

Project-Based Learning to Improve Course Understanding Plant Physiology

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Abstract

Project based learning is an instructional approach which uses contextual problems and the students have to research required information to solve those problems. This study was intended to improve the students' achievement on Physiology of plants subjects in UNTAG 45 Banyuwangi. The research target was the students fulfilled the standard minimum 70% toward all indicators observed in this study. This classroom action research was carried out into three cycles in which each cycle consisted of four phases of activities, they were planning, implementation, observation and reflection. The result of reflection revealed that all indicators contributed to improvement of the students achievement, such as, (a) the comprehension aspect of report result was on cycle I (68.12%), cycle II (69.54%), and cycle III (74.04%), (b) the comprehension aspect of discussion result on Cycle I (69.20%), cycle II (69.43%), and cycle III (76.25%), (c) comprehension aspect of test on cycle I (57.60%), cycle II (65.53%), and cycle III (74.48%). In sum, project based learning could improve all comprehension aspects and achieve the research target on cycle III.

Keywords

project based learning;
achievement; physiology of
plants



I. Introduction

An important factor that affects student learning outcomes is learning motivation. Therefore, every lecturer must be able to generate student learning motivation so that motivation always develops in students so that they can obtain optimal learning outcomes and students are able to interact actively with the environment.

Improving the quality of learning is absolutely necessary because quality learning will produce quality human resources as well. The quality of learning can be seen from the understanding of learning, namely from the results and learning processes carried out in lecture activities. According to Ausabell (1968) psychologically, learning will be successful if people understand how to learn, including teaching methods, the instructional process. The aim is to understand how people learn and retain new information on the social, emotional, and cognitive processes of lifelong learning.

The learning is aimed at reconstructing students who are looking for information and finding out knowledge that is able to solve problems, cooperate, and tolerate diversity. If the desire is successful in a satisfying way, it will increase students' self-confidence as well as a high sense of responsibility and civilized humans who can identify themselves with stable, independent personalities and have emotional stability with intellectual knowledge. They are also able to control themselves consistently, which is also called Emotional Quotient (Damanhuri in Pradana, D. et al. 2020).

Learning model is a conceptual framework that describes a systematic procedure in organizing learning experiences to achieve certain learning goals, and serves as a guide for learning designers and instructors in planning teaching and learning activities. (Akrim, 2020)

Learning Biology, especially Plant Physiology, is a natural science that studies the functions of plants until they are alive. Studying the physiology of plants will add to the wonder of the many things that happen to them. Water and dissolved materials move by special means of transport, water from the soil propagates through the roots, stems and leaves, mineral salts move in various directions in the plant. To achieve these learning objectives, students must be directed to understand the theory and apply it in the real world.

Based on semester scores two years ago, the low understanding of the material provided was seen from the aspect of the ability to express either in written form or student presentations in the learning process of Plant Physiology Biology Education Study Program, University of 17 August 1945 Banyuwangi has long been our thinking to find solutions. Where during the learning process the method used is still centered on the lecturer, students are less active in discussions, reporting is lacking. The results of this achievement become the rationale for changing the learning patterns that have been carried out. Learning patterns that have been carried out such as discussions, assignments and practicums, but have not shown the desired target. Other efforts that have been made by providing complete books as learning resources have also not shown good results. This shows that the learning pattern that has been carried out is less successful in providing students' understanding of the Plant Physiology course.

Based on the results of an initial survey of students taking Plant Physiology, given the lecture and discussion learning method, it turned out that from the results of the discussion only about 35% of the number of students who were active in the discussion and the results of the written test did not get satisfactory results, less than 50% with a minimum score of 70. so that it is concluded that their understanding is lacking in the Plant Physiology course because the target of learning completeness in this Plant Physiology course is to get at least 70% of all aspects of understanding, namely the results of reports, discussion results and cognitive (oral and written tests).

Plant Physiology Learning is a lesson that invites students to understand the processes and life activities that occur in plants. So that to achieve the standard of competence, it is necessary to program learning to instill and develop knowledge, skills and motivated attitudes.

In the Plant Physiology Course, according to Loveless (1991), many facts and concepts are studied, namely the natural environment and other living things, including humans. This is related to the material, among others, the relationship between water, mineral elements, soil and the environment, Metabolism in plants (Respiration, Photosynthesis and Nitrogen), Growth and Development and Growth Hormones. Also according to Bidwell (1979) basic processes such as photosynthesis, respiration, plant nutrition, plant hormone function, tropism, nastic movement, photoperiodism, photo morphogenesis, circadian rhythms, physiology of environmental stress, seed germination, dormancy and stomata function and transpiration, both parts of the relationship plant water, studied by plant physiologists.

Winkel (1989) states that learning to understand facts includes the path of learning verbal information. The learning outcomes obtained are knowledge that relies on the ability to express that knowledge in the form of language, so that it can be communicated to others.

So in this case the understanding of studying plant physiology, especially higher plants in this class action research, is an attempt to attach an impression in such a way that all the facts and concepts learned in plant physiology are stored and remembered that can be used in everyday life.

This aspect of understanding refers to the ability to understand the meaning of the material being studied. In general, this element of understanding concerns the ability to reveal the meaning of a concept, which is characterized by the ability to explain the meaning of a concept in their own words in written or oral form. In written form in the form of reports on observations and the ability to answer questions, the ability in oral form is seen in presentations and activities in discussions.

Learning is always related to the teaching and learning process. The teaching and learning process is essentially a communication process, namely the delivery of messages from lecturers to students through certain media. Task/project-oriented learning is an alternative for understanding a subject in the learning process. So that students are required to learn the subject matter through the development of independent learning experiences.

In project-based learning, students can get used to solving real problems. In addition, students are easy to conduct investigations and inquiries (Wena, 2009). The role of the lecturer is to present problems, ask questions, facilitate investigations and dialogues that are rooted in real life, which in turn are expected to grow and develop the competence of students.

According to Nurhadi and Senduk (2003) project-based learning is characterized as follows: 1) the existence of a problem or question oriented to authentic real-life situations and allows for various kinds of solutions. 2) Focusing on the interrelationships between disciplines 3) authentic investigation, requiring students to conduct authentic investigations to find real solutions to real problems. 4) Produce real products/works or artifacts, reports, models and demonstrations that explain or represent the nature of the problems they find.

From that problem, the results of a joint study between cognate lecturers found an alternative solution, namely applying Project Based Learning. Project-based learning requires a comprehensive learning approach in which the learning environment is designed so that students can investigate authentic problems, including deepening the material on a subject topic or assignment.

According to Tek (1998), Project Based Learning allows students to work independently in shaping their learning and accumulates it in the form of real products. Also according to Goodman and Stivers (2010) Project Based Learning is a teaching approach that is built during learning activities and real tasks that provide challenges for students related to everyday life to be solved in groups.

Based on the above problems, it is necessary to do action research with the aim to implement a based learning Project in order to improve understanding of students in Plant Physiology Course.

The results of this study are expected to contribute to lecturers and students in an effort to improve learning understanding so that it has an impact on satisfying final results. It is expected that lecturers in learning are able to provide innovative and creative learning so that they can motivate students to increase their creative power with various activities as well as maximize students' abilities and involvement in scientific processing.

II. Review of Literature

This research is classroom action research. In general, the flow of action implementation (each cycle consists of stages of action planning, action implementation, observation and reflection) in this study is a spiral model described by Kemmis and Tanggart (1990).

This classroom action research is carried out in collaboration with cognate lecturers as observers who will be involved in the observation process during the implementation of the

research action. This research was designed to consist of three cycles, namely cycle I. II and III. Achievement indicators get an understanding value of 70 as much as 70% of the number of students (minimum 17 students).

The research subjects were 24 students in the fourth semester, in the Plant Physiology Course with a total of 3 credits in one semester.

To achieve the expected target, this classroom action research is implemented in the form of a cycle that includes four activities in each cycle, namely: (1) Action Planning (2) Action Implementation, (3) Observation, (4) Evaluation and reflection.

III. Result and Discussion

As described above, the purpose of this classroom action research is to find out the application of Project Based Learning (Project Based Learning) in order to improve student understanding of the Plant Physiology Course at UNTAG 45 Banyuwangi. The level of understanding in this case is reviewed from the results of the report, the implementation of discussions and oral and written tests. What is expected in this action research is how students are able to understand the learning material with a variety of tasks so that they gain optimal experience and knowledge so that it has an impact on satisfying results.

Based on the results of observations of students taking Plant Physiology, the condition of all students has textbooks for their own circles as well as additional reference books. After observing 2 meetings at the location of the lectures in the Biology laboratory Untag 45 Banyuwangi, 24 students were given the lecture and discussion learning method, it turned out that only 8 students were actively asking and answering correctly, meaning around 33% of the number of students who were active in discussions. . Based on the results of the written test conducted on the Nitrogen Metabolism material with learning indicators of Nitrogen Fixation, Nitrate Reduction and Amino Acid synthesis, it turned out that they did not get satisfactory results because they did not reach 50% with a minimum value of 70, so it was concluded that while their understanding of Plant Physiology courses was lacking.

Project-based learning (Project Based Learning) is carried out at the 8th to 13th meetings or for 6 face-to-face meetings, each face-to-face time is 3 x 45 minutes while the results of the observations from the cycle are as follows:

The results of the classroom action research show that Project Based Learning contributes to increasing understanding in Plant Physiology courses from one cycle to the next. The research from each cycle was conducted in two face-to-face meetings.

The discussion is based on the results of data analysis in cycles I, II and III as follows:

4.1. Aspects of understanding the results of the report

In the first cycle, the material given was about Nutrients in plants and mineral nutrients found in the soil, students were given assignments/projects in the form of planting plants in polybags with different media compositions. 68.12 %).

Based on the results of observations from each indicator, it turns out that students do not really understand the indicators of writing a literature review and how to collect data correctly nor do they understand the data analyzer to be used as a discussion and then concluded. Lecturers in general have carried out learning according to scenarios, only in the learning process, students' activities to ask questions related to material related to assignments are not so many questions. From this condition, the results of the reflection carried out by the lecturer discussed indicators that were not yet understood and motivated students to improve the observation of parameters significantly in accordance with the tasks given before learning.

In cycle 2 with the material of various movements, the lecturer carried out according to the learning scenario, the atmosphere was rather active because the lecturer pointed at students who seemed to pay less attention. Based on the results of observations on students who were given project assignments in the form of tropical observations, it was seen from the results of the recapitulation and analyzed that the data included the category of aspects of understanding the report results included in the sufficient category (69.54%). So in this case there is a slight increase (1.42%) from cycle I.

Based on the results of observations of the indicators for the aspect of understanding the report results, it turns out that the indicators for data collection and discussion and conclusions are lacking. The reflections carried out provide examples of the correct way of observing to obtain data parameters. From the data obtained, it is reviewed with references obtained and related to analysis and discussion adjusted to the purpose of the assignment.

In cycle 3 with plant hormone material, the project task is making a paper on various hormones. Based on the results of data analysis on the aspect of understanding the results of the report included in the Good category (74.04%).

Table 1. Recapitulation of categories of aspects of understanding the results report

	Analysis Value	Category
Cycle I	68,12 %	Enough
Cycle II	69,54 %	Enough
Cycle III	74,04 %	Well

Based on the results of the analysis, project-based learning in the Plant Physiology course in cycle III has reached the expected target, namely getting a good category of at least 70% for the aspect of understanding the report results and 21 students (87%) getting an average score of 70 and above.

The results of this classroom action research are consistent with the opinion of Goodman and Stivers, (2010) that the project-based learning approach creates a "constructivist" learning environment where students build their own knowledge and educators become facilitators. Also according to Nurhadi and Senduk (2003) that project-based learning requires students to conduct authentic investigations to find real solutions to real problems and be able to put them in the form of reports.

4.2. Aspects of understanding the results of the discussion

In cycle 1, the results of the discussion during 2 meetings obtained recapitulation of the average data: 1 student was very good, 12 students were good, and 11 students were in the moderate category. Based on the results of the data analysis of the results of the discussion including the criteria for the level of understanding enough (69.2%).

Based on the results of observations, the lecturer felt that he had not succeeded in conditioning students to actively discuss because there were still 11 who had not been maximal in making good questions. Judging from the indicators during the presentation, there were still 8 students in the sufficient category, meaning that they did not show presentation skills that were easily understood by listeners.

The result of the reflection to be improved in cycle II is to give examples when explaining the initial material by using power points and bringing props as well as real pictures. Create a lively discussion atmosphere by pointing in turn.

In Cycle II, the data from the discussion were obtained during the learning process of meeting 1 and meeting 2 with material on various types of motion and plant growth and development. The average data recapitulation is obtained: 1 student is very good, 12 students

are good and 11 students are in sufficient category. Based on the overall average results for the discussion criteria in cycle 2, it was 69.43% in the enough category. Only increased 0.23% from cycle I

Based on the results of observations the lecturers have carried out according to the learning scenario, the condition of the students during the discussion seemed conducive and more involved, but the quality of the discussion remained the same. The results of the lecturer's reflection should motivate students to understand the material, when discussing giving examples of how to ask and answer the right questions, further enhance group cooperation, and get involved in group discussions.

The data from the discussion were obtained during the learning process of meeting 1 and meeting 2 with the material of various hormones in plants. Each presentation group always uses LCD media.

Based on the indicators of the results of the discussion cycle III, the criteria were obtained: Presentation of 9 students was very good 15 students was good, the ability to answer 9 students was very good 15 students was good, the ability to ask 7 students was very good 17 students was good, and participation in the discussion 8 students was very good 15 students was good 1 enough students.

The results of the understanding aspect of data analysis based on the overall average result for the discussion criteria in the third cycle is 76.25% (Good).

Table 2. Recapitulation of categories of understanding aspects of discussion results

	Analysis Value	Category
Cycle I	69.20 %	Enough
Cycle II	69.43 %	Enough
Cycle III	76.25 %	Well

Based on the results of the recapitulation, in terms of understanding the results of the discussion using project-based learning, it is able to improve the quality of learning, this is reinforced where in cycle III only one student is categorized as sufficient.

Project-based learning in the Plant Physiology course is indeed a long-term learning that focuses on the activities of students to be able to understand a concept or principle by conducting an in-depth investigation of a problem and finding relevant solutions and implemented in project work, so that participants Students experience a meaningful learning process by building their own knowledge. The emphasis of learning lies in the activities of students to solve problems by applying the skills of researching, analyzing, creating, and presenting learning products based on real experience. In accordance with the opinion of Woods (1989) that learning that makes students passive, their tendency to understand concepts is only 50%, whereas if learning requires students to actively participate in discussions, retell, present, simulate experiences and do something real, the tendency to understand concepts is 70-80%.

4.3. Aspects of understanding test results

The results of the cognitive aspect in the form of an oral test and a written test were obtained during the learning process in the first cycle, the data obtained were averaged so that the results of the recapitulation were as follows: 5 students were good, 17 students were good enough and 2 students were lacking, and the results of the analysis were 57.60 % (Not enough).

Based on the results of observations, the lecturers have carried out learning well, the atmosphere of the exam is a bit noisy, and based on the results of the assessment, it turns out

that almost 50% of them got enough marks. This shows many things that need to be improved both from lecturers and students.

The results of the reflection to be improved in cycle II are maximizing involvement in the discussion and assigning them to bring additional references, further improving the oral test.

Cycle II, the results of the cognitive aspect in the form of oral tests and written tests were obtained during the learning process, the data were averaged so that the recapitulation results based on the indicators of the results of the second cycle of tests obtained the criteria: Oral test 8 students were good, 16 students were sufficient, written test 2 students were very good 13 students good 9 students enough 1.

The results of data analysis aspects of understanding based on the overall average results for the test results criteria 65.53% (Enough).

The results of observations, the atmosphere of the written exam implementation process took place calmly, during the oral test only some students were able to explain related to the tasks given and the explanations given were not perfect as a whole.

The results of reflection improve the atmosphere of the exam and tighten the sitting position, the lecturer motivates students to dare to reveal what is known during the oral test and advises students to further increase their knowledge through various reference sources.

Cycle III based on the test results indicators obtained criteria: oral test 9 students were very good 13 students were good 2 students were fair, written test 13 students were very good 11 students were good. The results of the analysis of the understanding aspect of data based on the overall average result for the test results criteria in cycle 3 are 74.98%. (Good) and 23 students including good criteria and only 1 value is sufficient, this means that the minimum target has been achieved.

Table 3. Recapitulation of categories of understanding aspects of test results

	Analysis Value	Category
Cycle I	57.60 %	Enough
Cycle II	65.53 %	Enough
Cycle III	74.98 %	Well

Based on the results of the third cycle test, Project-based learning is able to improve understanding in the Plant Physiology course and has achieved the expected target, namely the understanding aspect of more than 70% and 50% of students get a score of 70 and above.

Table 4. Recapitulation of the overall criteria for understanding aspects

	Aspects of Reports	Discussion Aspect	Aspect Test	Average
Cycle I	68,12 %	69,20 %	57,60 %	64,97 %
Cycle II	69,54 %	69,43 %	65,53 %	68,17 %
Cycle III	74,04 %	76,25 %	74,98 %	75,09 %

Project-based learning on Plant Physiology in cycle 3 turned out to be of higher quality, which achieved the criteria for successful understanding of 75.09% with a good category, also able to increase students' understanding to create effective learning. Understanding in this case can be seen when discussing the material presented in accordance with the learning objectives and being able to express the results of his observations and at the end of the learning being able to answer all questions asked either in writing or orally.

The results of this study demonstrate that the learning *project based learning* is designed to be used on a complex problem that required subjects to investigate and understand, so that subjects Plant Physiology very suitable to use this learning. By grouping students in solving a project or task, students will practice their skills in planning, organizing, negotiating, and making consensus about the issues of the task to be done, who is responsible for each task, and how information will be collected and presented in presentation or report form.

In accordance with the opinion of Ibrahim and Nur (2002) project-based learning is used to stimulate higher thinking in problem-oriented situations including learning how to learn. Supported by the opinion of Wena (2009) states that project-based learning is learning that provides opportunities for educators to manage learning in the classroom by involving project work. This project work can create a form of work that contains complex tasks based on very challenging questions and problems and guides students to design, solve problems, make decisions, carry out investigative activities, and provide opportunities for students to work independently. So that they are able to express their observations in oral and written form.

IV. Conclusion

Based on the results of the actions that have been taken, it can be concluded that *Project-Based Learning* can improve Student Understanding of Plant Physiology Courses. In the first cycle the understanding aspect was 64.97%, the second cycle became 68.17% and in the third cycle increased to 75.09%, this increase in understanding occurred in all aspects, namely the results of reports, discussion results and tests.

In this project-based learning, students learn more on their own to discover the concepts being studied. Students are also required to be physically, intellectually and emotionally active, so that by being active students improve their understanding of plant physiology learning optimally.

It is recommended that when using project-based learning, tasks that are meaningful, clear and challenging, also diversify tasks so that they can produce real products or results as found.

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