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# The Effectiveness of Practice, Presentation-Demonstration, and Presentation-Discussion (PPDP) Learning Strategies Toward Students' Conceptual Understanding

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## ABSTRACT

Biology is one of the scientific fields that was born and developed through the steps of observation, problem formulation, making hypotheses based on experiments, drawing conclusions, and discovering concepts and theories. Biology learning will not be separated from laboratory or practical activities. Understanding the concept plays a very pivotal role in learning activities and has become the basis for achieving the learning outcomes. One of the instructional strategies is called PPD (Practice, Presentation and Discussion). This study aimed to determine the effect of the PPD strategies in enhancing students' conceptual understanding. This study applied a pre-experimental research method with One Group Pretest-Posttest Design. The subjects were twelfth grade high school students. These subjects were randomly selected with the number of 35 students. The results showed that the application of the PPD strategies has proven to be influential in enhancing students' mastery of photosynthesis concepts. The increase in concept mastery could be viewed from the level change of students' comprehension as the mean score of 43.18, where the students' initial knowledge (pretest) was 38.12, significantly increasing after the implementation of the PPD strategies (posttest) as of 81.30. Based on the standard of minimal accomplishment criteria, the effectiveness of the PPD strategies on students' concept mastery was between 71-85 which was stated in the high category.

**Keywords:** *conceptual understanding; instructional strategy; photosynthesis concepts; PPD strategies.*

## INTRODUCTION

Education is the main factor in making a better life. In formal education activities based on the Law of the Republic of Indonesia No. 20 of 2003 concerning the national education system states that education is a conscious and planned effort to realize the learning process so that students can actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills that needed by themselves, society, nation and state (Ichsan, 2021). According to the law, it can be mentioned that education has been the primary focus in developing the potential of students through the learning provided. One of the government's efforts to improve the national education system is through the Merdeka Curriculum learning framework.

The push for education reform in Indonesia, now reflected in the transition to the Independent Curriculum (Kurikulum Merdeka), addresses key challenges. These challenges include: (a) internal factors, focused on improving various aspects of the national education system, such as curriculum relevance, teaching quality, and student assessment (Dewi, 2025); (b) external pressures, particularly the need to improve Indonesian students' performance in international assessments such as the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS) (OECD, 2023), which have historically identified areas for improvement in student skills and knowledge. Furthermore, a recent study by Ismiati (2024) suggests that the Independent Curriculum is designed to address these challenges by promoting more student-centered learning and greater teacher autonomy.

Biology is one of the scientific fields that was born and developed through the steps of observation, problem formulation, making hypotheses based on experiments, drawing conclusions, and discovering concepts and theories (Gacheva, 2024). Biology learning will not be separated from laboratory or practical activities. There are at least four reasons for the importance of biology practical activities proposed by Hariyatmi & Tisniasari (2023). First, practice can generate motivation to learn biology. Second, the practice develops the basic skills of conducting experiments. Third, practice becomes a vehicle for learning scientific approaches. Fourth, practice supports the subject matter. The laboratory has an important role in supporting biology learning activities, especially in the process of science activities, so biology teachers should invite students to carry out practical activities in the laboratory. The influencing factor for the success of practical activities is the existence of resources including equipment, materials, space, laboratory staff, and technicians. The availability of these resources will support laboratory activities, on the contrary, the limited resources are often a consideration for teachers not to carry out practical activities (Navarro et al., 2024).

Biology curriculum, which deals with scientific information related to natural phenomena and abstract processes such as metabolic pathways, nervous systems, and photosynthesis (Gaiseanu, 2022), requires a strong conceptual foundation. Conceptual understanding is crucial for developing higher-order thinking skills and for problem-solving (Fiorella, 2023). Photosynthesis, as a complex concept, involves understanding abstract processes related to energy transformation, where light energy is captured and converted into chemical energy to form starch and release oxygen (Parthasarathy, 2023). The *Kurikulum Merdeka* seeks to address these challenges by emphasizing more flexible and in-depth learning of essential concepts rather than rote memorization (Pratiwi, 2025).

Initial observations were carried out at universities to determine learning activities. It could be seen that students' biology learning activities have not conducted the PPD (Practice, Presentation, and Discussion) yet. The teacher interviews suggested that students prefer to learning biology if the concept delivery uses some interesting learning media. This is supported by the student questionnaires showing that 85.52% of them prefer to learn biology using interesting media, such as interactive multimedia.

Interactive multimedia is the integration of digital media, such as a combination of electronic text, graphics, moving images, and sound in a digital environment that allows people to interact with data for the right purpose (Huang, 2020). However, there is no technology-based interactive multimedia in Universities.

Conceptual understanding is paramount for effective learning, serving as the cornerstone for students' academic achievement (Hansen, 2023). To facilitate this, lecturers must guide students through the processes, products, and factors that influence their grasp of complex concepts like photosynthesis, ensuring that students develop comprehensive knowledge. Accurate and relevant information about real-world examples is essential for several reasons: (1) it allows students to engage with foundational material effectively; (2) it establishes a common understanding between lecturers and students; (3) it minimizes misconceptions; (4) it stimulates meaningful cognitive engagement. Ultimately, successful conceptual learning in biology hinges on active student involvement, where hands-on activities and collaborative exploration reinforce core concepts and facilitate the construction of new knowledge (Bean & Meizer, 2021).

Conceptual understanding plays a very important role in learning activities and has become the basis for achieving students' learning outcomes (Hansen, 2023). The teacher must be able to show students the processes, products and factors that affect their understanding in photosynthesis concepts thoroughly so that they have a complete conceptual knowledge of that materials. According to Churchill (2007) , accurate and relevant facts from objects or phenomena found in the learning process are needed to: (1) study basic materials; (2) equalize perceptions between teachers and students; (3) minimize the inaccuracy of the description; (4) stimulate cognitive interaction; (4) form the knowledge. In the process of learning biology, understanding concepts will be successful if students are actively involved in learning activities so that the results of these activities will build up the ideas or concepts which will later be used in forming knowledge or information and the latest concepts as well (Bean & Meizer, 2021).

Based on the description above, it is clear that various learning strategies are needed to improve students' conceptual understanding of photosynthesis. One learning strategy that can be implemented is PPD (Practice, Presentation, and Discussion). Learning through a practical strategy stimulates students to enthusiastically participate in a series of learning activities through experimental activities. In addition, conceptual understanding will be formed directly through student involvement in discovering and proving theories and collaboration between students that can actively occur during learning activities (Saleem et al., 2022). The Presentation-Discussion strategy trains students to develop activeness, good communication and argumentation skills, and enhances high critical and analytical thinking skills (Priyambodo et al., 2023). Through this strategy, student-teacher interactions will be more effective because students gain a clearer picture of a process observed during learning activities. If there are doubts in the learning process, the lecturer will immediately correct the concepts learned (Amerstorfer & Münster-Kistner, 2021).

## METHOD

### Research Design

This study uses a pre-experimental research method with the group pretest-posttest design. The selection of the Weak experiment method used in the application of the PPDP is based on the fact that there is no learning model that is equivalent to the PPDP. The group pretest-posttest design was carried out in one class of students who applied the PPDP. Prior to the treatment, students were given a pretest to determine the initial knowledge possessed by students, and at the end of the treatment, a final test (posttest) was given to determine the improvement in learning outcomes after the PPDP learning strategies were applied (Lohr, 2021).

### Population and Samples

Research on the application of the PPDP learning strategy to improve students' conceptual mastery and higher-order thinking skills was conducted at a university in the 2024/2025 academic year. The population in this study was able to master concepts and higher-order thinking skills in photosynthesis. The subjects in this study were university students, consisting of 26 female students and nine male students.

### Instrument

The instruments in this study consisted of test instruments and non-test instruments. The test instruments in this study consisted of a concept mastery test instrument and a higher-order thinking ability test instrument, while the non-test instruments consisted of the first and second interview formats, a student worksheet assessment rubric, a student worksheet development assessment rubric, and a questionnaire.

### Procedure

This research consists of three stages. The three stages of the research consist of the preliminary, implementation and final stages. The description of the stages in this research can be seen in Figure 1.

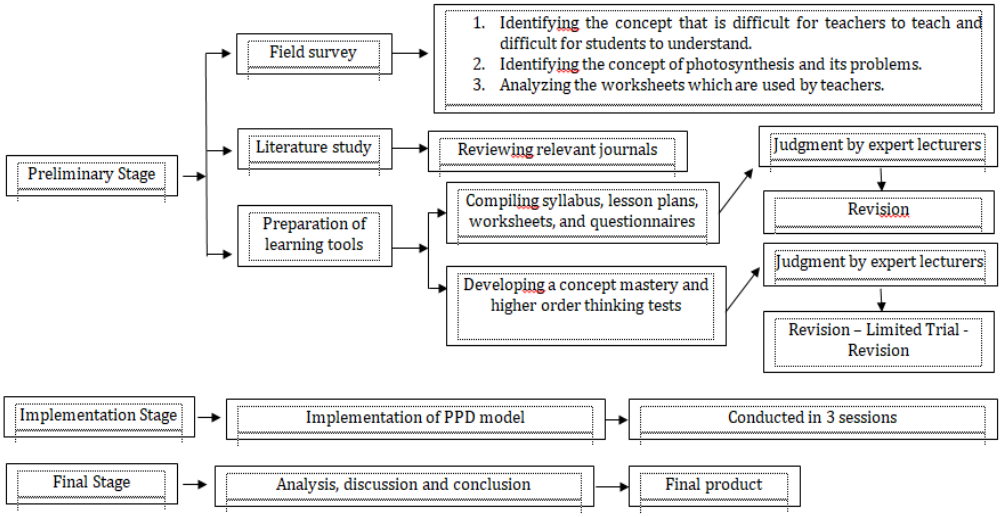


**Figure 1.** The Research Procedure

**Data Analysis Techniques**

Data collection techniques in this study involve tests. Before the learning (pretest) using PPDP, the students were given a concept understanding test and so was after the treatment (posttest). According to Meltzer (2002) the analysis for increasing understanding of concepts before and after learning can be tested by calculating the N-gain value. The index value of the N-gain category is interpreted in Table 1.

**Table 1.** N-gain Index Value

| Coefficient | Category |
|---|---|
| 0.80 < N-gain < 100 | Very High |
| 0.60 < N-gain < 0.80 | High |
| 0.40 < N-gain < 0.61 | Moderate |
| 0.20 < N-gain < 0.40 | Low |
| N-gain < 0.20 | Very Low |

Research data were analyzed using the Z-test supported by SPSS for Windows software. Hypothesis testing was done after the prerequisite tests were carried out, including the normality test using the Kolmogorov-Smirnov test and the homogeneity test using Levene's Test of Equality of Error Variances. To see the effect of the effectiveness of the PPDP learning strategies on the students' completeness concept mastery, a statistical test in the form of a Z-test (one-sample test) can be shown in Table 2.

Table 2. Effectivity Criteria

| Acquired Percentage | Criteria |
|---|---|
| 86 – 100 | Very High |
| 71 – 85 | High |
| 56 – 70 | Moderate |
| 41 – 55 | Low |
| < 40 | Very Low |

## FINDINGS AND DISCUSSION

Biology learning using PPDP in this study has the following stages: 1) orientation to the application of PPDP learning; 2) implementation of practicums; 3) presentation and discussion; and 4) reflection. In the orientation stage of the application of PPDP learning, students are introduced to the stages of PPDP. After that, students are oriented to the application of PPDP in starting learning to gain initial experience with the procedures and concepts to be learned. The next stage is to give the task of working on practicums to obtain data and create reports. The results of the practicum are then presented and discussed in class with teacher guidance during the presentation and discussion stages. In the reflection stage, students, with the guidance of the lecturer, reflect on the assignments that have been done and the results of the discussion to gain understanding. Data on the increase in concept mastery in the material of photosynthesis

was obtained from the analysis of 12 essay questions given during the pretest and posttest. The analysis of pretest and posttest scores can be seen in Table 3.

**Table 3**. Analysis of Pretest and Posttest Scores

| Value Statistics | Score | |
|---|---|---|
| | Pretest | Posttest |
| The average value of students | 38.12 | 81.30 |
| Minimum value | 27.8 | 60.8 |
| Maximum value | 46.8 | 97.5 |

Source: Process Primary Data, 2025

Based on Table 3, it is obtained that the average increase in mastery of concepts is 43.18, which is seen from the initial knowledge (pretest) of 38.12, which increases after the implementation of the PPDP (posttest) to 81.30. After doing the calculations, the average value of N-gain in the class was obtained with a value of 0.70. The value of 0.70 lies in the range of criteria 0.61 N-gain 0.80, with the interpretation of mastery of high category concepts. The results of the analysis showed that there was an increase in the mastery of students' concepts of photosynthetic material before and after the PPDP was applied. To see the level of understanding of the increase in mastery of concepts after the implementation of the PPDP, the categorisation of mastery of concepts according to Yoruk et al. (2006) was used.

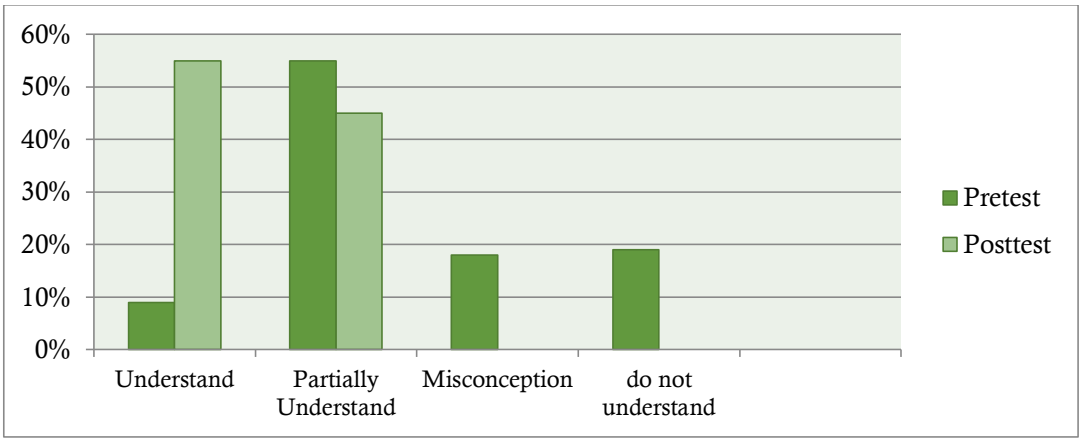


**Figure 2.** Improved Concept Mastery based on Criteria
Source: Process Primary Data, 2025

Based on Figure 2, there is an increase in mastery of concepts based on the criteria of Yoruk et al. (2006). This can be seen from the value of mastery of concepts before and after the implementation of the PPDP. Based on these data, it can be seen that the category of concept mastery during the pretest consists of four categories, namely the category of understanding, partially understanding, misconception, and not understanding. Mastery of concepts increased during the posttest into two categories: understanding and understanding only partially. Changes in the category of mastery of these concepts indicate a change in knowledge in the minds of students.

The results of the categorisation show that the effectiveness of the PPDP on the concept mastery completeness is in the range of 71-85, which is stated in the high category. To determine the effectiveness of the PPDP on the students' completeness concept mastery, a statistical test was carried out. The results of testing the effectiveness of the PPDP on students' concept mastery completeness obtained a significance value of p-value = 0.000, which indicates a significance probability of p-value less than a significance value of 0.05, so that Ho is declared rejected and Ha is declared accepted. The results of the analysis show that there is an effect of the effectiveness of the PPDP on the completeness concept mastery of students. The results of the analysis of the influence of PPDP learning strategies on higher-order thinking skills can be seen in Table 4.

**Table 4.** Testing the Effect of PPDP Learning Strategies on Higher-order Thinking Skills

**One-Sample Test**

| | Test Value = 0 | | | | | |
|---|---|---|---|---|---|---|
| | | | | | 95% Confidence Interval of the Difference | |
| | t | df | Sig. (2-tailed) | Mean Difference | Lower | Upper |
| pretest | 23,442 | 34 | ,000 | 53,486 | 48,85 | 58,12 |
| posttest | 72,992 | 34 | ,000 | 78,657 | 76,47 | 80,85 |

Source: Process Primary Data, 2025

From the data above, it is obtained that the significance value of p-value = 0.000, which indicates the probability of the significance of the p-value is less than the significance value of 0.05, so that H0 is declared rejected and Ha is declared accepted. It can be concluded that there is a significant effect of PPDP learning strategies on high-level thinking skills of students.

Assessment of the effectiveness of the PPDP learning strategies is obtained from the percentage of achievement of students who meet or are better than a score of 75 based on the Minimum Completeness Criteria that the University has determined.

In the case of 29 students who have met or exceeded the minimum completion limit that has been set, 6 students were declared incomplete. After analyzing the percentage of passing based on the completion standard, an analysis of the level of effectiveness of the PPDP learning strategy on students' mastery of concepts was carried out according to Sabri et al. (2023). The categorisation results showed that the effectiveness of the PPDP learning strategy on the completeness of concept mastery was in the range of 71-85, which was stated in the high category. To determine the effect of the effectiveness of the PPDP learning strategy on the completeness of students' concept mastery, a statistical test was carried out. The results of the test of the effectiveness of the PPDP learning strategy on the completeness of students' concept mastery can be seen in Table 5.

**Table 5**. The Effectiveness of PPDP on Completeness Students' Concept Mastery

**One-Sample Test**

| | Test Value = 75 | | | | | |
|---|---|---|---|---|---|---|
| | t | df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
| | | | | | Lower | Upper |
| p_konsep | 4,074 | 34 | ,000 | 6,286 | 3,15 | 9,42 |

Source: Process Primary Data, 2025

From the data above, a significance value of p-value = 0.000 is obtained, indicating that the probability of significance of the p-value is smaller than the significance value of 0.05, so that H0 is rejected and Ha is accepted. The results of the analysis indicate that there is an influence of the effectiveness of the PPDP learning strategy on the completeness of concept mastery. As stated in the previous explanation, learning effectiveness is only seen from the completeness of the post-test scores of student concept mastery (Figure 2 and Table 5).

The percentage results shown in Figure 2 can be declared complete based on the learning completeness criteria. According to the Mahyaeny (2021), learning completeness consists of two types, namely individual learning completeness and classical learning completeness. Both completeness studies refer to the completeness standards set by the school on the material of photosynthesis. The results of the analysis show that 29 students were declared to have completed learning individually because they obtained a score of 75, while based on the classical completeness criteria, students were declared to have completed. The assessment of incompleteness in a classical manner was because there were still students who were less than optimal in participating in learning activities. The results of the student questionnaire showed that some students expressed fatigue because Biology lessons were held after physical education.

In addition, preparations for the 12th-grade farewell party caused the learning atmosphere to be less conducive because some students who acted as committee members had to be invited in and out of the class. The presence of a tent erected in front of the class also caused some students to lose focus on learning. In addition to learning completeness, the classical percentage obtained was also analyzed based on effectiveness criteria. The percentage results in Figure 3 indicate that the effectiveness of the PPDP learning strategy towards the concept mastery completeness criteria was at a high level. The results of the student questionnaire regarding the implementation of the PPDP learning strategy also supported this effectiveness assessment. The questionnaire results showed that 99.49% of students accepted the implementation of the PPDP learning strategy well.

To strengthen the research results, a statistical test was conducted to determine the effectiveness of the PPDP learning strategy towards the concept mastery completeness standard. A one-sample t-test was used to test the mean value of a single sample with a reference value. Based on the output of the One-Sample t-test in the experimental class,

the calculated t-value was 4.074 with a Sig (2-tailed) value of 0.000. Because the expected hypothesis is a one-sided test, and the p value (sig) is Sig (2-tailed), then the P value is divided by 2 to obtain the P value. Based on the significance value, the Ha hypothesis is accepted because the P value is 0.000 <0.05. It can be said that the PPDP learning strategy has an effect on the completeness of students' mastery of concepts in photosynthesis material. The PPD learning strategy is an acronym for several learning methods that will be applied.

## CONCLUSION

Based on the research results described previously, it can be concluded that the application of the PPDP learning strategy on photosynthesis material has been proven to have an effect on increasing concept mastery and higher-order thinking skills. The increase in concept mastery can be seen from changes in students' level of understanding, the distribution of cognitive levels according to the Revised Bloom's taxonomy, and the percentage of student achievement in meeting the completion standards. Higher-order thinking skills in this study can improve several abilities, such as the ability to measure, analyze, interpret data, compare, and conclude. The correlation between concept mastery and higher-order thinking skills is at a moderate level with a positive coefficient value indicating a unidirectional relationship between concept mastery and higher-order thinking skills. If concept mastery increases, students' higher-order thinking skills will also increase.

Based on the research description above, several conclusions can be drawn, namely (1) the application of the PPD learning strategy on photosynthesis material has been proven to have an effect on increasing concept mastery. (2) The increase in concept mastery can be seen from changes in the level of student understanding where the average increase in concept mastery is 43.18 which is seen from the results of pre-knowledge (pretest) of 38.12 which increased after the implementation of the PPD learning strategy (posttest) to 81.30. and (3) based on the completion standard, the effectiveness of the PPD learning strategy on the completion of concept mastery is in the range of 71-85 which is stated in the high category.

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