



The effect of the project-based learning (PjBL) on concept understanding and environmental care attitudes



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ABSTRACT

Understanding concepts is very important for students to remember information and is closely related to students' attitudes towards things such as the environment. From the results of interviews and reviewing the list of grades of grade X students at Senior High School of 2 Magelang, it can be seen that students' understanding of concepts on ecosystem material and students' environmental care attitudes have not been maximized. This study aims to analyze the effect of using the Project Based Learning (PjBL) learning model on the understanding of concepts in ecosystem material and students' environmental care attitudes. The research method used is a quasi-experiment with a nonquivalent pretest-posttest control group design. The results of the analysis of pretest and post-test values in the experimental class and control class using the ANCOVA test obtained a significance value of 0.046. The results of the analysis of environmental care attitude questionnaires at the beginning and end of learning using the ANCOVA test obtained a significance value of 0.000 in the experimental class. Based on these results, it can be concluded that there is an influence of the PjBL learning model on students' understanding of concepts on ecosystem material and students' environmental care attitudes.

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INTRODUCTION

According to Sugrah, 2019 states that ideal learning is student-oriented learning so that students will try to construct their own knowledge and can be actively involved in finding information. From the results of preliminary studies through interviews conducted with biology subject teachers at Senior High School of 2 Magelang, it can be seen that class X has used an

independent curriculum. Learning models and methods carried out in learning are still less varied. The method most often done by the teacher, including in learning in class X, is the discussion method. The discussion method has the advantage of stimulating student creativity in forming new ideas and breakthroughs in problem-solving, but according to Taniredja et al., 2011 there are disadvantages to the discussion method used, namely considering that each student has a different background and there are students who understand the material, but many also do not understand the material. The course of discussion can be hampered because there are students who are only silent because they do not understand the material or students who find it difficult to express opinions due to limited material understanding so that the understanding of concepts in the material will not be the same (Nurfadilah & Rochintaniawati, 2021). In learning, teachers use learning resources in the form of power points made by teachers and reference books. Such learning activities do not make students active in learning, while the demands in the independent curriculum, students are required to be more active by creating or implementing projects that can develop their skills and potential through various fields (Ule, Bunga, & Bare, 2021). Students also often have difficulty understanding academic concepts because they only get material using something abstract (Mahanal, Darmawan, Corebima, & Zubaidah, 2010). Understanding the concept itself is very important because it is the ability of students to master the subject by expressing it in a form that is easier to understand, providing data interpretation, and having the ability to apply it to concepts that are in accordance with the cognitive structure they have (Sanjaya, 2009).

Based on the results of the review of the list of grades of grade X MIPA 1 to X MIPA 5 students for the 2020/2021 school year at Senior High School of 2 Magelang on ecosystem material, it can be seen that the KKM in Senior High School of 2 Magelang is 70, so there are still as many as 35% of the total students of grades X MIPA 1 to X MIPA 5 who have only KKM standard values, namely in the range of 70-76 values. While students who have scores below KKM 70 are 28% of the total students of grades X MIPA 1 to X MIPA 5. Learning ecosystem material in class X is closely related to the environment. According to Mahanal, Darmawan, Corebima, & Zubaidah (2010), attitudes can arise from several assessments developed in three models, namely affective, behavioral tendencies, and cognitive. An effective response is a physiological response to express an individual's liking for something. Behavioral tendency responses are verbal indications that can be seen from an individual's intent. Attitudes toward the environment that show environmental care can prevent damage to the surrounding natural environment and will develop action efforts to repair natural damage (Asmani, 2013). Based on the filling of questionnaires that have been carried out by grade X students of Senior High School of 2 Magelang as many as 22 students, it is known that there is a student's environmental care attitude which is divided into 3 aspects, namely affective response, behavioral tendency response, and cognitive response. There are still student responses that are less aware of environmental concerns from this statement. Ecosystem learning associated with students' attitudes towards the environment is expected to shape students to have an attitude of caring for nature and the environment around it. This is in accordance with the opinion of Kose, 2011 that one of the learning outcomes that can be associated with student attitudes towards the environment is to change students' attitudes towards the environment to be more positive because according to Narut & Nardi (2019) stated that students' environmental care attitudes are still relatively low.

One of the lessons that is expected to be able to overcome these problems is through the Project Based Learning (PjBL) learning model. Project Based Learning (PjBL) is a learning model that provides opportunities for teachers to be able to manage to learn in the classroom by involving project work Sari & Angreni (2018). PjBL can be used as a learning innovation carried out in the teaching and learning process. This PjBL learning is expected to affect the understanding of



students' concepts and environmental care attitudes in ecosystem material in class X semester 2. Relevant research related to the influence of the PjBL learning model on ecosystem materials on student attitudes and learning outcomes was conducted by Mahanal, Darmawan, Corebima, & Zubaidah (2010) that the PjBL learning model affects attitudes towards the environment and understanding the concepts of Senior High School of 2 Malang students. In this study, it was found that the average student taught with the PjBL model had an attitude towards the environment as much as 11.56% of students taught with conventional learning. Students taught with the PjBL model also had a higher understanding of concepts 81.05% than students taught with conventional learning. According to Sani (2014) who reviewed the steps of the PjBL model, it can be seen that PjBL has six syntaxes, namely the project starts with essential questions, makes planning, compiles scheduling, monitors project creation, conducts assessments/presentations, and evaluates. The PjBL model is a model that has been recommended by the Ministry of Education and Culture in 2016, in Permendikbud No. 22 of 2016 which states that to encourage the ability of students to produce contextual work, both individually and in groups, it is recommended to use a learning approach that produces PjBL work.

This research will use learning with the PjBL model on ecosystem material to determine the understanding of environmental concepts and attitudes in students in the Senior High School of 2 Magelang. Based on the background, problem analysis, and solutions offered, the problem formulation can be determined "Is there an influence of the model PjBL learning towards understanding the concept of ecosystem material and caring for the environment?". The purpose of this study is to analyze the effect of using the PjBL learning model on understanding concepts in ecosystem material and environmental care attitudes at the Senior High School of 2 Magelang.

RESEARCH METHODS

Research Design

The research method used in this study is a type of experimental quantitative research. This research is a quasi-experiment with a non-equivalent pretest-posttest control group design.

Table I. Research Design Non-Equivalent Pretest-Posttest Control Group Design

| Group | Pretest | Treatment | Posttest |
|-------|----------------|-----------|----------------|
| E | O ₁ | X | O ₂ |
| K | O ₃ | - | O ₄ |

Information :

- E : Experimental group (group treated with the PjBL learning model)
- K : Control group (group treated with conventional learning models)
- O₁ : Pretest the experimental group
- O₂ : Posttest experimental group
- O₃ : Pretest control group
- O₄ : Posttest control group
- X : Use of the PjBL learning model.

Population and Samples

The population in this study was 288 students in grade X at Senior High School of 2 Magelang. Class X of SMA N 2 Magelang consists of 8 classes. The class consists of XI to X8. Sample determination in this study was carried out using purposive sampling techniques. The sample in this study was used to test the level of understanding of concepts and attitudes towards the student environment was class X2 which amounted to 36 students as a control group and class XI which



amounted to 36 students as an experimental group. Both classes were chosen because they have the same composition of students and have homogeneous abilities when viewed from the value of the class's knowledge. This can be known from the results of the homogeneity test on the value of knowledge of biological materials which shows a significance value is 0.833.

Instruments

The focus of this research is the analysis of the influence of the use of the PjBL learning model on understanding concepts in ecosystem material and environmental care attitudes. The research instruments used are test instruments and non-test instruments. The test instrument consists of pretest and posttest questions. Non-test instruments consist of questionnaires of students' environmental care attitudes and observation sheets of the implementation of PjBL syntax.

Pretest and posttest questions are taken based on sub-chapters in the ecosystem material to find out students' understanding of concepts. Tests will be given before and after learning. Before being used as a research instrument, the question must go through several stages of analysis test first. The tests carried out are validity tests, reliability tests, difficulty tests, and question-differentiating power tests. The validity test is carried out through two stages. The first stage is construct validity by testing 50 ecosystem material questions on grade XI MIPA 5 students. In the second stage, namely the validity of the content carried out by expert lecturers. After the test instrument is carried out, of the 50 questions there are 27 questions that can be used as test instruments

Questionnaires are used to determine students' environmental care attitudes. A questionnaire is a technique used to collect data by providing a number of questions or written statements to respondents to be answered according to the most suitable conditions (Sugiyono, 2013). Questionnaires were given to the control class and experimental class before and after the lesson. Before use, the questionnaire sheet has been validated by expert lecturers and is suitable for research.

The observation sheet is used to monitor the implementation of the syntax of the PjBL learning model. The observation sheet will be filled in by an observer who will observe learning activities in the experimental class.

Procedures

The stages carried out in this study are: (1) Determining learning problems that occur at Senior High School of 2 Magelang (2) Looking for and collecting research references related to the problems to be researched. (3) Conduct research with the PjBL learning model and provide pretest questions and questionnaires on environmental care attitudes. (4) Provide posttest questions and questionnaires on environmental care attitudes at the end of learning. (5) Analyze research data that has been obtained to draw conclusions that can be drawn from the research that has been done.

Data Analysis

The pretest and post-test data analysis technique used is the parametric test ANCOVA test with the help of SPSS 25 for Windows. The ANCOVA is used to test the hypothesis and to see a comparison of students' level of concept understanding and environmental attitude on ecosystem material in experimental and control classes. Before the hypothesis test is carried out, prerequisite tests must be carried out in the form of normality tests, homogeneity tests and linearity tests. After the data is proven to be normal, homogeneous, and linear then proceed with the ancova test. In this study, it has two hypotheses, namely H_0 has no influence and H_1 has an influence. The test criteria

will adjust to the SPSS calculation. Testing will be conducted with the SPSS 25 for Windows application. The basis for making decisions to accept or reject H_0 in this test is as follows:

If the *sig* (2-tailed) < 0,05, H_0 will be rejected and H_1 accepted.

If the *sig* (2-tailed) > 0,05, H_0 will be accepted and H_1 rejected.

The PjBL observation syntax sheet will be filled in by an observer in the class. The aspect observed in this observation sheet is the stages of the PjBL learning process. The criteria for implementing the PjBL learning syntax is if it is carried out to get criteria (yes) with a score of 1 and if it is not carried out to get criteria (no) with a score of 0. The percentage scale to determine the implementation of PjBL syntax uses the following formula.

$$\% \text{ Implementation} = \frac{\text{Implementation Score Total}}{\text{Maximal Score}} \times 100\%$$

The percentage results will be categorized into learning syntax implementation criteria.

Table 2. Learning Syntax Implementation Criteria

| Score | Criteria |
|----------|-----------|
| 81%-100% | Very Good |
| 61%-80% | Good |
| 41%-60% | Enough |
| 21%-40% | Bad |
| 0%-20% | Very bad |

RESULTS

The syntax of the PjBL learning model consists of six syntaxes, namely: determining fundamental questions, planning and drawing up schedules, monitoring students and project progress, assessment of results, and evaluation of experience.

Table 3. Stages of Implementation of PjBL Model Syntax in Learning

| Stages | Meeting 1 | Meeting 2 | Meeting 3 | Percentage | Implementation Criteria |
|--|--------------|--------------|--------------|------------|----------------------------|
| Start with the essential question | √ | | | 83% | Very Good |
| Design project | √ | | | 100% | Very Good |
| Create schedule | | √ | | 100% | Very Good |
| Monitoring the students and the progress of the project | | √ | | 100% | Very Good |
| Assess the outcome | | | √ | 100% | Very Good |
| Evaluation the experience | | | √ | 100% | Very Good |

Students' concept comprehension is measured using a pretest and posttest. A pretest is used to determine students' initial ability to understand concepts in a material so that the pretest will be given before learning. Posttest is used to determine the ability to understand students' concepts after learning so that tests are given after learning.



Figure I. Average Pretest and Posttest

Information:

PRK = Pretest Control Class

PRE = Experimental Class Pretest

POK = Posttest Control Class

POE = Posttest Control Class

Data on pretest and post-test values of understanding concepts in the experimental class and control class will be carried out on two prerequisite tests, namely the normality test, homogeneity test, and linearity test. The normality test results can be known to show a significance level of > 0.005 so that the data is normally distributed.

Table 4. Pretest and Posttest Normality Test Results

| Class | Statistic | df | Sig. | Summary |
|---------------------|-----------|----|-------|---------|
| Pretest Experiment | 0.128 | 36 | 0.141 | Normal |
| Posttest Experiment | 0.144 | 36 | 0.057 | Normal |
| Pretest Control | 0.142 | 36 | 0.065 | Normal |
| Posttest Control | 0.137 | 36 | 0.086 | Normal |

The homogeneity test on the pretest and posttest values of conceptual understanding can be said to be homogeneous or diverse because it shows a sign of more than 0.005. The experimental and control class pretest data showed a significance level of 0.847, while the experimental and control class posttest data showed a significance level of 0.062. The results of the linearity test in the experimental class have a significance level of $0.130 > 0.05$ so that the data is linear. The control class has a significance level of $0.954 > 0.05$ so that the data is also linear.

The pretest and post-test data will then be tested for the ANCOVA test hypothesis because the pretest and post-test value data are proven to be normally distributed, homogeneous, and linear.

Table 5. ANCOVA Test Pretest and Posttest Results

| Treatment | df | F | Sig. (2-tailed) |
|--------------------|----|-------|-----------------|
| Experiment-Control | 1 | 4.141 | 0.046 |

In addition to understanding the concept, researchers also analyzed the influence of students' environmental care attitudes on the PjBL learning model. Students' environmental care attitudes were measured using questionnaires. Environmental care attitude questionnaires are given at the beginning of learning to determine students' initial environmental care attitudes and are also given after learning to find out students' final environmental care attitudes after learning. Before the

hypothesis test was carried out, student questionnaire data was carried out through prerequisite tests, namely normality tests, homogeneity tests, and linearity tests.

The normality test results can be known to show a significance level of > 0.005 so that the data is normally distributed.

Table 6. Results of the Normality Test of Environmental Care Attitude

| Class | Statistic | df | Sig. | Summary |
|-------------------------|-----------|----|-------|---------|
| Initial Experiment Data | 0.202 | 7 | 0.931 | Normal |
| Final Experiment Data | 0.245 | 7 | 0.560 | Normal |
| Control Initial Data | 0.164 | 7 | 0.921 | Normal |
| End of Control Data | 0.178 | 7 | 0.597 | Normal |

The homogeneity test on the questionnaire data on students' environmental care can be said to be homogeneous or diverse because it shows a sign of more than 0.005. The initial data of the experimental and control classes showed a significance level is 0.652, while the final data of the experimental and control classes showed a significance level is 0.947. The results of the linearity test in the experimental class have a significance level is $0.130 > 0.05$ so that the data is linear. The control class has a significance level is $0.954 > 0.05$ so the data is also linear. The student environmental care questionnaire data will then be tested for the ANCOVA test hypothesis because the data are proven to be normally distributed, homogeneous, and linear.

Table 7. Results of ANCOVA Test Environmental Care Attitude

| Class | df | Sig. (2-tailed) |
|--------------------|----|-----------------|
| Experiment-Control | 36 | 0.000 |

DISCUSSION

This study aims to analyze the influence of the PjBL learning model on students' understanding of concepts on ecosystem material and environmental care attitudes. Based on the pretest and posttest score data from the experimental class and the control class, it can be known that the increase in scores in the experimental class is greater than in the control class. The pretest result of the experimental class was 67.94; while the control class pretest result was 65.89. experimental class posttest result of 82.5; while the posttest result of the control class was 78.42. From these results, it can be seen that the increase in pretest and posttest scores in the experimental class was 14.56; while the increase in pretest and posttest scores in the control class was 12.53. The ANCOVA test result of the sample shows a significance value of 0,046; Which means H_0 is rejected and H_1 is accepted. In conclusion, there are significant differences in students' understanding of concepts in ecosystem materials between experimental classes, classes, and control classes. This is in line with research conducted by Mahanal, Darmawan, Corebima, & Zubaidah (2010) that the PjBL learning model affects attitudes toward the environment and understanding of the concept of Senior High School of 2 Malang students. In addition, there is research from Yuniarti, Pamungkas, & Sukmawati (2020) shows that the PjBL learning model affects students' understanding of concepts on virus material and COVID-19 literacy in grade X students of Senior High School of 5 Magelang. The ability to understand students' concepts develops at each stage of the syntax of the PjBL learning model.

Each stage in PjBL learning is interrelated so that it can help in increasing students' understanding of concepts. However, several stages have a big role in increasing students' understanding of concepts. According to researchers, the stages that have a big role are the stage of



fundamental questions, preparing schedules, and assessing results. The fundamental question stage is the beginning of students understanding the question and trying to find answers to the question. At this stage, there is a discussion between students and teachers so that students with an understanding of the concepts they have can form and construct their knowledge. Stages that have another role are in preparing schedules. At this stage, students carry out their projects according to schedules and plans that have been prepared in groups. In this case, students will be allowed to work on assignments given in the form of poster projects following what they have learned and obtained during learning, and given deadlines. Students have the freedom to build and develop their learning independently (Surya, Relmasira, & Hardini, 2018). The next stage of learning that has a role is the stage of assessment of results. The stage carried out with this group presentation can be used to find out the extent to which they are involved in working on the project and find out students' understanding of the resulting posters. In addition to presentations, to find out the extent of understanding of the concept, students are asked to do a posttest of ecosystem material. According to Furi, Handayani, & Maharani (2018) stated that PjBL can improve a person's skills in interacting with others and regulating himself so that he can develop maximum workability.

In addition to understanding the concept, this study also examines environmental care attitudes in students. Environmental care toward students can be done by providing opportunities to identify problems, solve problems, and make solutions to reduce these problems in PjBL learning (Rafsanjani, Surabakti, & Sikumbang, 2020). Students' environmental care attitudes are known based on environmental care questionnaires given before and after learning. The questionnaire instrument used adapts aspects of attitude responses according to Mahanal, Darmawan, Corebima, & Zubaidah (2010), namely: affective responses, behavioral tendencies, and cognitive responses. Based on these aspects, indicators of environmental care attitudes are obtained namely environmental insight, facing environmental problems, penchant for protecting the environment, and carrying out activities related to the environment.

The results of data analysis of environmental care attitudes at the beginning and end with ANCOVA hypothesis tests show that there is a significant influence from the use of the PjBL learning model. This is shown by the significance level of the Ancova test hypothesis test, which is 0.000 in the experimental class, which means that there is a significant influence on the use of the PjBL learning model in the experimental class compared to the control class. From the results of the analysis, it can be concluded that the PjBL learning model affects students' environmental care attitudes. This is in accordance with research conducted by Mahanal, Darmawan, Corebima, & Zubaidah (2010) that the PjBL learning model is proven to have an influence in improving students' attitudes towards the environment and also affects learning outcomes so that it can be recommended for biology learning. In addition, there is research conducted by Tanjung, Dalimunthe, Ramadhini, & Sari (2022) that the PjBL learning model can increase students' concern for the environment. The influence of the PjBL learning model on students' environmental care attitudes is also supported by the PjBL learning syntax. In environmental care attitudes, there is a nationalist character, namely how to behave, think, and act so that it can affect the cognitive aspects of students (Maharani, 2022).

In this cognitive aspect, students gain trust and understanding in an object that is learned through the process of seeing, hearing, and feeling (Azwar, 2010). This affective aspect is related to the sense of pleasure or displeasure that arises in a person towards the object of attitude. Emotional reactions that arise in this affective aspect, it is determined by one's trust in an object, namely the belief in an object whether or not, useful or not (Sujana, Hariyadi, & Purwanto, 2018). The aspect of behavioral tendencies has a relationship with the attitude of a person in the tendency to act towards objects. In this case, the tendency will arise when a person faces a certain stimulus that is determined by his beliefs and feelings towards the stimulus (Suharyat, 2009).

CONCLUSION

Based on the research that has been done. It was concluded that the PjBL learning model affects students' understanding of concepts in ecosystem material and students' environmental care attitudes. This is evidenced by the results of the Ancova test hypothesis test which obtained a significance value of 0.046 for understanding concepts in ecosystem material and 0,000 for students' environmental care attitudes. In every learning process of PjBL syntax, students' ability to understand students' concepts and attitudes can develop. The PjBL learning model if applied consistently and consequently to students as a whole can have a good influence in the form of increasing understanding of concepts and attitudes towards the environment. The scope of material in the use of the PjBL learning model can be wider, not only on ecosystem materials.

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