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# Problem-Based Learning in Biology Learning: Implementation in PPG Students of Manado State University

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## ABSTRACT

This study aims to assess the effects of incorporating the Problem-Based Learning (PBL) approach on the acquisition of biology knowledge among PPG students at Manado State University. The research subject comprised 31 students, comprising 14 males and 17 females. This is an instance of educational research referred to as classroom action research, which especially adheres to the approach defined by Kemmis and Taggart. The research was carried out in two distinct phases: the initial phase encompassed planning, execution, action, and observation, while the subsequent phase centered on reflection. Data for the research was gathered by conducting assessments that included both multiple-choice and essay questions. Professionals evaluate Psychomotor learning outcomes through direct observation utilizing a psychomotor assessment form. The cognitive outcomes of cycle I were 51.61% and the cognitive outcomes of cycle II were 80.64%. The psychomotor learning outcomes related to tool and material preparation showed a 19.35% rise, whereas the outcomes for tool and material assembly demonstrated a 25.80% increase. The experimental component experienced a 22.58% increase, the observational component saw a 29.03% increase, and the delivery part of the trial witnessed a significant 41.93% increase. Research indicates that implementing Problem-Based Learning (PBL) can enhance students' academic achievement.

**Keywords:** Learning Outcomes, PBL, Biology, Program, Profession, Teacher

# INTRODUCTION

In Indonesia, the government has several curricula that have been implemented in the world of education in Indonesia, one of which is currently running is the independent curriculum, where in 2022 the Indonesian government will start implementing a new curriculum called the independent curriculum. Therefore, there are changes to the curriculum components, one of which is the syllabus that will be used in implementing the independent curriculum and this is where a teacher's ability will be tested to see whether or not they are successful in implementing the independent curriculum. This is supported by Sholeh (2016) explaining that adjustments to various curriculum components must ultimately be followed by understanding and the ability to apply them in the teaching and learning process. In reality, with the implementation of the independent curriculum, not all teachers can fully understand every content of the curriculum, many teachers feel confused about implementing the independent curriculum because teachers are not used to using it and are still stuck to the old curriculum (Praptono et al., 2020). This curriculum requires students to be more active than teachers and implement student-centered learning so that teachers are also required to be more actively creative in designing learning models that are of course interesting and easy for students to understand and of course can improve students' learning abilities (Zulaiha et al., 2023).

Moreover, in the independent curriculum, several learning models are implemented, one of which is Problem Based Learning, this learning model is believed to be able to increase the effectiveness of learning and in this context, students are more often involved in various learning. The problem aims to increase in-depth understanding of the topic being taught. This is supported by Eguchi (2006) who states that Problem-Based Learning (PBL) can influence student motivation in learning by making students more active in exploring their skills and socializing training with colleagues in working on joint projects. This model encourages student-centered classes that focus on developing skills for lifelong learning and collaboration between students working either in small groups or classes (Domu et al., 2023). In this independent curriculum, not all teachers can implement PBL well according to the applicable syntax due to a lack of teacher knowledge (Kumesan et al., 2023). Meanwhile, to achieve effective learning goals by using an independent curriculum and of course, improving students' abilities, the role of a teacher is very necessary for this (Lohonauman et al., 2023). Teachers are required to have many skills in teaching and have the potential to be able to create interesting education and learning and make it easier for students to understand the lessons given (Mangelep et al., 2023).

Teaching is a special career that requires special abilities and can only be done by individuals in the field of education. Professional work relies on specialized information obtained from leading educational institutions to ensure that performance is based on scientifically validated expertise (Mangelep, 2023). Therefore, a professional educator must be well-equipped from the start, namely during his tenure as a prospective teacher (Oviysnti, 2016). A prospective educator must have the ability to design and integrate science learning methods that are suitable for students with diverse backgrounds and learning preferences (Gunawan et al., 2017; Defitriani, 2019; Ghani, 2023). Teacher education programs are developed using a sequential approach to meet the needs of professional teachers. The goal is to integrate subject matter expertise and pedagogical knowledge. Following Law Number 14 of 2005, professional teachers are required to have a bachelor's degree or equivalent, as well as professional education (Ardiansyah, 2013). These requirements apply regardless of their educational

or non-educational background. However, it is important to pay close attention to developing trends and future educational needs. Therefore, professional teacher education is categorized into two pathways, namely professional teacher education (PPG) for individuals who have a bachelor's degree in education, and professional education for teachers with a bachelor's or non-education background (Sukri et al., 2018). The design of this professional teacher education program focuses on content-based and content-specific pedagogy to equip prospective teacher students with teaching skills in a multicultural student environment (Danniarti, 2018). The entire program must facilitate the development of prospective teachers who can organize and implement the knowledge they gain in collaboration with fellow educators (Tambak, 2017).

Currently, to become a teacher it is not enough just to be an education graduate, and those with a bachelor's degree in education are not entitled to obtain an educator certificate, but since the enactment of Law Number 14 of 2005, the government has issued new regulations for prospective teachers in Indonesia. Teachers must take additional education. It's called professional teacher education (PPG). More specifically, it states that teachers must have academic qualifications, competence and education, certificates, be physically and spiritually healthy, and have the ability to realize national education goals. Professional Teacher Education must be taken for 1 year after the candidate graduates from an undergraduate or non-graduate education program. Through the PPG program, it is hoped that the PPG (Teacher Professional Education Program) can make teachers competent and professional (Putri & Ramadhani, 2022). Professional teacher education programs also understand the needs of students, especially students in the era of globalization, and must know the use of technology in all aspects used in the teaching and learning process and the implementation of the independent curriculum, especially using PBL in teaching practice programs (Susilo & Sarkowi, 2018).

The acquisition of biological knowledge is closely linked to problem-solving practices, requiring students to engage in critical thinking to identify and implement solutions to the challenges they face. This relates to the field of biology which includes a series of complex and ambiguous problem scenarios that tend to captivate students' interest and curiosity (Anggraeni, 2017). Examples of these scenarios include problems related to environmental pollution, a sudden increase in the caterpillar population, cases of food poisoning, etc. (Pitiriani, 2020). Learning natural sciences, especially biology must prioritize offering students direct encounters to foster a deep understanding of the natural environment and its potential for practical application in everyday life (A'yuna, 2017; Wilujeng, 2020; Pustikayasa et al., 2023). Incorporating elements of attitude, process, product, and application into biology education in schools allows students to gain a comprehensive understanding of the learning process, understand natural phenomena through problem-solving activities and scientific methodology, and imitate the work of scientists in uncovering new information (Wedyawati & Lisa, 2019). Research by Nirmala et al. (2024) has explored teachers' perspectives: exploring the difficulties of PBL. Based on this research, the researcher found several problems in this research, namely that it turned out that many PPG students did not fully understand how to use PBL, especially PPG students, some students felt they did not understand the correct use of PBL because they were still at school. Undergraduate students have never received detailed and in-depth knowledge about PBL and when they practice teaching Undergraduates, they have never applied PBL during the learning process, let alone when implementing the applicable independent curriculum, whereas in the PPG program, they are asked to

practice in schools that already have used an independent curriculum, whereas in the PPG program, there are no courses that specifically discuss PBL. In implementing PBL several syntaxes must be carried out by the teacher and each process must be based on existing syntax (Zamzami, 2022). In implementing PBL, teachers are required to be responsible or monitor student activities while completing projects so that students can develop ideas, produce and increase student creativity, and make students more active (Nugraha, 2023).

However, in implementing PBL, of course, the teacher must know and understand the steps in implementing PBL, and every process and activity carried out must be based on the syntax that applies in the PBL learning model, whether it is appropriate or not. In its implementation, some students experience difficulties when applying PBL in learning, one of which is adapting each activity or step in using PBL to PBL syntax (Mangelep, 2023). So, PPG students often go back and forth to work on each stage of PBL syntax. There are several obstacles faced by PPG students in preparing teaching materials and carrying out learning by implementing PBL during the teaching practice program. To find out each PBL implementation process, researchers are interested in seeing the PBL implementation process used by PPG program students during teaching practice at school.

In addition, instead of discussing the importance of the PPG program for teachers, not many researchers have studied the implementation process and teaching steps carried out by PPG program students, especially with the PBL learning model. It is necessary to identify the PBL syntactic steps used to evaluate the accuracy of the teaching methods used and the fulfillment of students' needs. Based on the problems found by previous researchers, the researcher believes it is important to conduct research entitled "Implementation of PBL Learning in Biology Learning Used by PPG Program Students" and this research aims to determine the implementation of PBL learning during teaching practice programs by PPG State University students Manado academic year 2022/2023.

## METHODS

The research was carried out in classes 001 and 002 of Batch 2 PPG Manado State University in 2023 involving a total of 31 students. This research uses classroom action research (PTK) methodology. The research model used is the PTK cycle based on the Kemmis and Mc Taggart design (Paizaluddin & Ermalinda, 2012); This approach is expected to provide better results. There are three stages in this research, namely 11) preparation, 2) implementation and observation, and 3) reflection.

### *1. Preparation*

Activities carried out at the preparation stage include a) creating a Semester Learning Plan (RPS) that outlines the steps of the learning process using the Problem-Based Learning (PBL) model and 1 Student Activity Sheet (LKPD), b) developing an observation sheet to assess lecturer activities and students' psychomotor abilities. at each learning session, and c) prepare test questions that will be given at the end of each cycle. Test questions are prepared by researchers, researched by professionals and

practitioners, and then given to students who have acquired knowledge in the fields of business and energy.

### *2. Behavior and Perception*

Action and implementation steps are executed simultaneously. In this scenario, the researcher acts as an instructor who delivers education using a semester learning plan (RPS). The initial research was carried out by giving initial assessments to students, followed by the application of the PBL learning paradigm as a form of treatment. Then observations were carried out to see the students' cognitive development after being given treatment. Here collaborative observation is carried out involving researchers and observers. This research used two observers, namely two teams of course lecturers who were tasked with observing lecturer activities by filling in predetermined observation sheets and monitoring students' psychomotor elements.

### 3. Reflection

At the reflection stage, data obtained through observations is collected for analysis. The data is in the form of lecturer activity observation sheets, student psychomotor evaluation sheets, and student test results. The observation data is analyzed and then discussed with the observer for reflection. Reflection activities are essential to assess the results of actions and identify areas that require further improvement, improvement, or maintenance. This action is a method of self-assessment. Reflection results are used to identify solutions, which are then forwarded to the next cycle. The four processes mentioned are carried out repeatedly in subsequent cycles until the problems encountered can be handled and consistent results can be achieved (Mangelep, 2017). Indicators of learning success are shown by the growth in student learning outcomes in each cycle, namely an increase in cognitive and psychomotor learning outcomes, both at the individual and class levels.

## RESULTS AND DISCUSSION

Based on the data obtained, it appears that the PBL model can improve learning outcomes as shown in Table 1.

**Table 1.** Cognitive Learning Outcomes

| Information | Initial test | Cycle I | Cycle II |
|---|---|---|---|
| The Highest Score | 67,96 | 91 | 97 |
| Lowest Value | 6 | 41 | 36,61 |
| Average | 48,88 | 73,59 | 85,16 |
| Number of students who completed | - | 16 orang | 25 |
| Completeness of classical learning | 0% | 51,61% | 80,64% |

Table 1 shows a consistent increase in students' cognitive learning outcomes in each cycle. In the initial test, the KBK percentage was 0%, meaning that not a single student completed it. The reason is that there is no teaching about this subject to students. After the intervention in cycle I was implemented, the CBC percentage reached 51.61%, which indicated adequacy. Based on the findings of the initial cycle analysis, the use of PBL as a learning method has not met the completion threshold of 80.64%. Therefore, it can be concluded that students' cognitive learning achievements in cycle I have not been successful.

This is caused by students' continuous confusion and struggle to complete the assignments offered by the LKPD. According to Majid (2013), learning challenges hinder students' ability to achieve their learning goals. Therefore, the instructor utilizes the findings of the first cycle reflection to improve the implementation of the learning process in the second cycle.

The classical proportion in cycle II was 80.64%. Cognitive learning outcomes increased by 29.03% from cycle I (51.61%) to cycle II (80.64%). This happens because students diligently follow the learning process and understand the material that has been presented. Novitasari et al (2015) also expressed a similar opinion regarding the benefits of Problem-Based Learning (PBL). These benefits include increased retention and understanding of educational content, increased concentration on related knowledge, stimulation of critical thinking, cultivation of teamwork, leadership, and social skills, development of learning skills, student motivation, and alignment with the realities of student life. Traditionally, the learning process in cycle II is considered complete because it has met the criteria for learning completeness of 75%.

Analysis of student learning outcomes data shows that implementing the PBL learning approach can improve student achievement in Business and Energy subjects. According to research by Suherman (2008), implementing the PBL learning model can improve students' physics learning outcomes at MTS Negeri 3 Pondok Pinang-Jakarta. Likewise, research by Asy'ari M (2013) found that the application of the PBL learning model could improve the learning outcomes of class XI IPA 2 students at MAN Gerung in the 2012/2013 academic year. See table 2.

**Table 2.** Psychomotor Learning Results

| Mark | Cycle I | | Cycle II | |
|---|---|---|---|---|
| | F | Percentage (%) | F | Percentage (%) |
| A | 3 | 9,68 | 17 | 54,84 |
| B | 23 | 74,19 | 14 | 45,16 |
| C | 5 | 16,13 | 0 | 0 |
| D | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 |
| The highest score | 84 | | 97 | |
| Lowes Value | 55 | | 63 | |
| Average | 71,51 | | 83 | |

From the results of cycle I, students obtained the highest score of 84 in the aspect of preparing tools and materials, while the lowest score of 55 was obtained in the element of presenting experimental results. Low scores in the area of explaining experimental results can be caused by students' lack of confidence in expressing their thoughts or representing their group effectively during presentations. Based on the learning outcomes obtained, a solution was designed, which involved encouraging students to show greater dedication during practical training and guiding all students to be actively involved in the learning process. See figure 1.

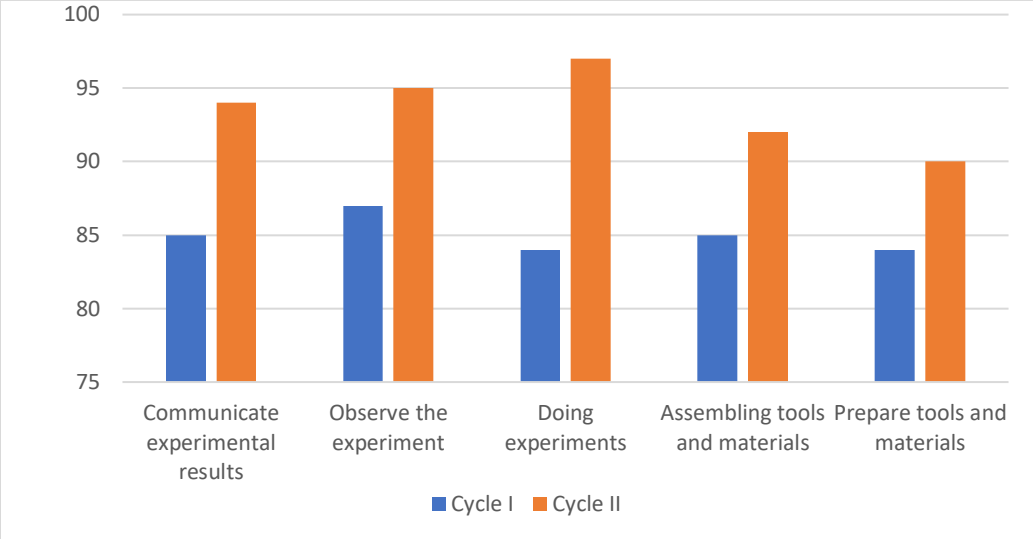


**Figure 1.** Increasing the value of each aspect of psychomotor learning outcomes

In cycle II, students obtained the highest score of 90 in the aspect of preparing tools and materials, while the lowest score of 73 was obtained in the element of presenting experimental results. Low scores on the element of conveying experimental results can be caused by students' lack of confidence in expressing their thoughts or effectively representing their group when presenting practical findings.

Based on the results of the analysis of the value of each aspect of psychomotor learning outcomes in Figure 1, it can be seen that there is an increase from cycle I to cycle II. The level of preparing tools and materials increased by 6 units, the level of assembling tools and materials increased by 7 units, the level of conducting experiments increased by 13 units, the level of observing experiments increased by 8 units, and the level of communicating experimental results increased by 9 units. Overall, test administration practices experienced a growth of 13%. This is due to the success of students in carrying out experiments. These findings are in line with the results of research conducted by Setyorini et al. (2011) which states that the application of the PBL model to GLBB sub-subjects causes an increase in students' psychomotor abilities.

Teacher activities include all actions carried out by educators during the teaching process. Teachers engage in activities that follow the syntax of the PBL paradigm. The use of a sequential approach to the Problem-Based Learning (PBL) model motivates students to actively construct their

knowledge through collaborative efforts (Wulandari et al., 2015). The average values of meeting 1 and meeting 2 in cycle I were 3.76 and 4.35 respectively. The average value of meetings 11 and 2 was obtained at 4.14. The average values of 1 meeting 4 and 1 meeting 5 in cycle 1 II were 4.21 and 4.36 respectively.

The average finding obtained at meetings 4 and 5 was 4.29. This data shows the success of implementing the Problem-Based Learning (PBL) learning approach throughout cycle II, achieving high effectiveness. The PBL model has been applied in cycles I and II to facilitate learning. It focuses on guiding students to understand theory and formulate hypotheses before conducting experiments. This aspect requires more time and intensive guidance from the teacher because students are not used to it. When creating a hypothesis, it is important to identify control variables, manipulated variables, and response variables, and analyze experimental data.

## CONCLUSION

Based on the research objectives, results, and discussion, this research concludes that the application of the PBL learning model can improve cognitive learning outcomes. This can be seen from the increase in KBK. The percentage of KBK in cycle I was 51.61%, while in cycle II there was an increase of 80.64%. Apart from that, the application of the PBL learning model can improve psychomotor learning outcomes. This can be seen through an increase in the preparation of tools and materials1 by 19.35%, an increase in the assembly of tools and materials by 25.80%, an increase in the implementation of experiments by 22.58%, an increase in experimental observations by 29.03%, and an increase of 41.93% in delivery. experiment.

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