

IMPROVING STUDENTS ENHACEMENT BY IMPLEMENTING PROJECT BASED-LEARNING ENABLE MOODLE IN BASIC ELECTRONICS SUBJECT

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ABSTRAK

Hasil belajar siswa SMK telah menjadi fokus pemerintah dalam peningkatan kualitas sumber daya masa depan Indonesia emas 2045. SMK khususnya pada jurusan keteknikan menunjukkan kurang maksimal yang disebabkan oleh faktor internal dan eksternal. Data statistik Kemendikbud 2024/2025, menyebutkan tren ketuntasan rendah pada jurusan vokasi teknik. Data menunjukkan hasil ujian akhir siswa SMK Keteknikan 60-70 yang belum mencapai KKM. Adapun penelitian ini bertujuan untuk meningkatkan hasil belajar siswa SMK melalui Pembelajaran Berbasis Proyek berbantuan Moodle. Penerapan model saintifik ini diharapkan mampu menjadi solusi peningkatan kompetensi siswa. Instrumen tes diterapkan pada kelompok eksperimen yang dikenakan PjBL berbantuan Moodle. Hasil penelitian menunjukkan bahwa penerapan PjBL berbantuan Moodle memberi dampak positif pada hasil belajar siswa SMK. Implementasi Moodle telah memudahkan guru dalam supervisi proyek siswa dalam aplikasi. Pada saat yang sama, penerapan PjBL berbantuan Moodle menjadi pilihan terbaik guru dalam menjadi pendidik sekaligus fasilitator proyek siswa. Kajian ini menegaskan pentingnya perhatian sekolah dalam menghubungkan pembelajaran dengan teknologi digital untuk mengatasi permasalahan rendahnya tren hasil belajar siswa SMK.

Kata kunci: Hasil Belajar Siswa SMK, PjBL, Moodle

ABSTRACT

Vocational high school students' learning outcomes have become a government focus in improving the quality of Indonesia's future human resources for the golden age of 2045. Vocational high schools, particularly those majoring in engineering, have shown suboptimal performance due to internal and external factors. Statistics from the Ministry of Education and Culture (Kemendikbud) for 2024/2025 indicate a trend of low completion rates in engineering vocational majors. Data show that 60-70% of final exam results for engineering vocational high school students have not yet reached the Minimum Competency (KKM). This study aims to improve vocational high school student learning outcomes through Project-Based Learning (PBL)

supported by Moodle. The application of this scientific model is expected to be a solution to improve student competency. The test instrument was applied to an experimental group that underwent Moodle-assisted Project-Based Learning (PjBL). The results of the study indicate that the implementation of Moodle-assisted Project-Based Learning (PjBL) has a positive impact on vocational high school student learning outcomes. The implementation of Moodle has made it easier for teachers to supervise student projects within the application. At the same time, the implementation of Moodle-assisted Project-Based Learning (PjBL) is the best choice for teachers in becoming both educators and facilitators of student projects. This study emphasizes the importance of schools' attention to connecting learning with digital technology to address the problem of the low trend in vocational high school student learning outcomes.

Keywords: *Students Result, PjBL, Moodle*

INTRODUCTION

The rapid development of science and technology, particularly in information technology, has impacted the quality of education in general. Education aims to help humans discover their true humanity and must be able to realize the whole person (Y Setyawati, 2021). Quality learning is key to improving the quality of education, and e-learning, particularly using Moodle, is one technology that enables learning without the limitations of space and time (Pasaribu, Hrp, Sahfitri, & Apriani, 2021). However, despite the widespread adoption of e-learning platforms such as Moodle, important to assess their effectiveness in enhancing learning quality across diverse educational contexts. The successful of Moodle implementation depends on various factors, including students' readiness, instructional design, and technological infrastructure.

Moodle-based e-learning will be effective if supported by an appropriate learning model, such as Project Based Learning (PjBL). PjBL provides opportunities for students to develop their potential to the maximum, and the implementation of this model has been proven to improve student learning outcomes in basic electricity and electronics materials (Laili, Ganefri, & Usmeldi, 2019). The use of Moodle in e-learning allows for a flexible learning process, with interactions occurring at three levels: conceptualization, construction, and dialogue. In addition, previous research shows that Moodle e-learning can improve students' critical thinking skills and receive positive responses from them (Kisworo, Cahyani, & Azizah, 2021). This suggests that Moodle not only supports a flexible and

interactive learning environment, but also improving critical thinking in class (Istiqamah, 2024).

Although previous research has demonstrated positive results related to the use of Moodle e-learning, no research has specifically addressed the implementation of Project-Based Learning using Moodle. Therefore, this study aims to explore and understand the impact of implementing a Project-Based Learning model with the assistance of Moodle in Basic Electricity and Electronics subjects at SMK Negeri 1 Darul Kamal. Based on this, the purpose of this study is to determine the learning outcomes of the Moodle-based Project-Based Learning model in basic electricity and electronics materials and to determine student responses to the Moodle-assisted Project-Based Learning model in basic electricity and electronics materials.

In this regard, it is important to first understand the concept of implementation as a basis for implementing the Moodle learning in this research. The term implementation is usually associated with an activity carried out to achieve a specific goal. In educational practice, the implementation of learning objectives increasingly relies on technology-based systems, (Learning Management Systems/ LMS) which support flexible and interactive learning processes such as Moodle to support teaching and learning activities. Moodle has flexibility in presenting content and allows for independent learning and supporting flexible and interactive learning (Cahyaningrum & Cuhazriansyah, 2023).

The Modular Object-Oriented Dynamic Learning Environment, or Moodle for short, is a platform used to support online learning management systems and utilizes computer devices. All learning activities, including access to materials, discussions, Q&A sessions, and evaluations, can be conducted through a website using a browser (Elyas, 2018). As a result, the learning process becomes more accessible, efficient, and adaptable to the needs of both educators and students in digital learning environments.

Therefore, to maximize the effectiveness of digital learning environments, effective pedagogical are required to engage students in meaningful learning suchh as Project Based Learning (PjBL). PjBL is a project-based learning model as a learning strategy to guide students. PjBL is a model whose tasks are complex in

learning that involve students in design, problem solving, decision making, and investigative activities, which provide students with the opportunity to work cooperatively on the resulting projects (Juanta, Tanadi, Angelin, & Parta, 2025). Through this approach, students are encouraged to develop critical thinking, creativity, collaboration and problem-solving skill with practical applications in authentic contexts (Makmuri & Harun, 2024).

METHOD

This study uses a quantitative approach with a pre-experimental method (Ramdhan, 2021), to investigate the effectiveness of the Moodle-assisted Project Based Learning (PjBL) learning model in improving student learning outcomes in the Basic Electricity and Electronics subject in class X TITL SMKN 1 Darul Kamal, Aceh Besar. The steps of Moodle-assisted PjBL learning involve determining fundamental questions, project design, scheduling, monitoring student activities, testing results, evaluating experiences, and closing stages. This study used a sample of all class X TITL SMKN 1 Darul Kamal students as an experimental group, with student learning outcomes assessed using pretest and posttest tests. The pretest was run to determine students' initial understanding, while the posttest was conducted after the learning intervention to measure the improvement in learning outcomes. During the implementation phase, the experimental group received instruction through the developed e-module integrated with the Project Based Learning (PjBL) approach.

The research process includes instrument validity testing, data normality testing, N-Gain calculations to measure student knowledge improvements, and hypothesis testing using Paired Samples T-tests to evaluate differences in learning outcomes between the Moodle-assisted PjBL model and the conventional model. N-Gain is used to measure the increase in cognitive learning outcomes before and after learning interventions (Wiyono, et al., 2020). Questionnaire data analysis was also used to obtain students' views on learning.

The results of this study are expected to contribute to understanding the effectiveness of the Moodle-assisted PjBL learning model in the context of this subject. To obtain a clear picture of the research, data analysis was conducted using

statistical techniques, using the percentage formula proposed by Sudijono as follows:

$$P = \frac{F}{N} \times 100\%$$

Description:

P = Percentage

F = Students who answered the statement/question

N = Number of individuals/students

With the interpretation developed by Sudjana as follows:

Table 1. Interpretation of Questionnaire Data Analysis

Percentage Level (%)	Evaluation
76-100 %	Very high
51-75 %	High
26 – 50 %	Low
0 – 25 %	Very Low

DISCUSSION

Based on the research process conducted in class X TITL SMKN Darul Kamal, Aceh Besar, it can be concluded that this research involved giving a pretest to students before implementing the Project Based Learning (PjBL) learning model assisted by Moodle on direct current electricity material. After going through the learning process with the implementation of the PjBL model assisted by Moodle, students underwent learning through group discussions. After this treatment, a posttest was conducted to assess the improvement in student learning outcomes.

To evaluate the implementation of the Moodle-assisted PjBL learning model, the researcher conducted a T-test. Prior to this, the researcher ensured that the data were normally distributed, which was verified through the Normality Test and the N-Gain Test. The N-Gain Test was conducted to determine the difference between pretest and posttest scores, reflecting students' knowledge at the beginning and end of the learning process.

Data analysis showed significant results. The results of the Normality Test showed that the Pretest and Posttest variables came from a normally distributed population. The Paired T-test produced a low significance value (0.000), implying the rejection of H₀, so it can be concluded that the implementation of the Moodle-

assisted PjBL learning model has an effect on learning outcomes in direct current electricity material in class X TITL SMKN Darul Kamal Aceh Besar.

A. Moodle Application

The design process includes the learning activities that students will undertake, menu displays, page layouts, assessments, attendance, quizzes, and so on. The resulting learning design using Moodle is as follows:

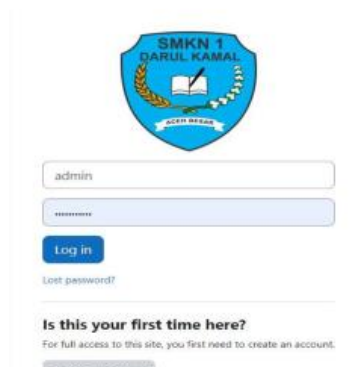


Figure 1. Login Page View

Next, information about the class type and the quiz's closing date will be displayed. Students can also see who is currently online, allowing them to communicate with each other.

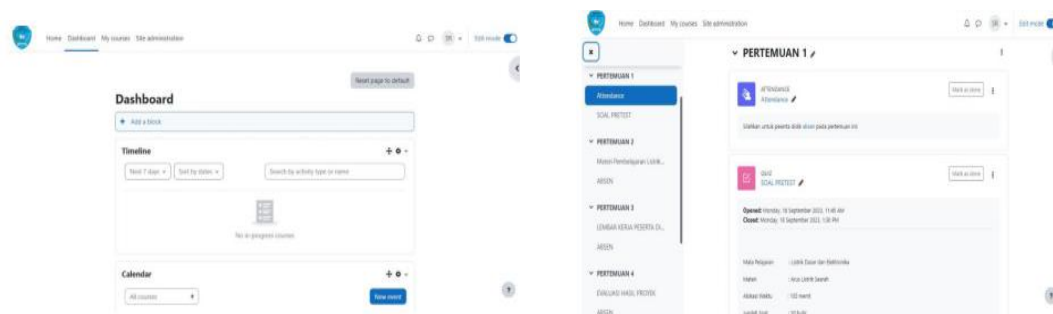


Figure 2. Dashboard and Classroom View

The main menu of learning activities, such as discussion forums, teaching materials, student projects, quizzes (pretest and posttest questions), student worksheets (LKPD), and questionnaires. Before the lesson begins, the teacher provides basic questions in the form of pretest questions.

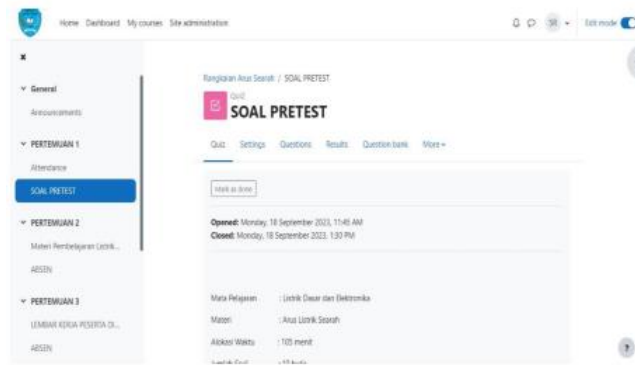


Figure 3. LKPD and Pretest View

After students have completed the pretest questions, students are expected to read and understand the material that has been provided. The next screen contains teaching materials, allowing students to independently study the material being covered in class. After the lesson is complete, students are given assignments to complete projects found on the student worksheet.

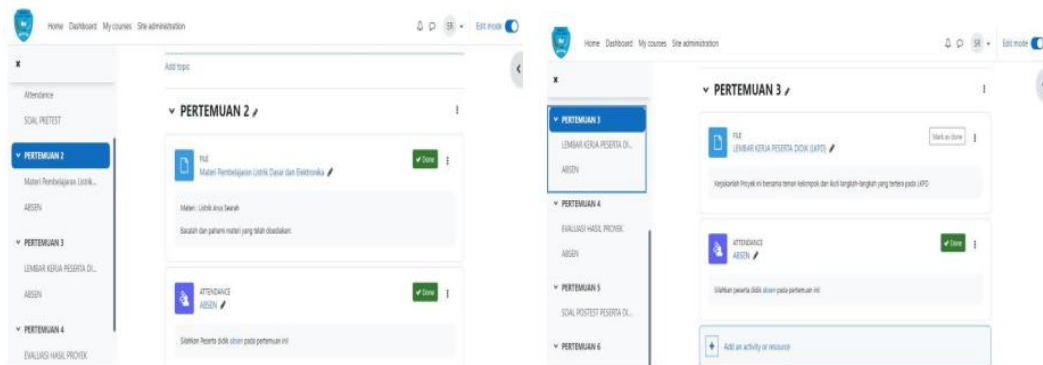


Figure 4. Material Subject View

Next, the student worksheet (LKPD) appears which contains the steps in implementing the project. After completing the project, students are expected to present the project results and their experiences during the project. After the project is completed, students are given the task of working on questions in the form of a post-test.

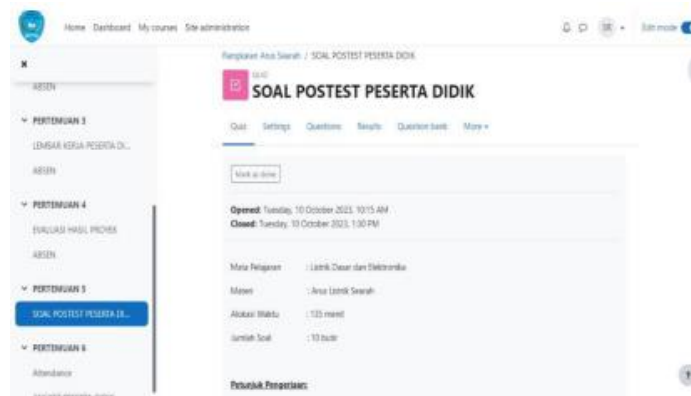


Figure 5. Posttest View

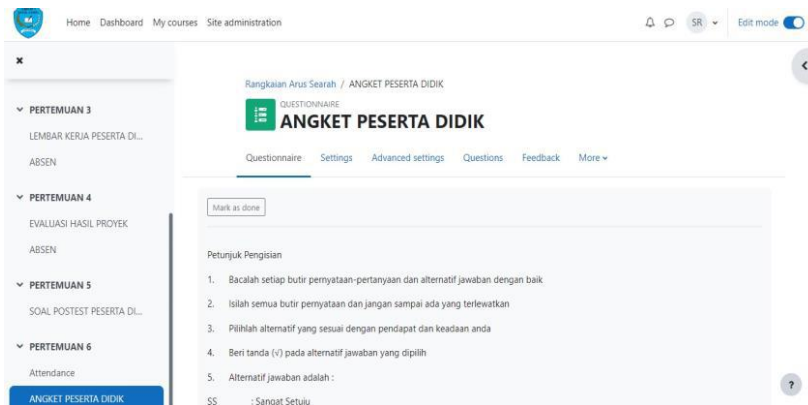


Figure 6. Questionnaire View

The next screen displays student responses to the Moodle-assisted project-based learning model. The statements are formatted according to the indicators, consisting of 10 statements, which each student completes individually within the allotted time. Once students have completed the steps on the Moodle page, their grades will appear.

First name / Last name	Email address	Attendance	SOAL PRETEST	ABSEN	ABSEN
ZA Zyan Alcam	zyanakram@gmail.com	100.00	40.00	100.00	100.00
RA Rafli Alfayyahl	raffi@gmail.com	100.00	40.00	100.00	100.00
MA M Athar	athar@gmail.com	100.00	50.00	100.00	100.00
FA Firza Aulia	firzaaulia@gmail.com	100.00	40.00	100.00	100.00
AF Akhyar Fadillah	akhyar1@gmail.com	100.00	50.00	100.00	100.00
TF Tsjul Fattari	tsjulfi@gmail.com	100.00	30.00	100.00	100.00
MM Mukalmina Mukalmina	mukalmina@gmail.com	100.00	40.00	100.00	100.00
AM Arief Munandar	aarifmunandar@gmail.com	100.00	50.00	100.00	100.00
Overall average		100.00	43.00	100.00	100.00

Figure 7. Grade Summary Page

B. Stages of Project-Based Learning (PjBL) Learning Model Results

1. First Stage: Determining Fundamental Questions

At this stage, the teacher poses essential questions that explore the students' existing knowledge based on their learning experiences, culminating in students being assigned to perform an activity. At this stage, a pretest is administered to students.

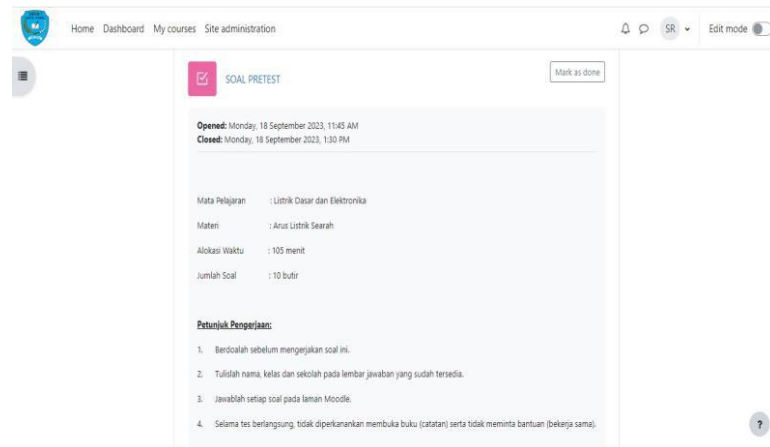


Figure 8. Basic Questions (Pretest Questions)

2. Second Stage: Designing the Project

In this stage, the teacher organizes students into heterogeneous groups (3-4 people). Next, the teacher provides material on Basic Electricity and Electronics and directs students to carry out the project. Next, students design the project by discussing how to solve the problem they are facing, what they will do, and dividing the tasks with their group members.

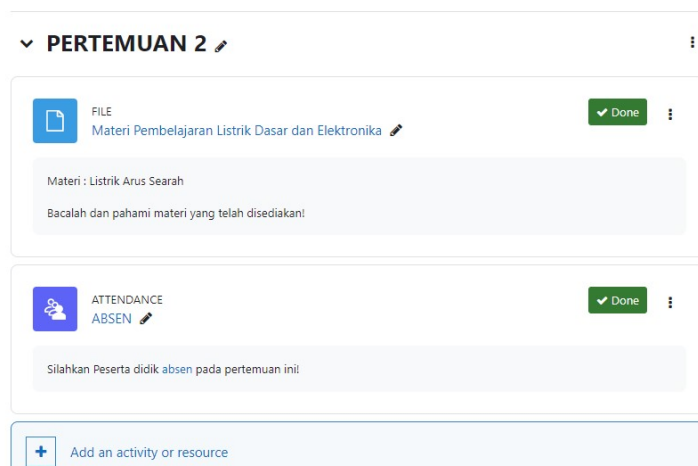
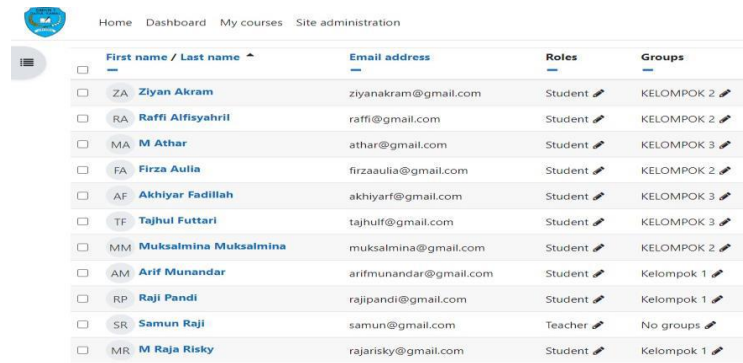


Figure 9. Providing Materials



	First name / Last name	Email address	Roles	Groups
<input type="checkbox"/>	ZA Ziyakram	ziyakram@gmail.com	Student	KELOMPOK 2
<input type="checkbox"/>	RA Raffi Alfisyahril	raffi@gmail.com	Student	KELOMPOK 2
<input type="checkbox"/>	MA M Athar	athar@gmail.com	Student	KELOMPOK 3
<input type="checkbox"/>	FA Firza Aulia	firzaulia@gmail.com	Student	KELOMPOK 2
<input type="checkbox"/>	AF Akhiyar Fadillah	akhiyarf@gmail.com	Student	KELOMPOK 3
<input type="checkbox"/>	TF Tajhul Futtari	tajhulf@gmail.com	Student	KELOMPOK 3
<input type="checkbox"/>	MM Muksalmina Muksalmina	muksalmina@gmail.com	Student	KELOMPOK 2
<input type="checkbox"/>	AM Arif Munandar	arifmunandar@gmail.com	Student	Kelompok 1
<input type="checkbox"/>	RP Raji Pandi	rajipandi@gmail.com	Student	Kelompok 1
<input type="checkbox"/>	SR Samun Raji	samun@gmail.com	Teacher	No groups
<input type="checkbox"/>	MR M Raja Risky	rajarisky@gmail.com	Student	Kelompok 1

Figure 10. Group Determination

2. Third Stage: Creating a Schedule

In this stage, the teacher facilitates students in creating an activity schedule that adheres to the agreed-upon maximum time. The teacher facilitates students in developing alternative steps if any sub-activities exceed the scheduled time.



Figure 11. Project Schedule Preparation

3. Fourth Stage: Monitoring student activities and project progress

Students work on student worksheets (LKPD) on Direct Current, and Discuss with group members. Next, the teacher monitors student activity during the project completion process to see if any groups are taking inappropriate steps.

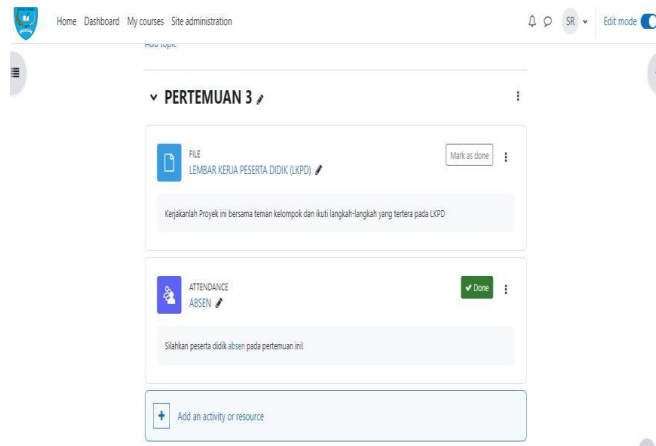


Figure 12. LKPD



Figure 13. Monitoring Session

e. Fifth Stage: Testing Results

In this stage, the teacher assesses the project's product and process skills during the discussion on Direct Current Electricity and students answer and express their opinions.

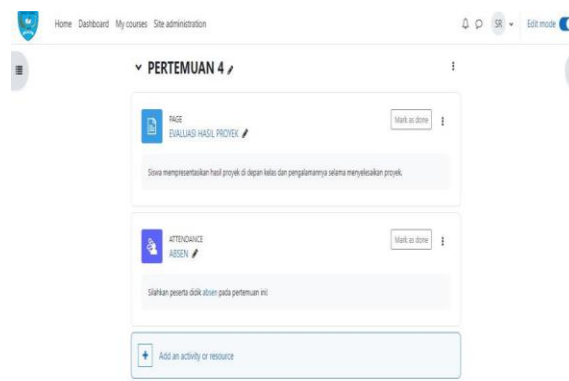


Figure 14. Project Results Evaluation



Figure 15. Project Presentation

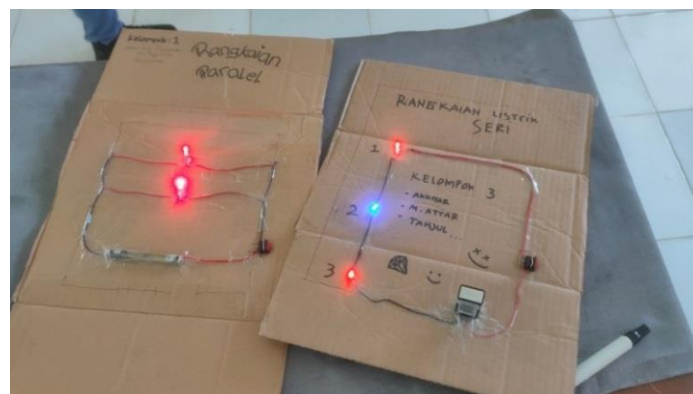


Figure 16. Project Results

f. Sixth Stage: Evaluating Experience

At this stage, the teacher measures the students' understanding of the material they have learned. A post-test is administered to students to assess their progress during the learning process.

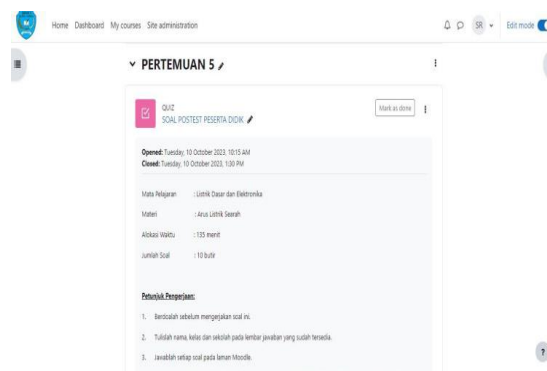


Figure 17. Post Test

g. Seventh Stage: Closing

In this stage, students are asked to complete a questionnaire regarding the responses they received during the learning process. The questionnaire is provided by the teacher on the Moodle page.

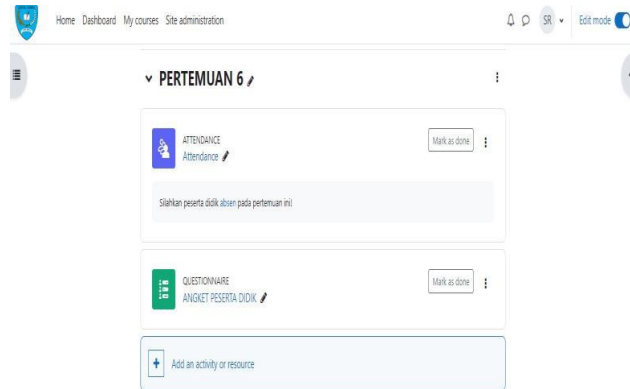


Figure 18. Questionnaire

C. Learning Outcome Data

In this study, the Moodle-assisted Project-Based Learning (PjBL) model in the Basic Electrical and Electronics subject was evaluated by observing the pretest scores before the Moodle-assisted PjBL model was implemented and the posttest scores after the Moodle-assisted PjBL model was implemented. Based on the table above, the average pretest score was 43, while the average posttest score was 84. Therefore, the average posttest score was higher than the average pretest score.

Therefore, the data obtained above yields a significance value of 0.287 for the Pretest variable and 0.177 for the Posttest variable. Using a margin of error of 0.05, the conclusion is that H0 is rejected. Therefore, it can be concluded that the Pretest and Posttest variables come from an abnormally distributed population.

Table 2. Paired T Test Result

		Paired Samples Test							
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
Pair	Nilai Pretest - Nilai Posttest				Lower	Upper			
1		41.0000	8.75595	2.76887	-47.26363	-34.73637	-	9	.000
		0							

The Paired T-Test aimed to determine the differences in learning outcomes between students who used the Moodle-assisted PjBL model and those who used the

conventional model in Basic Electricity and Electronics in Grade X of the Junior High School (TITL) at SMKN 1 Darul Kamal. Based on the data above, a significance value of 0.000 was obtained. Using a margin of error of 0.05, the decision to reject H0 was made. Therefore, it can be concluded that the Moodle-assisted PjBL model has an effect on learning outcomes in Basic Electricity and Electronics in Grade X of the Junior High School (TITL) at SMKN 1 Darul Kamal.

Table 3. N-Gain Result

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
N-gain	10	.50	1.00	.7329	.17904
Valid N (listwise)	10				

The N-Gain test aims to determine the difference between pretest and posttest scores by demonstrating knowledge at the beginning and end of the lesson. The average N-Gain score was 0.73. It can be concluded that the Project-Based Learning model using Moodle, provided to 10th-grade students at SMKN Darul Kamal Aceh Besar, has had a positive impact on them. This can be seen from the frequency of student scores in the high category.

D. Questionnaire Data Results

The results of this questionnaire data are used to assess student responses to the Moodle-assisted Project-Based Learning (PjBL) learning model. In this case, there are three indicators to be measured: appearance, user-friendliness, and benefits of the Moodle-assisted PjBL learning model.

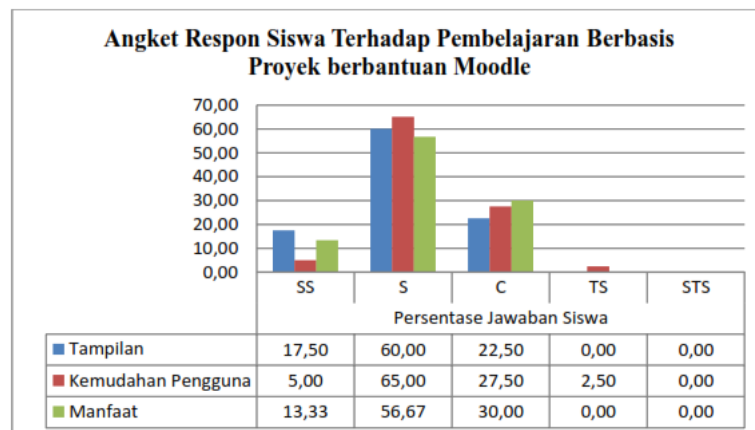


Figure 19. Questionnaire Result

Based on all the indicators measured and analyzed, using data interpretation developed by Sudjana (2004), the percentage for each indicator of project-based

learning using Moodle is classified as good. These results indicate that Moodle-assisted projects meet the requirements, with a greater number of affirmative responses for each indicator in Moodle-assisted project-based learning.

CONCLUSION

Based on the results of data analysis from research conducted in class X-TITL SMKN 1 Darul Kamal Aceh Besar, it is proven that the use of the Project Based-Learning learning model assisted by Moodle in the subject of Basic Electricity and Electronics on the material of direct electric current, provides an increase in student learning outcomes. The results of the T-Test calculation show a significance of 0.000 with an error rate of 5%, which indicates that the null hypothesis is rejected. Therefore, the conclusion that can be drawn is that the Project Based-Learning (PjBL) learning model supported by the Moodle platform is effective in improving student learning outcomes on the material of direct electric current in the subject of Basic Electricity and Electronics

Furthermore, student responses to the use of the Moodle-assisted project learning model showed a good percentage for each project-based learning indicator. These results indicate that the Moodle-assisted project has met the requirements, with the majority of indicators in Moodle-assisted project-based learning receiving a positive response of "agree" from students. Furthermore, the positive responses indicate that Moodle-assisted project-based learning is effective in facilitating interactive, student-centered, and meaningful learning experiences.

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