

# Effectiveness of Project Based Learning Model in Learning Evaluation Course in Physics Education Study Programme

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**Abstract:** The use of project-based learning model in learning can improve the quality of learning and students' learning outcomes. The purpose of this study was to determine how effective the project-based learning model is on learning outcomes. The method used in this research is quasi-experiment with one group pretest-posttest design. This research instrument is in the form of a student learning outcomes test in the form of descriptions, from the test results the n-gain test is carried out. The results showed an increase in student learning outcomes with an average pretest score of 45.73 and an average posttest score of 82.08. The result of the n-gain analysis is 0.57 which shows a moderate effectiveness category. Therefore, learning evaluation courses using project-based learning models is effective on student learning outcomes.

**Keywords:** Evaluation; Learning Outcome; Project Based Learning.

## Introduction

Learning Outcomes Evaluation course is one of the compulsory courses in Department Physics Education of Universitas Negeri Manado. This course discusses the evaluation process in learning and the application of designing and processing learning outcomes. Students as prospective educators must be able to master this course, so that they can analyze and evaluate their students' learning outcomes appropriately. Some of the problems found in this lecture are that students have difficulty understanding the material, the media used is only power point, and the unavailability of learning resources that can make students learn independently (Nerita et al., 2018; Paramitha et al., 2023; Selasmawati & Lidyasari, 2023).

In the 21st century, humans are faced with a variety of very complex challenges. This is characterized by easy access to all types of information because it is available anywhere and can be accessed at any time. However, students have not been able to process this

information properly to understand the evaluation process in learning. So to overcome this problem, students need to be exposed to learning that produces products by applying a project-based learning model (Gultom et al., 2023; Nurwahidah et al., 2022; Susilawati et al., 2023).

In every learning process, evaluation is an important thing for prospective educators to master. Because it is related to the assessment of the achievement of learning objectives. Evaluation also serves to determine the efficiency and effectiveness of the teaching and learning process that has been carried out. The results of the evaluation can be used to improve and make learning more interesting. Learning evaluation courses play an important role in fostering knowledge about the assessment of the learning process. In this course, students are expected to be able to make appropriate learning questions and objective assessments. In practice, learning in the course still often explains the theory only by means of discussions and lectures. Whereas the new curriculum requires students

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to produce learning products. Therefore, there needs to be learning innovation in learning evaluation courses. One of the learning models that can be used to increase students' understanding of product-based learning is the project-based learning model. (Adinugraha, 2018; Utama & Sukaswanto, 2020).

The use of the project-based learning model is a model that is in great demand by educators. It is because students can produce products from the learning process that is passed. In addition, the influence of rapid technological development also helps a lot in the learning process. So that students are increasingly encouraged to increase understanding through the products produced. The learning model that is currently widely applied is the project-based learning model, because this learning model focuses on the activities of students. Learning is required to produce products related to the problems faced by students. (Muhammad Rafik et al., 2022). Learners will be able to explore knowledge according to their wishes. It can also be combined with the use of technology used in learning today. The development of digital technology also has an impact on modern learning methods. With technological advances, various types of media can be combined (Sumarsono & Anggaryani, 2022).

Based on observations in the physics education department, many students still have low grades. There are still many students who have difficulty in processing data on student learning outcomes. Therefore, to improve students' understanding and learning outcomes, project-based learning is needed in the lecture process. With the aim that when later becoming educators, prospective educators can make learning evaluations by utilizing digital technology in the learning process. Skills in using digital technology should be trained in the teaching and learning process (Herawati et al., 2019; Tabrani et al., 2021).

In physics learning evaluation courses, lecturers have long used discussion, question and answer and lecture methods. It makes the learning process monotonous and learning outcomes are not as expected. This is evidenced by the acquisition of students' scores in the previous year. As observed by researchers in the learning process, students are active in discussions but students are not yet familiar with the process of collecting data and processing data in learning evaluations. Meanwhile, the independent learning curriculum also emphasizes project-based learning. So, there needs to be a product-based learning process to increase students' knowledge (Lestari, 2008; P. S. Mahulae et al., 2017).

This project-based learning model is able to encourage learners to be more active in creating new concepts, gaining experience so as to improve learning outcomes through the products produced. Learners can

also find a way out of the problems they face through the data they get and the data processing that is directly done by the learners themselves. So that the learning process that is directly carried out by students can be remembered and practiced in their research (Made et al., 2022; P. Mahulae & Sirait, 2018.).

Project Based Learning (PjBL) prioritizes project-oriented learning. In this learning, students become learning subjects. Students in this course compile a grid of questions and make item analysis. The question instruments made by students are tested at a predetermined school, then analyze the items by making categories very low, low, medium, high and very high (Bendriyanti et al., 2014; Herawati et al., 2019).

The application of this learning model is expected to improve the quality of learning and the activeness of students in the learning process so as to improve learning outcomes in learning evaluation courses. Because the skills to make evaluations and assessments of students must be mastered by prospective educators. This study aims to determine whether the project-based learning model can improve the quality of learning and student learning outcomes in physics education learning evaluation courses. The results of this study can be a consideration for lecturers in improving the quality of learning and student learning outcomes (Aprilia & Susilo, 2014; Vahlia, 2017).

## Method

The method used in this research is quasi experiment with quantitative approach. Using a single group design, namely one-group pretest-posttest design by giving a test at the beginning (pre-test) before treatment and the final test (post-test) after treatment, to students (Sari & Siahaan, 2022). The research activities were carried out in August 2023 in the FMIPAK environment of the Physics Education Study Program, Manado State University. The research population was all 5th semester physics education students. The research sample used purposive samples, namely with certain considerations using views that had a close relationship with the characteristics of the population that were previously known (Febrianti et al., 2020)

The research instrument used a 10-item description test in the learning evaluation course. The increase in student understanding is expressed in the percentage of the average normalized gain score (N-gain) using three criteria in the table 1. (Silaban et al., 2022) The effectiveness of the project-based learning model in improving student learning outcomes in learning evaluation courses obtained through pretest and posttest scores. Based on the results of the study, the scores of students were obtained which were then converted into student scores and then analyzed by

calculating N-Gain. The N-Gain value is the difference between the post-test and pretest scores to determine the increase in value that occurs (Aprida & Mayarni, 2023; Dewi et al., 2023; Wahyuddin et al., 2023). To obtain data on the results of the study, learning was carried out project-based learning model. Then experiments were conducted to obtain research data. The testing data adjusted to the existing metrics were analyzed according to the improvement criteria of each participant (Kurmiawan & Hidayah, 2022; Prakasa & Suwito, 2022).

$$N - Gain = \frac{\text{Score posttest} - \text{score pretest}}{\text{Score ideal} - \text{score pretest}} \quad (1)$$

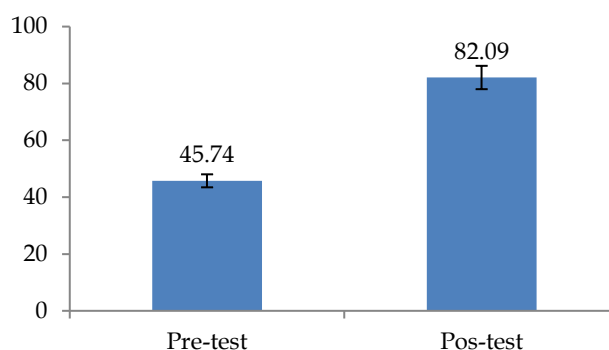
**Table 1.** N-gain Index Criteria

Percentage	Criteria
$g \geq 0.70$	High
$0.30 < g < 0.70$	Medium
$g \leq 0.30$	Low

## Result and Discussion

This study was conducted to determine the effectiveness of the project-based learning model in the learning process, especially in improving understanding and quality of learning in learning evaluation courses. The effectiveness of the learning model is seen from the value of student learning outcomes. At the beginning of the meeting, a pretest was conducted to determine the initial knowledge of students. Next, learning is carried out with a project-based learning model. At the final meeting, a post-test was conducted to determine the understanding of students after treatment. For the pre-test results obtained an average of 45.73. While for the post-test an average of 82.08 was obtained (Ruski & Sholeh, 2019; Wibowo, 2014)

After being treated, students showed a significant increase in knowledge. This can be seen from the average score in the post-test has increased compared to the pre-test. This proves that there is an increase in understanding in the learning evaluation course. In project-based learning, learners tend to be more active and enthusiastic about working on projects given to them (Fisher et al., 2020; Kokotsaki et al., 2016). This helps them come up with better products related to their projects. It also signifies a higher level of creativity. This is in accordance with what was stated by Meyer (Meyer, 2015) shows that project-based learning has a positive influence on students' life skills development at the grade 6-12 level and helps prepare them for success in the 21st century global community and economy. Project-based learning is a well-known method to apply cognitive competence and to create a flexible, capable learning environment for low-achieving students (Mergendoller & Thomas, 2005).



**Figure 1.** Average of pre-test and post-test

After obtaining the initial and final knowledge value data, the next step is to analyze the effectiveness of using the learning model by conducting the n-gain test. The results of the n-gain analysis are presented in the Table 2.

**Table 2.** N-gain data for each criterion

Percentage	Criteria	Amount
$g \geq 0.70$	High	3
$0.30 < g < 0.70$	Medium	20
$g \leq 0.30$	Low	0

The results of the n-gain analysis were obtained at 0.57 with a moderate effectiveness category. From the table above, it shows that the increase in students' understanding in the high category is 3 people, 20 people are medium and 0 is low. There is a large increase in the pre-test and post-test, so it can be concluded that the project-based learning model can make students' learning outcomes increase (Adinugraha, 2018; Arga & Rahayu, 2019)

The use of project-based learning models in learning evaluation courses provides benefits to students. In the learning process, each participant actively participates in making learning evaluation products that can later be used in research or when going directly to schools to teach. Students also have the opportunity to plan learning activities either independently or in groups. Based on previous research, the project-based learning model is influential in realizing good quality learning fiber improves students' understanding (Muhammad Rafik et al., 2022; Ningsih et al., 2023)

Making these products makes students understand the learning evaluation process better. This research is in line with previous research as in Gunawan and friends showed that the project-based learning model with virtual media applied successfully increased student creativity in physics learning. (Gunawan et al., 2017). This is in line with research conducted by Susanti and friends (Susanti et al., 2022) shows that there is an increase in student learning motivation through the use

of interactive digital books based on interactive digital based on Project Based Learning (PjBL) project-based learning obtained an increase in student learning outcomes. In addition, it can also improve students' creative thinking skills and increase learning effectiveness to obtain high learning outcomes (Suradika et al., 2023; Yanti et al., 2023; Yufrizal, 2021). Other research conducted by Chan Lin (ChanLin, 2008) regarding the use of technology in project-based learning also showed that all students who participated in the project were able to achieve their project objectives as evidenced by their achievements related to the development of skills and abilities to synthesise and elaborate knowledge, their positive attitudes to participating in scientific exploration, and their willingness to use technology to conduct and report their research.

## Conclusion

Based on the research, the application of the project-based learning model in the learning evaluation course of the Physics education study program can be declared effective in improving student learning outcomes marked by an n-Gain value of 0.57 including in the moderate category. The average percentage of pre-test and post-test shows an increase from 45.73 to 82.08. Learning with project-based learning models can improve the quality of learning by producing learning evaluation products that can be used for research materials or evaluation process materials in schools. The results of this study are expected to be used as a reference for making learning innovations so as to improve student learning outcomes.

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## Author Contributions

Conceptualization, P.S.M., T.M., P.M.S.; validation, A.M.R., writing-original draft preparation P.S.M. and T.M.; data acuration, P.M.S and A.M.R.; writing-review and editing, P.S.M.

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## Conflicts of Interest

The authors declare no conflict of interest.

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