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The Effect of Implementing the Problem Based Learning (PBL) Learning Model on Student Learning Outcomes

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ABSTRAK

Sekolah-sekolah di Indonesia umumnya menggunakan model pembelajaran konvensional atau tradisional dimana pembelajaran masih terpusat pada guru sebagai sumber pengetahuan utama, sedangkan siswa lebih pasif dalam perannya sebagai penerima informasi. Kurangnya interaksi aktif dan keterlibatan siswa dalam pembelajaran dapat menyebabkan kebosanan dan kurangnya motivasi untuk belajar sehingga dapat menyebabkan rendahnya hasil belajar siswa. Adapun tujuan yang akan dicapai dalam penelitian ini yaitu untuk mengetahui adanya pengaruh penerapan model pembelajaran *problem based learning* (PBL) terhadap hasil belajar peserta didik yang dilaksanakan di kelas X SMA Negeri 8 Makassar pada materi bioteknologi. Jenis penelitian ini adalah penelitian eksperimen dengan penentuan
2 kelas independen yaitu kelas control dan kelas eksperiment. Berdasarkan hasil penelitian dan pengolahan data menggunakan spss statistik, dan uji hipotesis menggunakan uji Man Whitney ditemukan nilai Asymp. Sig. (2-tailed) yaitu 0,004. Hal ini membuktikan bahwa Asymp. Sig. (2-tailed) bernilai lebih kecil dari 0,05 sehingga hipotesis 1 diterima. Dengan demikian, dapat disimpulkan bahwa terdapat pengaruh signifikan penggunaan model pembelajaran *Problem Base Learning* terhadap hasil belajar siswa kelas X SMA Negeri 8 Makassar khususnya pada materi bioteknologi.
Kata Kunci: Pendidikan, Problem Based Learning, Hasil Belajar, Model Pembelajaran, Quasi Eperiment

ABTRACT

Schools in Indonesia generally use conventional or traditional learning models, where teaching is still centered around the teacher as the main source of knowledge, while students play a more passive role as recipients of information. The lack of active interaction and student engagement in learning can lead to boredom and a lack of motivation to learn, which can result in lower student achievement. The objective of this study is to determine the effect of implementing the Problem-Based Learning (PBL) model on students' learning outcomes, conducted in Class X at SMA Negeri 8 Makassar on the topic of biotechnology. This research is an experimental study with two independent classes: a control class and an experimental class. Based on the research results and data analysis using SPSS statistics, and hypothesis testing using the Mann- Whitney test, an Asymp. Sig. (2-tailed) value of 0.004 was found. This shows that the Asymp. Sig. (2-tailed) value is less than 0.05, thus Hypothesis 1 is accepted. Therefore, it can be concluded that there is a significant effect of using the Problem-Based Learning model

on the learning outcomes of students in Class X at SMA Negeri 8 Makassar, particularly on the topic of biotechnology.

Keywords: Education, Problem-Based Learning (PBL), Learning Outcomes, Learning Model, Quasi Experiment

1. INTRODUCTION

Education is one of the fundamental pillars in community development and human civilization advancement. Through education, individuals not only acquire knowledge and skills but also values, ethics, and critical thinking abilities necessary for active participation in society. Education is a human right recognized by various international conventions, including the Universal Declaration of Human Rights, which states that everyone has the right to education. Access to quality education opens doors to broader opportunities, allowing individuals to reach their full potential regardless of social, economic, or cultural backgrounds.

Education not only brings direct benefits in terms of increased knowledge and skills but also has long- term positive impacts on economic, social, and environmental well-being. Therefore, ensuring fair and quality access to education should be a top priority for governments, communities, and all stakeholders committed to creating a better and more sustainable future for everyone (Slameto, 2018). Each component of the education system is interconnected and contributes to the quality and success of education. Focusing on the development and strengthening of each of these components is key to creating a holistic, inclusive, and effective education system. By ensuring that all these elements work together, we can provide education that not only improves academic outcomes but also supports students' social, emotional, and cognitive development. Students' success in education does not depend on a single factor but is the result of the interaction of various interconnected components. A combination of quality teaching, a conducive learning environment, family and community support, student motivation and attitudes, a relevant curriculum, diverse assessments, psychosocial support, access to technology and resources, and supportive educational policies all contribute to achieving optimal learning outcomes (Slameto, 2018).

Education in Indonesia shows a mix of progress and challenges that still need to be addressed. According to PISA (Programme for International Student Assessment), which measures students' abilities in reading, mathematics, and science, Indonesia remains below the international average. In 2022, Indonesian students scored 383 points in science, a decline compared to PISA results from 2015-2018. With a score of 383, Indonesian students are at level 1a in science. Students at level 1a are not yet able to use abstract concepts to explain more complex phenomena, make hypotheses, predictions, or question and identify limitations in scientific data (OECD, 2023). The low learning outcomes of students in Indonesia are caused by various factors, including the application of less effective or unsuitable learning models (Nabilla & Abadi, 2019). Current issues faced by Indonesian students require them to develop higher-level critical, creative, analytical, and collaborative problem-solving skills. Critical and creative thinking skills can be nurtured through learning that demands exploration, inquiry, discovery, and problem-solving, as well as through small group learning using scaffolding approaches and tasks requiring cognitive and

metacognitive strategies (Sunaryo, 2014). One of the learning models that is assumed to address these issues is Problem-Based Learning (PBL).

According to Sanjaya (2006:214), the Problem-Based Learning strategy can be defined as a series of learning activities that emphasize the scientific process of solving problems. In implementing the Problem- Based Learning model, students work in groups and discuss to solve problems related to real-life situations (Sunaryo, 2014). Additionally, by applying concepts and knowledge in the context of problem-solving, students tend to remember and understand the material better. PBL helps students construct their own knowledge, which is more effective for long-term retention compared to traditional learning methods. PBL is often carried out in groups, which encourages cooperation and communication among students. These collaborative skills are not only important for academic success but are also highly valued in the workplace. The ability to work in teams and communicate effectively can enhance students' learning outcomes through the exchange of ideas and knowledge (Nafiah, 2014). Resa Noviasari (2015) states that students' learning outcomes in cognitive, affective, and psychomotor aspects improve with the use of Problem-Based Learning.

Regarding the implementation of the Problem-Based Learning model in schools, observations at SMA Negeri 8 Makassar revealed that, according to interviews with biology teachers at SMA Negeri 8 Makassar, the application of the Problem-Based Learning model is still rare due to time constraints. The number of meetings for one semester with effective teaching hours is considered insufficient for applying this teaching method; the material to be taught in one semester can only be covered in 2-3 meetings per chapter, leading teachers to believe that conventional learning methods are easier and more practical to implement. In conventional learning models, teaching is still centered around the teacher as the primary source of knowledge, while students play a more passive role as recipients of information (Nafiah, 2014). The lack of active interaction and student engagement can lead to boredom and a lack of motivation to learn, thus hindering students' ability to understand learning concepts more deeply. Additionally, there are also learning approaches focused on memorizing facts and information without a thorough understanding of concepts. Students may be able to recall information on tests but might not deeply understand or apply that knowledge in different contexts, which can hinder critical and creative thinking skills, as well as problem analysis abilities. Purwoto (2003:67) notes that one of the drawbacks of conventional learning models is that they can be boring, making students passive and not providing opportunities for them to discover the taught concepts on their own. Through the implementation of the Problem-Based Learning model, students are expected to develop problem-solving skills that can be applied in their daily lives and also increase classroom engagement. The achievement of this goal will be measured by improvements in learning outcomes assessed after teachers and students apply the Problem-Based Learning (PBL) model during instruction.

2. METHOD

The research method used in this study is a Quasi-Experimental design, which is a type of research that includes a control group but does not fully control for external variables that might affect the experiment. This study uses two groups differentiated by the treatment

applied in each class. The first group, or the experimental group, will receive instruction using the Problem-Based Learning (PBL) model, while the second group, or the control group, will receive conventional teaching methods, including lectures and discussions. The study will be conducted during the second semester of the 2023/2024 academic year, specifically in April 2024 according to the 2023/2024 academic calendar. The research will take place at SMA Negeri 8 Makassar, located at Jl. Andi Mangerangi 2 Lorong 3 No. 24, Bongaya, Kec. Tamalate, Kota Makassar.

The population for this study consists of all tenth-grade students at SMA Negeri 8 Makassar for the 2023/2024 academic year. Given the large number of tenth-grade students at SMA Negeri 8 Makassar, a smaller sample size will be necessary for data collection. The population under study is all 316 tenth- grade students at SMA Negeri 8 Makassar. The sampling technique used is purposive sampling, which involves selecting samples based on specific criteria (Sugiyono, 2013). Purposive sampling is employed with the consideration that both sample groups have similar average abilities. The classes selected for the sample are X Merdeka 8, with 30 students, and X Merdeka 5, also with 30 students. Initial observations show that the learning outcomes across all tenth-grade classes are similar, indicating a homogeneous population. The research design employed in this study is a pretest-posttest control group design, where two classes are selected using purposive sampling based on the criterion that the average abilities of the two sample groups are similar. This study involves two classes: an experimental class and a control class. Both classes were given a pre-test using the same instrument, which consisted of 30 test items. The experimental class then received treatment through the teaching of biotechnology material using the Problem-Based Learning (PBL) model, while the control class was taught using the conventional method of lectures and discussions. After the instructional activities were conducted in both classes, a post-test was administered to both classes to assess the learning outcomes achieved after the instructional activities.

For data analysis, both descriptive statistical analysis and inferential statistical analysis techniques were used. Descriptive statistical analysis was conducted using SPSS 22 and Excel to process the data in order to determine the students' learning outcomes. The students' learning outcomes were measured based on the post-test scores obtained by the students. The test results were then analyzed and converted into grades. The formula used to measure individual students' mastery is as follows:

$$\text{Score} = \frac{\textit{Obtained Score}}{\textit{Maximum score}} \text{ x } 100$$

After determining the students' learning outcomes, these results are categorized into several groups. The categories used for learning outcomes are based on the guidelines provided in the educational and assessment handbook for early childhood education, primary education, and secondary education, prepared by the Curriculum and Learning Center, and aligned with the Merdeka Curriculum. Inferential statistical analysis techniques are used to analyze the sample data and apply the results to the population. The purpose of inferential statistical analysis is to test research hypotheses. Before testing hypotheses, prerequisite tests are conducted, including tests for normality and homogeneity

3. RESULT AND DISCUSSION

Based on the research conducted at SMA Negeri 8 Makassar, data was collected on students' initial abilities through pre-tests administered in both the control and experimental classes, as well as data on students' final abilities obtained through post-tests in both classes after the instructional activities were completed. The pre-test and post-test data were then analyzed using the SPSS 22 statistical analysis application. This study focused on the biology subject, specifically on biotechnology material. Based on descriptive statistical analysis, the pre-test scores in experimental and control classes are almost the same, with the minimum score in the control class being 20 and the minimum score in the experimental class being 10, while the maximum score for both is 70. These scores are relatively low, indicating that the students' abilities in both the control and experimental classes were similar at the beginning, before the learning interventions were applied. Subsequently, in the post-test column, a significant change in the students' learning outcomes in both classes is observed. In the post-test column for the control class, the highest score achieved is 93.33, while the lowest score is 40.00. This differs from the post-test results in the experimental class, where the maximum score is 100 and the minimum score is 60. To observe the changes in more detail, the following presents the students' learning outcomes categorized into interval ranges based on KKTP (Criteria for Achievement of Learning Objectives) according to the Merdeka Curriculum:

Table 1 Frequency Distribution of Pre-test and Post-test Scores for Control and Experimental Classes

		Class A (**Control**)		Class B (**exsperiment**)	
Category	Score	pre-test	**post-test**	pre-test	**post-test**
Mastered, enrichment possible	86-100	0	6	0	15
Mastered, no remediation needed	66-85	6	11	4	13
Not mastered, remediation needed for some parts	41-65	9	11	13	2
Not achieved, full remediation required	0-40	15	2	13	0
Number of students		30	30	30	30

In Table 1 above, a significant difference in learning achievement between the experimental and control classes can be observed. The frequency of students achieving mastery in the control class is noticeably lower compared to the frequency of students achieving mastery in the experimental class. In the control class, only 17 students achieved mastery in the post-test, whereas in the experimental class, 28 out of 30 students achieved mastery. To examine the difference in learning outcomes as a percentage, the following table shows the differences in percentage terms. The learning outcome categories used are divided into two groups only: mastered and not mastered.

Table 2 Percentage Distribution of Pre-test and Post-test Frequencies for Control and Experimental classes

		Class A(Control)		Class B(Experiment)	
Category	Score	pre-test	**post-test**	pre-test	**post-test**
Mastered	>66	20%	56.66%	13.33%	93.33%
No mastered	<65	80%	43.33%	86.66%	6.66%

In both tables of the analysis results above, we can clearly see the mastery of learning outcomes obtained by the control class and the experimental class during the pre-test and post-test. According to the KKTP of the Merdeka Curriculum, there are four categories of mastery: mastery with enrichment, mastery without remedial, incomplete with partial remedial, and incomplete with full remedial. Table 4.3 shows the percentage distribution of students who achieved mastery and those who did not in the pre-test and post- test. Based on the comparison of the percentage between the pre-test and post-test in the control class and experimental class, the percentage of students in the control class who achieved mastery increased by 36.66%, while the experimental class experienced a sharper increase of 80%. Additionally, the percentage of students in the control class who did not achieve mastery decreased by approximately 36.67%, whereas the percentage of students in the experimental class who did not achieve mastery significantly decreased by 80%. This indicates a significant increase in the mastery rate among students in the experimental class after undergoing learning with the Problem-Based Learning (PBL) model, resulting in a reduction in the number of students who did not achieve mastery.

The research findings show that the learning outcomes of Class X students in biotechnology material using the Problem-Based Learning model were higher than the learning outcomes of students using traditional learning methods such as lectures and discussions. This is in line with the research by Resa Noviasari, which stated that students' cognitive, affective, and psychomotor learning outcomes increased using the Problem-Based Learning model (Noviasari, 2015).

PBL (Problem-Based Learning) places students in situations that simulate real-world challenges, allowing them to apply theoretical knowledge in practical contexts. This not only deepens their understanding of the subject matter but also prepares them to face similar situations outside the academic environment. PBL teaches students to reflect on their own thinking processes and problem-solving strategies. These metacognitive skills help students become more independent and effective learners, capable of planning, monitoring, and evaluating their own learning. This aligns with Sunaryo's (2014) view that students' critical and creative thinking skills can be developed through learning activities that require exploration, inquiry, discovery, and problem-solving, as well as through learning in small groups that employ tasks demanding both cognitive and metacognitive strategies.

In PBL, students are taught to seek, evaluate, and use information from various sources to solve problems. These skills are crucial in today's information age and help students become more critical and selective when accessing information. PBL places students at the center of the learning process and gives them greater responsibility for their own learning. By directing their own learning process, students feel more empowered and motivated to achieve higher learning outcomes. According to Wena Made (2012), problem-

based learning strategies are also an approach that confronts students with practical, ill-structured, or open-ended problems through learning stimuli. This statement is evident in problem orientation activities, where students are highly enthusiastic about discussing the issues presented by the teacher, opening their minds to potential solutions that can serve as alternative resolutions. In the learning activities, teachers also divide students into heterogeneous groups to organize their learning, allowing them to collaborate and communicate effectively. As stated by Rusman (2015), PBL facilitates the success of problem-solving, communication, teamwork, and interpersonal skills better than other approaches.

Individual or group investigations have also proven to be effective, especially in improving students' literacy skills and developing their critical and creative thinking skills in seeking various reference materials needed to solve problems. Additionally, students review the strengths and weaknesses of each solution they find. This statement aligns with the research conducted by Masrina EN et al. (2019), which states that critical thinking skills can be improved through PBL (Problem-Based Learning) because it involves the application of learning based on authentic problems, and students not only analyze one problem but also have to collaborate to solve it.

The Problem-Based Learning model has been shown to have a significant impact on improving students' learning outcomes, particularly in biology. This suggests that the problem-based learning model can be applied in schools to enhance students' learning outcomes, thereby increasing students' proficiency index in science, especially improving their learning index on international assessments like PISA. To achieve improved student learning outcomes, researchers have sought to formulate learning objectives based on the Problem-Based Learning model to stimulate students' critical thinking, innovation, creativity, and problem-solving skills.

To determine whether students have successfully achieved the learning objectives, educators need to establish criteria or indicators for the achievement of these objectives. These indicators are encompassed in Bloom's Taxonomy's cognitive domain at levels C1, C2, C3, and C4. The achievement of learning objectives, which can serve as a benchmark for improving students' learning scores, is also experimental class where the Problem-Based Learning model was implemented, a considerable number of students achieved a perfect score of 100 points, indicating their ability to answer analysis-level (C4) questions well. In contrast, the maximum score in the control class, which did not apply the Problem-Based Learning model, was 93.33, suggesting that students' performance in the experimental class improved significantly after the implementation of the PBL model.

Descriptive statistical data analysis also showed a notable gap between the pre-test and post-test results in the control and experimental classes. In the control class, the increase from pre-test to post-test was only 36.66% after the learning activities. In contrast, in the experimental class that applied the PBL model, the increase was much greater, at 80%. This improvement indicates that the implementation of the PBL model had a much larger impact on the students' learning outcomes compared to the control class, which did not implement the PBL model. Based on data processing using the Mann-Whitney test, the Asymp. Sig. (2-tailed) value was less than 0.05, meaning that H0 was rejected and H1 was accepted. Therefore, it can be concluded that "There is an effect of applying the Problem-Based Learning (PBL) model on the biology learning outcomes of 10th-grade students at SMA Negeri 8 Makassar," and this statement is proven to be accepted.

4. CONCLUSION AND SUGGESTION

The implementation of the problem-based learning model in the experimental class resulted in higher learning outcomes compared to the control class, which did not use the problem-based learning model. Therefore, there is a significant effect of using the Problem-Based Learning model on the biology learning outcomes of 10th-grade students at SMA Negeri 8 Makassar.

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