

The Influence of the Problem Based Learning Model Assisted by Instructional Video Media on Students' Achievement in Basic Electronics Engineering at SMKN 4 Pariaman

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Abstract - Finding out how much the Problem Based Learning (PBL) paradigm, with the use of instructional video resources, influences the learning outcomes of students in class X at State Vocational High School (SMK) 4 Pariaman in the foundational courses of electronic engineering is the aim of this study. In this study, a quantitative method of the quasi-experimental type is combined with a pre-experimental design that includes a post-test pre-test group design. The sample is selected using the census/total sampling approach. The sample consisted of twenty-four students majoring in industrial electronics engineering. The study was conducted during the 2024–2025 school year. In this study, students' post-test scores—76.67 higher than 58.67—are higher than their pre-test scores. The sig(2-tailed) values for the pre-test and post-test are $0.000 < 0.05$. Depending on the students' learning outcomes, there may be significant differences between the pre-test, which is the first variable, and the post-test, which is the last variable. This illustrates how each variable was significantly impacted by the different treatments used. It may be concluded that H_a is accepted and H_0 is not at SMK N 4 Pariaman, indicating that the PBL learning approach with video media support has a major impact on class X students' learning results in the fundamental subjects of electronic engineering.

Keywords: Problem Based Learning, Learning Video Media, Learning Outcomes.

I. INTRODUCTION

Currently, the teaching-learning process aims to encourage students to actively participate in seeking, finding, building, cultivating, and applying their knowledge. By doing so, educators can achieve an effective teaching and learning process. An independent curriculum that applies a research-based approach has been used in Indonesia to adapt students' active actions to modern standards. The teaching and learning process uses the 5M procedure – seeing, asking, trying, thinking, and communicating – to implement a research-based approach [1]. This approach aims to encourage students to seek information from various sources (make observations), formulate problems (ask questions), and not just solve problems [2].

According to Permendikbud No. 7 of 2022, the content standards for the independent curriculum of early childhood education programs (PAUD), DIKDAS (Elementary School,

Middle School), and DIKMEN (Senior High School, Vocational School) are minimum standards that cover the scope of materials needed to achieve graduate competencies in certain paths, levels, and types of education. The free curriculum offers more targeted content and a variety of intracurricular learning opportunities to provide students ample time to master new ideas and hone existing abilities. Additionally, teachers are allowed to select different teaching resources to tailor instruction to students' needs and interests [3].

The alignment of humans and technology is expected to be able to provide solutions and create the latest innovations, so that the Human Resources (HR) created can compete in the global arena. The development of students' talents or skills to be able to work in specific professions, adapt to the work environment, see career chances, and develop themselves in the future is a top priority for Vocational High Schools (SMK), which are part of the National Education System [4].

Students must be active and enthusiastic in learning basic electronics engineering (DDTE) at vocational schools. However, uninteresting learning makes students bored and bored. Learning environment factors such as methods, media, and devices that are not in accordance with the student's learning style, as well as the time and classroom conditions used, can cause students to become unenthusiastic and inactive during the basic electronic engineering process [5]. At SMK, one of the components of basic electronics engineering lessons is one of the elements in the basic electronics engineering lessons at SMK are electrical measuring instruments, electronics and instrumentation [6].

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PBL is a type of learning that can optimize students' thinking skills through the process of teamwork or groupwork. In this way, students have the opportunity to reinforce, hone, test, and develop their thinking skills consistently. The focus of learning the PBL model is on the selected problem. This implies that in addition to acquiring knowledge problem-related topics, students also learn how to solve issues using scientific procedures. This will help them develop an excellent mindset [7]. PBL model learning has many advantages. Students are given incentives to think critically and have the ability to learn independently and in groups, PBL is an effective process teaching method [8].

In addition to the learning paradigm, the use of learning materials has a substantial influence on learning outcomes and thinking skills. Using video-based learning materials might probably improve the PBL approach. Students' comprehension and enthusiasm for learning are enhanced by video-based learning materials, which can also heighten their critical thinking and curiosity [9]. Discovered that videos improve student learning. Teachers must be able to adapt their teaching strategies to meet the needs of their students. One way to do this is by using cutting-edge, technology-based educational materials to make learning more engaging and enjoyable for students. Educators can use video and other audiovisual materials as teaching tools [10].

Learning videos play a crucial role because they help teachers explain concepts to their students more effectively [11]. Teachers know that without educational materials, students would struggle to understand the material, especially when it comes to complex and challenging subjects. Therefore, the goal of learning media is to assist students absorb the material while minimizing its delivery [12]. SMK N 4 Pariaman is a private vocational high school in West Sumatra Province, Indonesia. SMK was established in 2008 and is located in Taluk Pariaman Village, Pariaman District, Pariaman City, on Jalan Tuanku Naali.

According to the author's findings on April 22, 2024 at SMK Negeri 4 Pariaman in the subject "Basics of Electronics Engineering" in class X of industrial electronics engineering, students are still having difficulty following lessons in class. There is no attraction shown by students to the lessons. One of the reasons is the lack of use of learning media in the learning process in the classroom that relies on conventional learning models and media. Another factor is the lack of variety of learning resources used by teachers during the learning process, so that students feel bored and bored. In interviews with teachers and students of DDTE class X subjects, we found that teachers often use various learning methods, such as lectures, questions and answers, and discussions.

The results of interviews conducted by the author on April 26, 2024 with teachers teaching at SMK Negeri 4 Pariaman, found that some teachers are already familiar with PBL but have not applied it, and some others have applied it but are not in accordance with PBL syntax. As a result, the implementation of PBL in schools has not reached an optimal level. Students are expected to use PBL to learn independently about the material studied. However, students are not fully involved in the problem-solving process because teachers are still providing materials. One of the students said that the subject matter given by their teacher bore them. This is due to

the fact that the subject matter given by the teacher is only printed books and blackboards. The low learning outcome is not surprising, as pupils do not comprehend the material provided by the teacher because the teacher primarily uses the lecture approach to communicate the material. Table I below illustrates this:

Number	Student Grades	Number of Students	Percentage
1	>80	11	35,48%
2	<80	20	64,52%
Total		31	100%

The table above shows that students still have low learning outcomes. This is shown by the fact that only 11 students out of 31 scored above the Learning Objectives Achievement Criteria (KKTP). This shows that learning in the classroom is less effective. At SMK Negeri 4 Pariaman, there is another reality that teachers continue to teach students without assessing their learning outcomes. Students become lazy and not interested in learning because of the slow learning process and poor learning outcomes. This results in a lack of creativity and group collaboration, and poor learning outcomes. Therefore, efforts should focus on increasing students' interest in learning, enhancing creativity, and improving learning outcomes by making full use of available facilities and resources such as models and selection of learning resources that are in line with learning strategies. This can improve student learning outcomes, which in turn will result in their lesson memory for longer [13].

The learning model is enhanced with the use of video media to make its implementation more engaging and easier. It is expected that by incorporating this video learning media, students will experience improved learning outcomes, including enhanced critical thinking skills, problem-solving abilities, and the confidence to communicate and discuss issues with peers or instructors. This approach is anticipated to contribute to the development of effective learning models, media, and strategies that equip students to tackle the challenges they will face in the workforce.

The author primarily drove the research presented in this study through their thesis titled "The Influence of the PBL Learning Model Supported by Learning Video Media on the Learning Outcomes of Class X Students in the Basic Electronics Engineering Subject at SMK Negeri 4 Pariaman," as outlined in the previous description.

II. RESEARCH METHODS

This study adopts a quantitative approach and applies a quasi-experimental method, specifically utilizing a one-group pretest-posttest design and a pre-experimental design. The research design is outlined in Table II below.

Pre-test	Treatment	Post-test
O1	X	O2

Description:

O1 = Pre-test X = Treatment O2 = Post-test

SMK N 4 Pariaman, which is located on Jln. Tuanku Naali, Taluk Village, Central Pariaman District, Pariaman City, West Sumatra, will conduct this research in the 2024/2025 academic year. In class X of Industrial Electronics Engineering, research was carried out for three meetings. On Thursday, July 25, 2024, the first meeting will take place; on Tuesday, July 30, 2024, the second; and on Thursday, August 1, 2024, the third. The class size for the 2024–2025 school year is 24 students.

All tenth-grade Industrial Electronics Engineering (TEI) students enrolled in SMK N 4 Pariaman for the 2024–2025 school year make up the study's population, totaling 24 students. The sampling method employed was a census or total sampling approach, resulting in a sample size of 24 students from the Industrial Electronics Engineering major. To assess cognitive learning outcomes, a test instrument was utilized. This instrument comprised 50 multiple-choice questions that had been previously validated by the subject teacher before being administered to students at both the beginning and end of the session.

The stages of the research are described as follows. (1) Orient students to problems; Explain the learning objectives; Motivating students to participate; Provide questions and triggers; Dividing groups of 24 students into 4 groups of 6 students each; and display learning videos. (2) The researcher forms a group of students, then explains the rules of group activities. For example, the researcher explained that students are expected to be active and cooperate in learning. In addition, students are expected to make small notes about the questions in the learning videos. (3) Guiding individual and group investigations Researchers help students find the information they need to solve their problems. Students solve problems in learning videos by having group discussions. (4) Create and display results. The results are presented in front of the class along with the lkpd that has been discussed. Groups of four students come to the front of the class to present their results. On the other hand, the other group noticed and asked questions about the results presented by the group. (5) Evaluate the problem-solving process: The researcher helps students evaluate the problem by showing the problem-solving in the learning video. After that, students summarized the material in their respective books [14].

The researchers analyzed the data using descriptive statistics with the help of SPSS version 29.0.10. Descriptive analysis aims to describe the state of the data collected from the sample. A frequency distribution table is then presented, followed by the calculation of the coefficient of variation and standard deviation. Researchers conduct normality and homogeneity tests before using the paired samples t-test to assess the hypothesis. They only apply the paired t-test when these assumptions are met. If the significance (sig) value is less than 0.05, researchers classify the data as non-normal, whereas a value greater than 0.05 indicates a normal distribution. Similarly, they use the homogeneity of variance test to evaluate homogeneity, considering a significance value above 0.05 as indicating homogeneous variance and a value below 0.05 as indicating non-homogeneous variance [14].

To ensure the paired samples t-test is valid for decision-making, researchers must meet specific conditions. When the two-tailed significance value is below 0.05, researchers

conclude that a significant difference exists between the pre-test and post-test variables [15]. This result indicates that the treatments applied to both variables differ significantly, leading them to accept H_a and reject H_0 . On the other hand, if the significance value is above 0.05, they determine that no substantial change occurred between the pre-test and post-test variables, suggesting that the treatment had no significant effect. In this case, they reject H_a and accept H_0 [14].

III. RESULTS AND DISCUSSION

Six 45-minute learning sessions (total 270 minutes) using the PBL approach with the help of instructional videos were used on Tuesday, July 25, 2024. Then, on Thursday, July 30, 2024, it was carried out for 4 45-minute sessions (total 180 minutes). Before the learning process begins at the first meeting, the instructor gives students a pre-learning test. After that, the instructor divides 24 students into 4 study groups, with each group focusing on the definition of measuring instruments, types of measuring instruments, and the working principles of measuring instruments. The instructor conducts the instructional process using the PBL model and integrates educational videos. In these videos, the instructor encourages students to participate in group discussions to answer the given questions. During the second session, the same learning groups received further instruction through the PBL model.

This session was enhanced by a video demonstration illustrating the proper use of measuring instruments and the interpretation of measurement results. Students were also asked to discuss in their respective groups to answer the questions shown in the video. In the third meeting, the PBL learning model assisted by video media was used to explain the maintenance material of electrical and electronic measuring instruments.

After that, students were asked to present the results of the group discussion for 30 minutes, while the group that did not appear was asked to listen, ask questions, and provide criticism and suggestions for improving the presentation of the group that appeared about the problem being studied. Furthermore, the data collected from the test results are analyzed and interpreted to solve the formulation of the research problem. The next section describes and analyzes the research data.

TABLE III
ANALYSIS OF PRE-TEST SCORE DATA

Statistics		
Learning Outcomes		
N	24	24
	0	0
Mean	58,67	
Median	58,00	
Std. Deviation	11,820	
Variance	139,710	
Range	44	
Minimum	38	
Maximum	82	
Sum	1408	

The educational results of students using the SPSS version 29.0 application were achieved in the execution of the pre-test prior to treatment applying the PBL learning model nourished by learning video media, as shown in the table from the descriptive analysis above. Average value = 58.67, median value = 58.00, standard deviation = 11.820, minimum value = 38, and maximum value = 82. Using the formula $K = 1 + 3.3 \log 24$, many interval classes can be found. The result is 5,554, which is rounded to 6. The data range is $38 - 82 = 44$, and the class length obtained from the range divided by many classes is $44/6 = 7.33$, which is rounded to 7. Table IV shows this:

TABLE IV
FREQUENCY DISTRIBUTION OF PRE-TEST VALUES

No	Value interval	Frequency	Relative Frequency
1	38-44	2	8,3%
2	45-51	3	12,5%
3	52-58	7	29,2%
4	59-66	6	25%
5	67-74	3	12,5%
6	75-82	3	12,5%
Total		24	100%

As to table IV above, the majority of pre-test results fall between 52 and 58 for 7 students (29.2%), and between 59 and 66 for 6 students (25%). Table V beneath shows the students' post-test results following their education with the PBL learning methodology helped by learning video content in Table V.

TABLE V
ANALYSIS OF POST-TEST SCORE DATA

No	Value Interval	Frequency	Relative Frequency
1	60-65	5	20,8%
2	66-72	4	16,7%
3	73-79	2	8,3%
4	80-85	8	33,3%
5	86-91	3	12.50%
6	91-97	2	8,3%
Total		24	100%

The learning outcomes of students using the SPSS version 29.0 application were acquired in the post-test implementation following treatment utilizing the PBL learning model with the aid of learning video media, as indicated by the descriptive analysis table above. The score ranges from 60 to 96, with the average being 76.67, the median being 80, and the standard deviation being 10.462. Using the formula $K = 1 + 3.3 \log 24$, many interval classes can be found, and the result is 5.554 rounded to 6. The data range is $60 - 96 = 36$, and the class length obtained from the range is divided by many classes $36/6 = 6$.

TABLE VI
FREQUENCY DISTRIBUTION OF POST-TEST VALUES

Test of Homogeneity of Variances				
	Levene Statistic	df1	df2	Mr.
Based on Mean	,031	1	46	,861
Based on Median	,156	1	46	,695
Based on Median and with adjusted df	,156	1	45,929	,695

Based on table VI above the frequency value *post-test* The majority located between 80-85 is 8 students (33.3%) and the score range of 60-65 is 5 students (20.8%). After analyzing the data using descriptive statistics, the researchers performed an analytical precondition test, including a paired sample t-test, to assess whether a significant difference existed in the mean of two related samples. The researchers ensure that the data follows a normal distribution for the paired sample t-test and also perform a homogeneity of variance test. The table VII below shows the results of the data normality test.

TABLE VII
NORMALITY TEST

Tests of Normality						
Value	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Mr.	Statistic	df	Mr.
Pre-Test	,205	24	,010	,951	24	,282
Post-Test	,176	24	,054	,937	24	,139

The Shapiro-Wilk normality test results in the table above show a pre-test significance value of 0.282 and a post-test significance value of 0.139. Researchers consider the data normally distributed when the significance value exceeds 0.05, while they interpret a value below 0.05 as indicating a non-normal distribution. Since both the pre-test value (0.282) and the post-test value (0.139) exceed 0.05, these results confirm that the data follows a normal distribution.

TABLE VIII
HOMOGENEITY TEST

Statistics		
Learning Outcomes		
N	Valid	24
	Missing	0
Mean	76,67	
Median	80,00	
Std. Deviation	10,462	
Variance	109,449	
Range	36	
Minimum	60	
Maximum	96	
Sum	1840	

The preceding table shows that the data variations for the pre-test and post-test values remain consistent, with the significance value based on the mean at 0.862, which exceeds 0.05. This confirms that the researchers have met the necessary conditions for conducting the paired samples t-test. The researcher then evaluates the hypothesis using the paired samples t-test method. They conduct a two-tailed paired samples t-test with SPSS version 29.0, and Table IX displays the hypothesis test results.

TABLE IX
OUTPUT PAIRED SAMPLES T-TEST

Paired Samples Test						
Paired Differences						
	Mean	Std. Deviation	t	df	Sign (2-tailed)	
Pair 1 pretest - posttest	-18	9.745	-9.049	23	,000	

The data analysis of the pre-test and post-test results in SPSS version 29.0 showed a statistically significant threshold (2-tailed) of 0.000, which is less than 0.05. This shows that a significant difference exists between the pre-test and post-test variables. It suggests that the treatment of each variable had a noteworthy effect. Thus, it may be concluded that H_a is accepted and H_0 is denied, indicating that class X students enrolled in the foundational Electronics Engineering course at SMK Negeri 4 Pariaman benefit greatly from the PBL learning paradigm with the use of instructional video resources.

The analysis and comparison of the pre-test and post-test results revealed that the average scores for both sets of learning outcomes differed. The average score was 58.67 before the test and 76.67 after the test. This suggests that before adopting the PBL learning paradigm, students' learning outcomes were generally worse than after using it with video content. The researchers determined that the data followed a normal distribution if the significance value from the normality test exceeded 0.05. Using the Shapiro-Wilk test in SPSS version 29.0, they found a pre-test value of 0.282 and a post-test value of 0.139. Since both significance values were greater than 0.05, these results show that the data follows a normal distribution.

Furthermore, the significance value criterion—which is predicated on an average that is greater than 0.05—was used to calculate the homogeneity value. The homogeneity test, conducted using SPSS version 29.0, yielded a result of 0.861, indicating that the data is homogeneous. After completing the descriptive, normality, and homogeneity tests, the researchers performed a hypothesis test using the paired samples t-test in SPSS version 29.0. Additionally, the pre-test and post-test results showed a significance value of 0.000 (2-tailed), which is below 0.05. Based on this, the researchers concluded that a significant difference exists between the students' educational outcomes from the pre-test and post-test. It also indicates that the handling of one variable differs significantly from the others. Thus, it can be said that H_a is accepted and H_0 is not, demonstrating that the PBL learning approach, supported by educational video resources, significantly affects the learning results of class X students enrolled in SMK Negeri 4 Pariaman's foundational Electronics Engineering course.

Both of these approaches have an influence on students' cognitive learning results, according to a 2022 research by [16], titled "The Effect Of Learning Model Discovery Learning Assisted by Liveworksheets Media on Students' Cognitive Learning Outcomes In The Subject Of Biology In Grade X at SMA N 1 Punggur". [17] stated that the help of video media can make learning more interesting and not boring, so that it can support the application of problem-based learning models. Video media also has advantages because it can make learners more focused and interested in the lesson, increase students' attention, motivation, and memory, and improve their comprehension.

IV. CONCLUSIONS

The PBL learning model, aided by video media, significantly affects the learning outcomes of students in class X for the foundational electronics engineering course at SMK

Negeri 4 Pariaman, according to the findings and analysis of the Quasi-Experiment research on the subjects. The pre-test had an average score of 58.67, while the post-test had an average score of 76.67. Therefore, using the PBL learning model with video media resulted in better post-test learning outcomes compared to the pre-test outcomes.

The following recommendations are made based on this study: (1) From a theoretical perspective, the PBL model, supported by video learning media, is an effective approach and tool for fostering an engaging and enjoyable learning environment. Therefore, teachers should focus on capturing students' attention during the learning process. (2) For students, video-based learning media serves as an enjoyable, effective, and efficient tool, but students must maintain a higher level of focus beyond just reading textbooks in order to better grasp the learning content. (3) For teachers, it is recommended that the PBL model be integrated with video learning media, especially at SMK Negeri 4 Pariaman. (4) For schools, school principals are expected to continue to encourage teachers to innovate in the learning process. (5) The researcher advises other researchers to be interested in researching this problem and to seek the latest literature and make improvements to improve this research.

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