in the table above, there is a difference in the increase in Learning Outcomes between the experimental class and the control class. The experimental class was given treatment using a problem-based learning (PBL) model showed an average increase from 38.97 at the pretest to 88.21 at the posttest. Meanwhile, the control class using teaching devices provided by the school only experienced an average increase from 45.60 to 57.33. The higher increase in the experimental class indicates that the influence of the problem-based learning model improves Learning Outcomes in the material of classification of living things compared to learning using conventional teaching methods in the school.

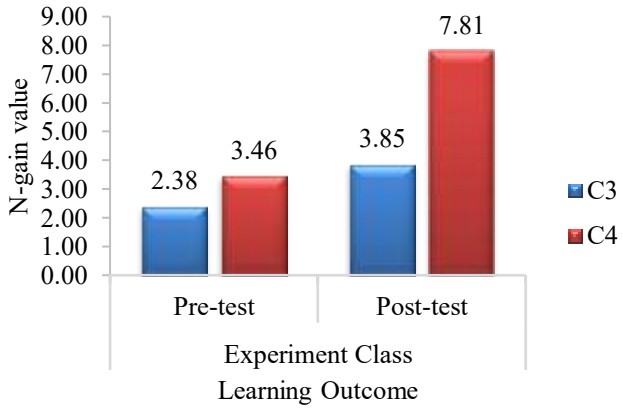

Figure 1. Percentage of cognitive achievement of Experiment class

Shows the comparison of the average pre-test and post-test scores on the cognitive aspects of C3 (Applying) and C4 (Analyzing) in the experimental class after being given treatment using the Problem-Based Learning (PBL)

learning model. It can be seen that there is a significant increase in both aspects. In the C3 indicator, the average pre-test score of 2.38 increased to 3.85 in the post-test, while in the C4 indicator, there was a more striking increase from 3.46 to 7.81. These results indicate that the influence of the learning modelproblem based learning (PBL).

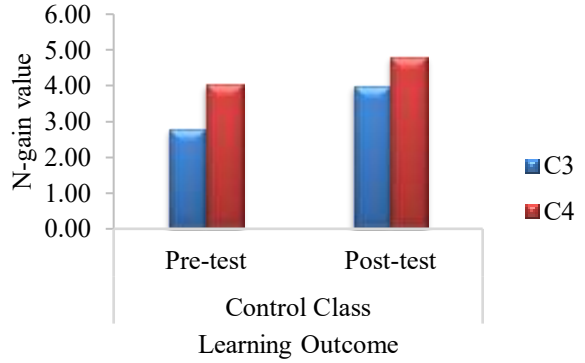

Figure 2. Percentage of cognitive achievement of the Control class

Figure 2 shows the comparison of the average on indicator C3, the average value of the students' pre-test results is 2.8, while at the time of the post-test, it increased to 4. This increase indicates a positive change in learning outcomes on indicator C3, although the increase is classified as moderate. Furthermore, on indicator C4, the average pre-test value was 4.04 and increased to 4.8 on the post-test. This increase indicates that in the control class, there was a better increase, and learning was carried out conventionally without special treatment; students still showed development in mastering concepts.

The results of observations of the implementation of learning by educators, science subjects, class VII, SMP Negeri 1 Suwawa, can be seen in the image below.
Presentation image of learning implementation

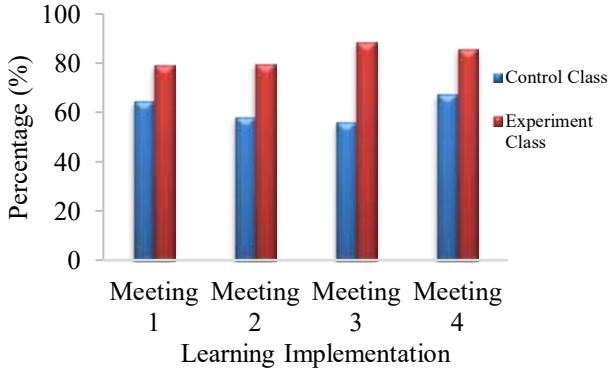

Figure 3. Presentation of learning implementation

Based on Figure 3 at meeting 1, the percentage of learning implementation in the experimental class was 100%, while the control class was only around 74%, so that students' mastery of concepts in the experimental class was higher. At meeting 2, the implementation of learning in the experimental class decreased to 88%, due to lack of time during the study, but it was still higher than the control class which was only around 58% and had an impact on the difference in concept mastery, at meeting 3 the implementation of learning in the experimental class increased again to more than 99%, while the control class was around 59%, which showed that the mastery of concepts in the experimental class students remained better, at meeting 4, the implementation in the experimental class reached around 96%, while the control class was around 67% which reflected the difference in concept mastery of the two classes.

Normality Test

The normality test is one of the initial stages in statistical analysis that aims to determine whether the data used in the research is normally distributed or not. In this study, the normality test was carried out using the Kolmogorov-Smirnov test, which is one of the methods commonly used to test data distribution, especially in relatively large sample sizes. This study uses the normality test formula of Smyrna, which is used by using Microsoft Excel. Testing the normality of data in both classes, namely, the experiment and the control. As for
The results obtained from the statistical test can be seen in the following table of normality tests for research data results.

Based on the table of data normality test results, it is known that $F_i \geq K$ for the real level $\alpha = 0.05$. This shows that the research results for the experimental and control classes are normally distributed.

Hypothesis Testing

Hypothesis testing was conducted to determine whether there was a significant influence of the problem-based learning (PBL) learning model on student learning outcomes in the material on the classification of living things. This test compared the results between the experimental class and the control class in terms of concept mastery. The results of the hypothesis test in both classes can be seen in the table.

Based on Table 4.4, t-count$_{\geq}$ t-table with standards $\propto =$ 0,05 for the experimental and control classes, therefore accepted. This shows that there is an influence of the problem-based learning (PBL) learning model on the material of classification of living things on learning outcomes in the experimental class.
n-gain analysis

Table 2. Data normality test results

Class	Fi	K	Status
Experiment	0.4769	0.26	Normally Distributed
Control	0.4759	0.26	Normally Distributed

The N-gain test aims to see the increase in learning outcomes quantitatively by looking at the increase through pre-test and post-test. The n-gain analysis uses the test course average normalized gain per class can be seen in Table 4.5 as follows:

Table 3 N-gain Test Results

Class	n-gain	Criteria
Experiment	0.82	High
Control	0.08	Low

The n-gain value for the experimental class is 0.82, which is included in the category high**.** It shows that there is a significant increase in learning outcomes after students participate in learning with the problem-based learning (PBL) model. On the other hand, the N-Gain value in the control class was 0.08, with very low criteria. This shows that the increase in learning outcomes in students who follow conventional learning is relatively low. Conventional learning tends to be one-way in the delivery of material by the teacher.

This researcher uses learning using a problem-based learning (PBL) model, on the material of classification of living things in class VII, which was implemented at SMP N 1 Suwawa. This study took class VII as a sample; then the sample consisted of 2 classes, namely class VIIA as the experimental class and class VII C as the control class. The control class is a group of students who do not receive special treatment. The control class functions as a comparison class with the experimental class, so that researchers can observe and measure differences in students' mastery of concepts using the problem-based learning (PBL) model.

This researcher uses learning using a problem-solving model, based on learning (PBL), on the material of classification of living things in class VII, which was implemented at SMP N 1 Suwawa. This study took class VII as a sample; then the sample consisted of 2 classes, namely class VIIA as the experimental class and class VII C as the control class. The control class is a group of students who do not receive special treatment. The control class functions as a comparison class with the experimental class, so that researchers can observe and measure differences in students' mastery of concepts using the problem-based model.

Problem-based learning (PBL) is a learning model that involves students in solving real problems both in groups and individually, so that students' curiosity increases and they are active in learning, and students' mastery of concepts increases [11].

Step by step implementation of the learning model Problem Based Learning (PBL) consists of five stages: 1) Directing students to problems, 2) Organizing students in learning activities, 3) Guiding individual and group investigation processes 4) Developing and presenting work results 5) Analyzing and evaluating the problem-solving process [12]. In this phase, there was an increase because researchers provided evaluations to students with learning that was easy to understand and comprehend. This is in line with the existence of the problem-based learning model [13]. The learning process allows students to learn to understand the meaning based on problems, so that they are able to build student learning outcomes by solving these problems. Using this model, students are more involved in teaching activities, thus making students more motivated to be involved in class [14].

In general, it can be said that the Problem-Based Learning (PBL) learning model has a significant influence on student learning outcomes in the material on the classification of living things. This can be seen from the increase in pretest to posttest scores; the increase was also strengthened through analysis using the N-Gain test, which showed a high category, indicating an increase in concept mastery after implementing the learning model. In this study, data on student concept mastery were obtained from two classes, namely the experimental class and the control class. The two classes received different treatments, namely the experimental class using treatment in the form of a problem-based learning model and the control class as a comparison class, namely using treatment in the form of a conventional learning model or using teaching tools used in schools. To measure learning outcomes, a multiple-choice test was carried out that had been validated by a validator lecturer. Before being given treatment, students first took a pretest to determine the level of initial concept mastery. Furthermore, after giving the pretest, each class followed the PBL-based learning process and learning with the model, Discovery learning, which is used in schools for the Classification of Living Things material during four meetings in accordance with the teaching module that has been prepared.

Based on the percentage of cognitive achievement in the experimental class and the control class, there is a significant difference in the improvement of student learning outcomes in indicators C3 and C4. In the experimental class that uses the problem-based learning learning model (PBL), indicator C3 increased from an average pre-test value of 2.38% to 3.85% in the post-test. This increase is still relatively low in indicator C3, which is related to skills, remembering and understanding basic concepts; students are not fully active in understanding the material. This is due to the low number of students asking and discussing during the learning process. On the other hand, in indicator C4, there was a significant increase from 3.46% in the pre-test to 7.81% in the post-test. This shows that the influence of the PBL model is able to improve students' mastery of concepts, especially in analyzing and linking information, namely from indicator C4. Meanwhile, in the control class using the conventional learning model from the school, the increase in learning outcomes in both indicators was moderate. Indicator C3 increased from 2.8% to 4.0%, and indicator C4 from 4.04% to 4.8%. Although there was an increase, this achievement was not as large as that obtained by the experimental class. This PBL is one of the best examples in developing constructivist learning [15-16]. PBL has a positive contribution to critical thinking skills, which are part of the cognitive sub-dimension, but has not examined how it affects [17-19].

Data analysis in this study was carried out using several tests, namely normality tests, hypothesis tests and n-gain tests for each class, both experimental and control classes. Testing the normality of experimental and control class data using a goodness-of-fit test using test statistics. Colmograve of Smyrna. The normality test for the experimental class and control class is normally distributed, then continued with the Homogeneity test using the F Test which obtained F-count < F-table significance level α = 0.05 for the experimental and control classes, it can be said that both classes are homogeneous, then continued with statistical testing using the t-test which is obtained by t-count ≥ t-table by level $\alpha = 0{,}05$, for the experimental and control classes, it can be concluded that H0 is rejected and Ha is accepted. This shows that the experimental class and the control class have significant learning outcomes or according to the established criteria. However, the T value count, which was significantly higher in the experimental class, showed that the influence of the learning model,

problem-based learning (PBL), on the material on classification of living things has a higher influence on the implementation of learning compared to the learning method used in the control class.

Model Problem-Based Learning is an innovation in the learning process because, through a problem-based approach, students' thinking skills can be honed through structured group work activities. Thus, this model helps develop students' thinking skills and understand the various concepts being studied [20-21].

Conclusion

Based on the research results, it can be concluded that there is an influence of the learning problem-based learning (PBL) model on Student Learning Outcomes on the material of classification of living things at SMP N 1 Suwawa in the experimental class. This is shown by the results through testing using a hypothesis test where t-count ≥ t-table with the standards $\alpha = 0{,}05$, for the experimental class H0 is rejected and H1 is accepted. This is supported by the average value obtained for the course average normalised gain for the experimental class, which is included in the high category, namely 0.82. This shows that the learning model, problem-based learning (PBL), influences student learning outcomes on the material on classification of living things at SMPN 1 Suwawa in the experimental class.

Author Contributions

Amelia Sari: Conceptual, Drafting of Original Paper, Methodology; Chairunnisa J Lamangantjo: Methodology; Supartin: Curation, Writing-drafting of Original Paper; Dewi Diana Paramata: Writing – review and editing; Frida Maryati Yusuf: Formal Analysis, Methodology; I Made Hermanto: Validation

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