How to Improve the Mastery of Students’ Concept on Photosynthesis Topic?

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Abstract. The PPDP learning strategy in this research is the acronym of Practicum method, Presentation-discussion method, Demonstration method, and Presentation-discussion method. This study aims to describe the effect of applying PPDP learning strategies to mastery of high school students' concepts on photosynthesis topic. The research method is a weak experiment, with the research design "The One-Group Pretest-Posttest Design". The implementation of the study involved 35 students in one of the high schools in the city of Palembang. The research instrument used is in the form of test equipment, assessment rubric and questionnaire. Data were analyzed using Microsoft Excel and SPSS 24 Program. The statistical result showed that PPDP learning strategy had an effect on improving conceptual and Effective on the achievement of the value on the minimum criteria set by the school. This is due to the transformation of knowledge from hands-on to minds-on through the discovery of facts about the concept of photosynthesis. This fact leads to the construction of further understanding through cognitive sharing when the activities of the discussions formed similarity and consolidation of the concept of photosynthesis intact. In addition, demonstration activities also cause students' logic of thinking to develop through observation of factors that may affect the rate of photosynthesis. This PPDP learning strategy can be utilized by teachers in explaining photosynthetic topic.

1. Introduction

Biology as one of the disciplines of natural science is perceived and not easy to be understood or mastered by learners [1-2]. This can be seen from the acquisition of National Biology Test Scores of high school level in 2015-2016 is still relatively low [3]. In essence, matter in Biology learning consists of a number of facts, concepts and principles. The fact leads the student to the observation of an object / phenomenon so as to produce concrete knowledge. The principle shows how the object / phenomenon occurs while the concept shows a mental abstraction of an object or phenomenon. One of the material that contains the concept felt difficult to be understood by teachers and students is the material of photosynthesis. Basically photosynthetic material invites students to understand an abstract energy transformation process, capturing and using light energy, then stored in the form of chemical energy that occurs in the chloroplast, through various processes to form starch and release oxygen[2]. According to some scientist, the concept of photosynthesis is an important concept in biology [4-7]. The principle of a large concept of abstract and complex photosynthesis processes must be able to direct the knowledge that students have from conceptual (abstract) to be transformed into factual (concrete).

Some research on the concept of photosynthesis proves that, still found students who are confused and misconception [8-11]. The confusion and misconceptions on the concept of photosynthesis were
found in junior high school students [12-13], high school students [9, 14-16], Student level [17-19] and to prospective teachers [20-23].

One of the learning strategies considered to assist students in developing conceptual mastery is the PPDP learning strategy. The PPDP learning strategy in question is the acronym of the learning method consisting of the Practicum method, the Presentation-discussion method, the Demonstration method, and the Presentation-shortened methodology into PPDP. The PPDP learning strategy consists of four goals. First, integrated lab work aims to generate many facts related to the concept of photosynthesis. Second, in the presentation-discussion activities conducted cognitive sharing of the facts found that aims to equate and consolidate the concept of photosynthesis. Third, demonstration activities using photosynthesis kits aims to develop students' thinking and logic skills to factors that influence the rate of photosynthesis. Fourth, the presentation-aims of discussion aimed to equate and consolidate the concept of photosynthesis in a holistic way. The PPDP learning strategy is expected to reduce the level of confusion and misconception among students.

2. Experimental Method

The research method used is the weak experiment method with the research design "The One-group Pretest-Posttest Design. Subjects in the study were 35 students of class XI at one school in the city of Palembang. The PPDP learning strategy is divided into three stages. The first stage is the application of classroom practicum method completed with Student Worksheet (LKS). It aims at developing conceptual mastery by practicing Ingenhousz, Sachs, Pristley, and leaf disks. In the second stage, two methods of learning are applied, namely presentation-discussion method and demonstration method. Method of presentation-discussion conducted aims to discuss the findings or facts of practical activities that have been done previous students, resulting in similarity and stability in the mastery of the concept. After completion of the presentation-discussion activity, continued the demonstration method. The demonstration method aims to develop students' high-level thinking skills. During the demonstration activities, teachers used photosynthesis kits as a demonstration medium. Through the use of photosynthesis kits, students are trained in analyzing and evaluating activities undertaken. The third stage, applied presentation-discussion method. This method aims to discuss the results of observations made by students during the demonstration activities. This method is selected by researchers to guide students to connect all information that has been obtained into a whole concept of photosynthesis. The research instrument used is in the form of concept mastery test, assessment rubric and questionnaire. Data were analyzed using Microsoft Excel and SPSS Program 24.

3. Result and Discussion

Statistical data show pretest, posttest, and mean value of n-gain mastery of student concept after applying PPDP learning strategy can be seen in Table 1.

| Statistics | Pretest | Posttest |
|------------|---------|----------|
| average    | 38,12   | 81,30    |
| variance   | 21,5    | 83,2     |
| at least   | 27,8    | 60,8     |
| maximum    | 46,8    | 97,5     |

Based on Table 1, shows an increase in the average mastery of the concept of 43.18 after applied PPDP learning strategy. Once analyzed, the average N-gain shows a value of 0.70 in the range of 0.61 ≤ N-gain ≤ 0.80 with high category interpretation. Achieving the improvement of conceptual mastery caused during the learning process takes place, the teacher strives to create an active and enjoyable learning environment. The discovery of many facts about the concept of photosynthesis, the existence of cognitive sharing and the development of mind logic led to the formation of constructions of understanding in students. The concept of a person is formed by experience, and each student has the
potential to process the information received [24-25]. Understanding the concept of photosynthesis can also be seen from the improvement based on the criteria of understanding according to Morgil and Yoruk [26] in Figure 1.

Based on Figure 1, shows significant differences in mastery of student concepts before and after the applied PPDP learning strategy on photosynthesis material. Direct experience in the discovery of facts leads to the transformation of knowledge from hands-on to mind-on. This affects the students' understanding of photosynthesis material. If studied in the "discovery" format, then the observed facts form the basis of concept or principle formation. If learning is "verification", then the observed facts become clear evidence of the correctness of the learned concepts or principles [27]. Based on statistical analysis, the effect of applying PPDP learning strategy can be seen in table 2.

Table 2. The influence of PPDP learning strategies on mastery of student concepts

| One-Sample Test | 95% Confidence Interval of the Difference |
|-----------------|------------------------------------------|
| Test Value = 0  | Mean Difference | Lower | Upper |
| t               | df            | Sig. (2-tailed) |                          |                          |
| pretest         | 48,672        | 34      | .000      | 30,114 | 28,86 | 31,37 |
| posttest        | 52,721        | 34      | .000      | 64,229 | 61,75 | 66,70 |

Table 2 above shows the significant effect of PPDP learning strategy on mastery of student concept which is seen from p-value < 0.05 significance. The influence of the application of PPDP learning strategy can be seen from the increase in mastery of concepts in students.
4. Conclusion
Based on the above explanation, it can be concluded that the improvement of conceptual mastery is caused by the implementation of appropriate learning strategy. Through the application of PPDP learning strategies, students can understand the concept of photosynthesis through the discovery of many facts. This strategy also stimulates students to be active in explaining and arguing while learning takes place. In addition, logical thinking and reasoning skills can develop through activities that can stimulate the ability to analyze, predict, interpret and conclude. Implementation of learning strategies requires good time management to be accomplished.

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