



The Effect of Implementing Problem-Based Learning (PBL) Model on Junior High School Students' Learning Outcomes on Cell Material

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ABSTRACT

The study aims to investigate the effect of implementing the Problem Based-Learning (PBL) model on students' learning outcomes in science subject matter, specifically cell introduction, for Grade VIII Students at SMP Gloria Dei Wee Kura. The research employed a quasi-experimental method with a Pre-test and Post-test Control Group Design. The subject consisted of 22 students divided into two classes: 11 students in the experimental class and 11 students in the control class. The research instrument was a multiple-choice test consisting of 14 items that had been tested for validity and reliability. Data collection was conducted through Pre-test and Post-test, while data analysis was carried out using the non-parametric Mann-Whitney U Test with the assistance of SPSS version 16.0. The results showed a significant difference in learning outcomes between the experimental class and the control class, a significance value of $0,000 < 0,05$. This finding demonstrates that the application of the Problem Based-Learning (PBL) model has a positive effect on students' learning outcomes in the science topic of Cell Introduction for Grade VIII at SMP Gloria Dei Wee Kura.

INTRODUCTION

In the context of globalization, education faces rapid and complex changes. Education plays a very important role in developing the quality of a nation's human resources. Good quality education will produce a generation that is not only cognitively intelligent, but also has skills that are relevant to the demands of the real world, including critical thinking, communication, and problem-solving skills (Zheng et al., 2020; Pirmik et al., 2025). However, improving the quality of education is not always easy, especially in areas with limited access to educational facilities and infrastructure.

The teaching and learning activities carried out at Gloria Dei Wee Kura Junior High School are ineffective. Based on field observations, students at Gloria Dei Wee Kura Junior High School still rely heavily on traditional learning models, where teachers dominate the delivery of learning materials and students tend to be passive listeners (Budianto et al., 2021). The learning models and methods used by teachers do not involve students in an active learning process (Aisyah et al., 2019). This can be seen from the way students learn, which tends to be passive analysis of information, without involving in-depth skills or problem solving. In the long term, learning that does not actively involve students can have an impact on low student motivation and interest in learning, which directly affects low student learning outcomes (Bandura, 2019; Harapi, 2018).

The low learning outcomes of eighth-grade students at Gloria Dei Wee Kura Junior High School indicate problems in the learning process that occur in the classroom, where students' learning outcomes in science lessons have not yet reached the expected standards and are even relatively low (Ambarwati & Riyanto, 2018). These low learning outcomes are caused by the lack of use of interactive and varied learning models and a tendency toward Teacher-Centered Learning (TCL) or learning models that only focus on the teacher, so that students become passive during the learning process (Sari et al., 2021). Therefore, it is necessary to improve the quality of learning by implementing more innovative and effective learning models so that students can achieve maximum learning outcomes (Daryanto, 2018; Suharto, 2020).

One of the efforts that can be made to overcome this problem is to use a learning model that actively involves students in the teaching and learning process so that their learning outcomes improve. One learning model that is considered to be a solution to this problem is the Problem-Based Learning (PBL) model (Tan, 2017). The Problem-Based Learning (PBL) model is a learning model that is able to involve students actively during classroom learning (Muawanah et al., 2025). This model also emphasizes problem solving as the center of learning activities and provides students with real problems that are relevant to their daily lives, so that students will be actively involved in working together in groups to find solutions to these problems (Arends, 2016; Hung et al., 2020). Therefore, with the application of this model, students are actively involved in learning.

Several studies have shown that the application of the Problem-Based Learning (PBL) model can improve student learning outcomes in science subjects (Rahman, 2019; Djati et al., 2023). This learning model emphasizes the active involvement of students in solving problems that are relevant to everyday life so that students can understand concepts deeply and critically (Masek & Yamin, 2017; Wahyuni, 2019). The Problem-Based Learning (PBL) model also encourages students to work collaboratively, improves critical thinking and creativity, and strengthens their understanding of basic biology concepts, including cell introduction material (Hmelo-Silver et al., 2016). The application of the Problem-Based Learning (PBL) model allows students to be more active in finding solutions, discussing, and developing conceptual understanding through complex problem solving (Dolmans et al., 2016; Belland et al., 2018).

Based on the background description above, the researcher was interested in conducting direct research to determine the effect of the learning model on student learning outcomes, with the title "The Effect of Implementing Problem-Based Learning (PBL) Model on Junior High School Students' Learning Outcomes on Cell Material".

METHOD

This study uses a quasi-experimental design with a pretest-posttest control group design. This design was chosen because it allows researchers to compare learning outcomes between the experimental group taught using Problem-Based Learning (PBL) and the control group taught using a conventional learning model, by measuring changes in learning outcomes before (pretest) and after (posttest) the treatment was given.

This research will be conducted in the even semester of the 2025/2026 academic year, namely in July 2025, and the research location will be at Gloria Dei Wee Kura Junior High School, located in Wee Kura Village, West Wewewa District, Southwest Sumba Regency, East Nusa Tenggara Province.

The experimental class will be taught using the Problem-Based Learning (PBL) model, while the control class will be taught using the conventional learning model. The research instrument consists of a learning outcome test (pre-test and post-test) with 30 multiple-choice questions that will be tested for validity, reliability, difficulty level, and discriminating power. Data were analyzed using normality and homogeneity tests, t-tests for normally distributed data, and Wilcoxon Signed Rank Tests for non-normally distributed data.

RESULTS AND DISCUSSIONS

Research Results

The sample in this study consisted of 22 eighth-grade students, with 11 students in the experimental class using the Problem-Based Learning (PBL) model and 11 students in the control class using the conventional learning model. Before the treatment was given, each student in both classes was given a pre-test to determine their initial ability in cell introduction material. After the learning process, students were again given a post-test with the same questions to determine the improvement in learning outcomes after the treatment.

The instrument used in this study was a multiple-choice test consisting of 14 questions that had been tested for validity, reliability, discriminating power, and level of difficulty. The questions were tested through both expert validation and empirical validation. Expert validation was carried out by two experts, namely a junior high school science teacher and a science lecturer from Weetebula Catholic University with expertise in the field of biology.

Based on the validity test results, there were 14 valid questions and 16 invalid questions. These valid questions were used as research instruments. Next, a reliability test was conducted using Cronbach's Alpha, and the result was $\alpha = 0.772$, which is classified as high, meaning that the instruments were reliable.

Tabel 1. Reliability Statistics

| Cronbach's Alpha | N of Items |
|-------------------------|-------------------|
| .772 | 15 |

The results of this study are data (pre-test) before treatment and data (post-test) after students participated in the learning process using the Problem-Based Learning (PBL) model.

Tabel 2. Compared the values of the control class and the experimental class

| | Control | | Eksperiment | |
|----------------------|-----------------|------------------|--------------------|------------------|
| | Pre-Test | Post-Test | Pre-Test | Post-Test |
| Minimum Score | 36 | 36 | 29 | 71 |
| Maximal Score | 50 | 57 | 57 | 93 |
| Amount | 473 | 543 | 480 | 937 |
| Average | 43 | 49,36 | 43,64 | 85,18 |

Based on the data in Table 2, it appears that the average post-test scores in the experimental class increased more significantly than those in the control class. This indicates that the implementation of the Problem-Based Learning (PBL) model had a positive effect on improving student learning outcomes.

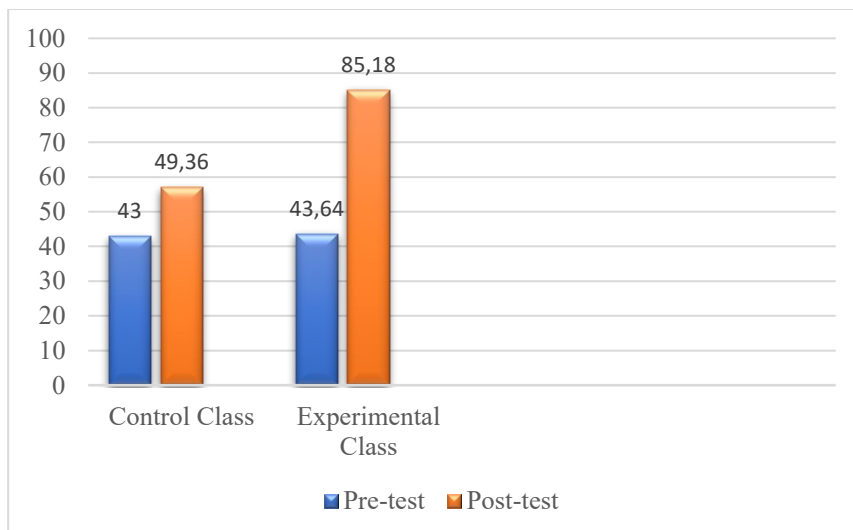


Fig 1. Comparison Diagram of Average Values for Control and Experimental Classes

Based on Figure 1, it is clear that the average pre-test score in the control class was 43, while in the experimental class it was 43.64, indicating relatively balanced initial conditions. After learning, the average post-test score in the control class increased to 49.36, while in the experimental class it increased to 85.18. Thus, the average post-test score of the experimental class was 35.82 higher than that of the control class, indicating that the application of the Problem-Based Learning (PBL) model had a positive effect on student learning outcomes in the subject of Cell Introduction.

The Shapiro-Wilk normality test showed that the data were not normally distributed ($p < 0.05$), so the analysis used a non-parametric test.

Tabel 3. Tests of Normality

| Class | Shapiro-Wilk | | |
|--------------------------------------|--------------|----|------|
| | Statistic | df | Sig. |
| Result Pretest (Experimental) | .948 | 11 | .620 |
| Posttest (Experimental) | .828 | 11 | .022 |
| Pretest (Control) | .824 | 12 | .018 |
| Posttest (Control) | .833 | 10 | .036 |

The Wilcoxon Signed Rank Test is one of the tests used to determine the effect of learning outcomes between two classes (experimental and control) before and after treatment. The experimental class used the Problem Based Learning (PBL) learning model and the control class used the conventional learning model. This test is an alternative to non-parametric tests used when the assumption of normality is not met.

Tabel 4. Wilcoxon Test for Experimental Class

| Pretest – Posttest | |
|------------------------|---------------------|
| Z | -2.943 ^a |
| Asymp. Sig. (2-tailed) | .003 |

The results of the analysis in Table 4 above show that the significance value Asymp. Sig. (2-tailed) = 0.003 < 0.05. These results indicate that there is a significant effect of the application of the

Problem-Based Learning (PBL) model on student learning outcomes in Grade VIII science material on cell introduction at Gloria Dei Wee Kura Junior High School.

The analysis results in Table 5 above show that the significance value Asymp. Sig. (2-tailed) = $0.026 < 0.05$. These results indicate that there is no significant effect of the conventional learning model on student learning outcomes in the Grade VIII Science subject of Introduction to Cells at Gloria Dei Wee Kura Junior High School.

Table 4. Wilcoxon Test for Control Class

| | Pretest – Posttest |
|------------------------|---------------------------|
| Z | -2.232 ^a |
| Asymp. Sig. (2-tailed) | .026 |

Discussions

Based on the description of the research results, the normality test results in the experimental class pretest had a sig. value of 0.620 ($p > 0.05$), indicating that the data was normally distributed. Meanwhile, the data in the control class pretest had a value of 0.018 ($p < 0.05$), indicating that the data was not normally distributed. This shows that at the beginning of the study, there was a difference in the characteristics of the data distribution between the two classes. However, in general, the pretest in both classes, the experimental class and the control class, can still be said to be comparable because neither class had been given any learning treatment. The difference in normality distribution at this early stage may be due to variations in the initial abilities of the students, which cannot be fully controlled by the researcher. This is consistent with the perspective that initial data variations are common in educational research involving diverse student backgrounds (Nismalasari et al., 2016).

According to Sugiyono (2019), research data at the initial stage does not always have to be identical, but the most important thing is how the treatment given is able to show significant changes at the final stage of the study. Thus, the difference in data distribution at the pretest stage is not a major obstacle but rather a basis for comparison to see the extent of the effect of the treatment after the learning process takes place. In contrast to the pretest results, the normality test results for the posttest data showed that both the experimental class and the control class had significance values smaller than 0.05, namely 0.022 ($p < 0.05$) for the experimental class and 0.036 ($p > 0.05$) for the control class. This means that the post-test data for both classes are not normally distributed. This condition requires the researcher to use non-parametric statistical analysis, because the basic assumption of parametric tests (normality) is not met (Syamsuddin & Wijayanti, 2020; Jusariani et al., 2024).

Therefore, the researcher used the Wilcoxon Signed Rank Test as an alternative to analyse the effect on learning outcomes before and after the treatment (Indrawati et al., 2020). Based on the results of the Wilcoxon Signed Rank Test analysis in the experimental class, a significance value of Asymp. Sig. (2-tailed) = $0.003 < 0.05$ was obtained, indicating that there was a significant effect between the pretest and posttest learning outcomes in the experimental class after applying the Problem-Based Learning (PBL) model (Rahman, 2019; Wahyuni, 2019). Meanwhile, in the control class, the Wilcoxon Signed Rank Test results showed a significance value of Asymp. Sig. (2-tailed) = $0.026 < 0.05$, indicating that learning using the conventional learning model did not have a significant effect on student learning outcomes (Budianto et al., 2021).

The significant difference in learning outcomes in the experimental class shows that the application of the Problem-Based Learning (PBL) model has an effect on student learning outcomes compared to learning using the conventional model (Djati et al., 2023). This is because the Problem-Based Learning (PBL) model provides opportunities for students to understand concepts through real problem-solving activities, making the learning process more meaningful (Tan, 2017). Through the stages of problem orientation, independent investigation, group discussion, and presentation of results, students actively construct their own knowledge (Arends, 2016). This active involvement has an impact on improving their understanding of science concepts, especially in the material on cell introduction.

This is in line with the opinion of Masek & Yamin (2017), who explain that Problem-Based Learning (PBL) can improve learning outcomes because it encourages students to construct knowledge

through contextual learning experiences. In addition, Problem-Based Learning (PBL) helps students understand concepts in depth because they are directly involved in the process of finding and applying information relevant to the problems they face (Dolmans et al., 2016; Hung et al., 2020). Thus, students do not just memorise, but truly understand the content of the lesson.

The results of this study also support the findings of Hmelo-Silver (2004), who stated that problem-based learning can improve students' conceptual understanding and academic learning outcomes through active engagement and reflection during problem solving. In the context of this study, the application of Problem-Based Learning (PBL) made students more active in science learning activities, discussing, asking questions, and seeking solutions to problems given by teachers, thus having a direct impact on learning outcomes (Zheng et al., 2020).

Thus, based on the analysis of the research findings, it can be concluded that learning with the Problem-Based Learning (PBL) model has a more significant effect on student learning outcomes in cell introduction material in Grade VIII at Gloria Dei Wee Kura Junior High School. The increase in post-test scores in the experimental class compared to the control class shows that the application of Problem-Based Learning (PBL) is more effective in helping students understand the material, because learning is not only teacher-centred but also focused on the activities and understanding of the students themselves (Suharto, 2020).

CONCLUSION AND SUGGESTION

Based on the results of the research conducted, it can be concluded that there is a significant effect of the application of the Problem-Based Learning (PBL) model on student learning outcomes in the subject of Cell Introduction in Grade VIII at Gloria Dei Wee Kura Junior High School. This is evidenced by the results of a non-parametric test (Wilcoxon Signed Rank Test) which shows a significant increase in post-test scores in the experimental class after the implementation of the Problem Based Learning (PBL) model compared to the control class which used a conventional learning model. Thus, the application of the Problem Based-Learning (PBL) model has been proven to have a positive and effective influence on student learning outcomes, because through this model, students can be actively involved in the learning process, understand concepts through contextual problem solving, and build their own understanding of the material being studied. The results of this study also answer the research objective, which is to determine the effect of implementing the Problem-Based Learning (PBL) model on student learning outcomes in science material on cell introduction in Grade VIII at Gloria Dei Wee Kura Junior High School.

It is recommended that science teachers implement the Problem-Based Learning (PBL) model as an alternative in the learning process, especially for conceptual material such as cell introduction. This model has been proven to encourage active and collaborative involvement of students in understanding concepts through problem solving. Schools are expected to provide support for the implementation of innovative learning models such as Problem Based Learning (PBL), both in terms of teacher training, provision of supporting facilities and infrastructure, and policies that encourage teachers to develop student-centred learning. Referring to the results of this study, it is hoped that future researchers will conduct research by applying the Problem-Based Learning (PBL) model to other learning materials, especially in science subjects such as Introduction to Cells.

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