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The Effect of Mind Mapping Integrated Problem Based Learning (PBL) Learning Strategies on Learning Outcomes in Biodiversity & Plantae Topics

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ABSTRACT

Learning Strategy Problem Based Learning (PBL) is a learning strategy that develops students' critical thinking skills through solving real-world problems. This study aims to determine the effect of learning through a Problem-Based Learning strategy integrated with Mind Mapping on students' Biology learning outcomes. This research was conducted at SMA Negeri 1 Merbau using a pre-test and post-test control group design. Data from the pre-test and post-test results were analyzed by looking at the N-Grain Score, followed by the ANACOVA test and continued with the parameter estimate test. The Anacova test was carried out to determine the influence of the mind mapping integrated PBL learning model on student learning outcomes. Therefore, a follow-up test was carried out: a parameter estimate test showing Class A (PBL-mind mapping) = 21.582, Class B (PBL) = 21.505 and control class = 0. PBL integrated Mind Mapping has a very significant effect on students' cognitive learning outcomes.

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INTRODUCTION

Learning Biology is a Scientific Process-based learning that encourages students to observe and analyze material concepts scientifically (Suryaningsih, 2017). One of the characteristics of learning Biology is being able to construct students' knowledge independently in order to be able to solve problems in everyday life (Sudarisman, 2015). Many topics in Biology learning are almost entirely abstract in nature, such as physiological processes, cell components and even molecular (Çimer, 2012). Learning difficulties in Biology lessons are generally caused because the material is abstract and there is too much latin (Zamzami, *et al.*, 2020) and boring learning because too much rote (Solikhatun, *et al.*, 2015).

Based on the results of observations on students' Biology learning outcomes at SMA Negeri 1 Merbau, it was found that the average student Biology score was below 6.5 (below the KKM). The student learning outcomes of Biology at SMA Negeri 1 Merbau

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are very low. Biology learning conducted at SMA Negeri 1 Merbau is still conventional, making students less active in discussions. Based on this, it is necessary to apply student-centered learning strategies so students can be more active in learning, namely Problem Based Learning (PBL) integrated with Mindmapping.

Learning Strategy Problem Based Learning is a learning strategy that develops students' critical thinking skills through solving real-world problems (Nur, *et al*., 2016; Wulansari, *et al*., 2019). Applying the PBL strategy will encourage students to be more active in exploring their knowledge and working together to solve problems (Kasih, *et al*., 2018). PBL learning strategies can be integrated with mind mapping models to improve student learning outcomes (Arahmat, *et al*., 2017).

Mind mapping is a learning model that allows students to remember various information in a short time so that students can build on the knowledge that has been given (Ginting, 2017). The Mind mapping learning model can improve students' critical thinking skills and assist students in increasing conceptual knowledge which will affect student learning outcomes (Muharam & Jaenudin, 2020). The Mind Mapping learning model has several advantages, including improving students' creative thinking skills, helping students concentrate and assisting students in conceptualizing material (Hakim, *et al*., 2019).

Relevant research was conducted by Supiandi & Julung (2016) regarding the effect of PBL strategies on problem-solving abilities and cognitive learning outcomes of Biology students, which showed that PBL learning strategies significantly influenced students' Biology learning outcomes compared to conventional learning. PBL learning can also improve students' problem-solving skills by 17.73%. Classroom action research conducted by Elita (2018) showed that student learning outcomes increased by 70.39% in the first cycle and 82.22% in the second. The research conducted by Fitriyah, *et al*. (2015) also showed that the Mind Mapping integrated Creative Problem Solving learning strategy significantly positively affected students' cognitive learning outcomes. Some relevant studies indicate that Problem-Based learning can be integrated with the Mind Mapping model.

Based on the explanation of the problems above, it is necessary to research "The Influence of Integrated Problem Based Learning (PBL) Mind Mapping Strategies on Student Biology Learning Outcomes." This study aims to determine the effect of learning through a Problem-Based Learning strategy integrated with Mind Mapping on students' Biology learning outcomes. This research is expected to provide an overview of effective methods on the topic of biodiversity and plantae.

METHODS

Research Samples

This research was conducted at SMA Negeri 1 Merbau. The population in this study were all students of class X, with a sample of 3 classes totaling 40 students. The class in the research sample consisted of 2 experimental classes and one control class. The experimental class consisted of an integrated Mind Mapping PBL learning treatment (A) and PBL learning (B). The control class consisted of conventional learning treatment (C). Learning is carried out on Biodiversity and Plantae (Plant World) material. The design used in this study is the pretest-posttest control group design which was adapted from Sugiyono (2019) as follows significantly positively affected (Table 1).

Table 1. Research Design Pretest-Posttest Control Group Design

Sample	Pre-Test	Treatment	Post-Test
Class A	O	X_1	O_1
Class B	O	X_2	O_2
Class C	O	-	O_3

Note: Class A (PBL+Mind Mapping); Class B (PJBL); and Class C (Conventional)

Data Collect and Analysis

It was collecting research data using learning achievement test instruments on cognitive aspects (C1-C6). The learning outcomes test instrument was tested first for its validity and reliability by three validators. Data analysis on increasing learning outcomes is calculated using the N-gain formula, which was adapted from Sugiyono (2019) as follows:

$$N\text{-}gain = \frac{postest\ score - pretest\ score}{maximum\ score - pretest\ score}$$

Data analysis was carried out by testing the hypothesis, which was carried out using the Analysis of Covariance (Anacova) approach.

RESULT AND DISCUSSION

The results showed that there were differences in learning outcomes in the application of Problem Based Learning. The pre-test was carried out before the three classes were given treatment. The Pre-Test is in the form of multiple choice questions with the subject of Biodiversity and Plantae (plant world), totaling 54 questions tested for validity and reliability. The score obtained will be converted with a scale of 0-100, as seen in Table 2 as follows.

Table 2. Average Pretest Scores

Class	Mean	Maximum	Minimun
A	35,38	46	17
B	34,00	52	11
C	35,08	44	14

Based on the data above, the highest average score in the Pre-Test was obtained in class A, which was 35.38. The lowest average score in the Pre-Test was obtained in class B, 34.00. The Post-Test was given to the 3 sample classes at the end of the meeting with the same form of questions. The Post-Test was conducted to know students' learning outcomes after being given treatment. Post-Test scores of students can be seen in Table 3 as follows:

Table 3. Average Posttest Scores

Class	Mean	Maximun	Minimum
A	80,12	94	67
B	75,02	85	57
C	60,88	74	48

Based on the data above, the average value of the three classes experienced a significant increase between the Pre-Test and Post-Test. The increase can occur because the 3 sample classes have received lessons on biodiversity and Plantae (plant world). The highest average score in the Post-Test was obtained in class A, which was 80.12. The lowest average score in the Post-Test was obtained in the control class (C), which was 60.88. Analysis of the Pre-Test & Post-Test is carried out by calculating the N-Gain, the results of which are presented in the graph as follows Figure 1.

Based on the graphic data above, in class A it was found that 23 students (57.5%) had moderate learning outcomes, 17 students (42.5%) had high learning outcomes, and no students had low learning outcomes. In class B, it was found that one student (2.5%) had low learning outcomes, 30 students (75.0%) had moderate learning outcomes and nine students (22.5%) had high learning outcomes. In the Control class (C), it was found that eight students (20.0%) had low learning outcomes, 32 students (80.0%) had moderate learning outcomes and no students had high learning outcomes. A hypothesis test can be carried out with the Anacova approach to

determine the effect of the learning model on students' Biology learning outcomes.

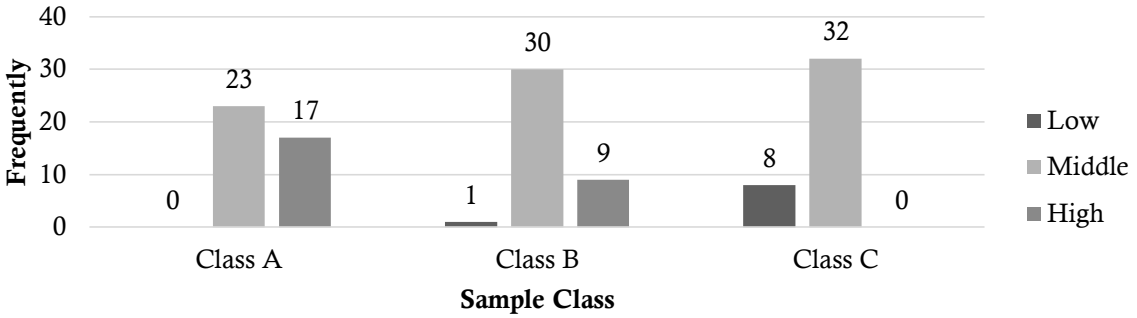

Figure 1. Graph of Student Posttest Score Categorization

A prerequisite analysis test is carried out before the Anacova test, which consists of the normality and homogeneity tests. The Shapiro-Wilk normality test results obtained sig. 0.136, which means <0.05. Based on this, it can be said that the data is usually distributed. Levene's Test t4 homogeneity test results. Sig. 0.881 results were obtained. Based on this, the data is homogeneous, which means that it has never been given any treatment. Based on these calculations, $F_{count} > F_{table}$ is obtained, namely: 3.074> 92.470, so with a confidence level of 95%, Ho is rejected, which means there are differences in learning outcomes in Biology taught with different learning models. Based on this, there is an influence of the learning model on student biology learning outcomes. To discover the answer or solution to something the learning model that has a significant influence on student learning outcomes, a follow-up test can be carried out through the Parameter Estimates test, which can be seen in Table 4. as follows:

Table 4. Parameter Estimates Test Results

Parameter	Standart Error	Significancy
Intercept	7.034	.000
Class A	8.412	.012
Class B	8.097	.008
Class C	.	.

The data in Table 4 shows Class A> Class B> Class C, namely 21.582> 21.505> 0. Class A, which is taught using the integrated PBL Mind Mapping strategy, has a greater influence on student learning outcomes than Class B, which is taught using PBL and Class C, namely the control class, taught conventionally. Based on this, it can be said that Mind Mapping integrated PBL learning strategies significantly influence students' Biology learning outcomes.

During the learning process, students in class A who were taught with integrated PBL Mind Mapping tended to be more creative, as seen from the more varied student notes. Students also seem more active in solving the problems given. During learning, the teacher only acts as a facilitator and motivator in guiding students in problem-solving. The difference in the learning atmosphere was evident in class C which was taught conventionally. Students tend to be passive, and learning is one-way, so that information only comes from the teacher.

PBL is based on providing factual information based on understanding and problem-solving so that it can increase student activity in solving contextual problems (Bilgin & Erdal, 2019; Ulger 2018). Astriani (2020) also revealed that Mind Mapping learning could increase students' creativity and activeness in mapping information obtained

through colors, images, and symbols, making it easier for students to remember and understand the information they have obtained. Based on this, the PBL strategy will be very good to be integrated with Mind Mapping based learning.

Mind Mapping integrated PBL learning can improve student-teacher interaction, so according to Febriyanti (2014), good learning interactions can improve student-learning outcomes. According to Gunawan, *et al*. (2018); Veriansyah, *et al*. (2018), in addition to the interactions built between teachers and students, learning models and strategies can also influence student learning outcomes. Models and good learning strategies can positively influence student learning outcomes.

Relevant research has been conducted by Saparuddin, *et al*. (2021) concerning the effect of the Mind Mapping integrated PBL learning strategy on Biology learning outcomes, with results of 70% of students taught with PBL and Mind Mapping experiencing increased learning outcomes, while 30% of students experienced increased abilities critical thinking. Research conducted by Novita, *et al*. (2019) also showed that the results of the PBL learning strategy with Mind Mapping significantly influenced students' Biology learning outcomes in environmental pollution material. PBL learning with Mind Mapping can also improve students' scientific attitudes with an average of 3.20 (high). Astuti (2019) said that Mind Mapping integrated PBL learning is very effective in science learning in the 21st Century.

CONCLUSION

Based on the results of the hypothesis analysis, the Mind Mapping integrated Problem Based Learning learning strategy has a more significant influence than Problem Based Learning and conventional learning. Data from the results of the students' Post-Test also showed that in the experimental class there were no students who were in the low category, this indicated that there was a significant positive effect of the integrated Mind Mapping Problem Based Learning learning strategy on students' Biology learning outcomes.

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