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THE EFFECTIVENESS OF PROBLEM BASED LEARNING (PBL) MODEL IN IMPROVING PHYSICS LEARNING OUTCOMES WITH AI CANVA IN SENIOR HIGH SCHOOL 1 JENEPONTO

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ABSTRACT

This study examines the effectiveness of applying the problem-based learning (PBL) model supported by AI in Canva (AI Canva) to improve the physics learning outcomes of class X students in high school. The subjects of this study were students in class X, odd semester 2024/2025 at SMAN 1 Jeneponto. This type of research is quantitative research with pre-experimental designs in the form of a group pretest-posttest design. The research instrument was a physics learning outcome test before and after treatment. AI Canva was used as an interactive visual aid to clarify abstract concepts in physics. At the same time, the PBL model was applied to encourage students to be actively involved in the learning process through problem-solving. The results showed, in effectiveness test results showed an effectiveness value of 66.87% in the practical category, then the average N-gain score was 0.66 in the moderate category, while the t-test results were -21.615, the dependent sample t-test results showed the Signification value was 0.000 because the value of the significance level α = 5%. So, as a basis for decision-making, it can be concluded that Ho is rejected and Ha is accepted. Thus, the data shows that learning with the PBL model and AI Canva assistance is efficacious in improving the physics learning outcomes of class X SMA students. Recommendations for further research include integrating character values in the technology-assisted PBL model to achieve more holistic and meaningful learning.

Keywords: Problem-Based Learning; AI Canva; physics learning; learning outcomes

1. INTRODUCTION

An interactive and relevant learning approach to help learners understand lessons that require critical thinking skills, such as physics. Physics learning often requires visualising abstract concepts and deep understanding, which is difficult to achieve through the lecture method alone. One approach considered adequate is Problem-Based Learning (PBL) because it invites

students to think critically, solve problems, and relate them to everyday life. In PBL, learners are in the process of finding solutions through discussion, analysis, and collaboration in solving problems related to everyday life, in line with Law No. 20/2003 on the National Education System, which emphasises the importance of quality education to build critical thinking and problem-solving skills in learners. Article 3 states that education aims to develop learners' potential to become faithful, moral, healthy, skilled, creative, independent, and responsible individuals. In modern learning advances, especially in physics subjects, an interactive and relevant approach is needed to achieve this goal optimally.

The problem-based learning (PBL) learning model is one approach that is by this mandate because it encourages students to think critically when solving problems that are real and relevant to their daily lives. (Walker & Leary, 2023).. PBL demands the active involvement of learners through discussion, analysis, and collaborative work in dealing with complex problems according to the demands of the law to build 21st-century skills. The results of previous research also state that PBL can develop students' problem-solving skills, so using the PBL model will make it easier for students to solve complex problems in the future. (Ali, 2019). In addition, to make it easier for students to understand abstract concepts in physics, technology based on Artificial Intelligence on Canva (AI Canva) can provide appropriate visual assistance to make the learning process more effective and interesting.

Therefore, implementing PBL requires learning media that can attract learners' attention and help visualise difficult concepts. Canva allows teachers to easily and quickly create visual content that supports PBL learning more interactively. By using Canva, teachers can design engaging and interactive physics materials, which in turn helps learners understand abstract physics concepts. The utilisation of Canva AI technology in *Problem-Based Learning* (PBL) based learning is supported by various research results that show the increased effectiveness of interactive and visual learning. Previous studies have found that using AI Canva technology can improve understanding of abstract concepts, especially in science subjects such as physics, mathematics, biology and chemistry, which often require visual representations to clarify concepts. The literature study on integrating learning media in applying PBL positively affects students' mathematical abilities. (Rohmatulloh et al., 2022).

This is also true of physics material, most of which material must be mastered in mathematics to master physics concepts. Other research results regarding artificial intelligence-based PBL models show that it positively affects student learning outcomes. (Sumardi, 2024) Meanwhile, research results on the *problem-based learning* (PBL) model assisted by Canva-based animation media on physics learning outcomes show that physics learning outcomes at the high school level are influenced by applying the *Problem-Based Learning* (PBL) model supported by Canva-based animation media. (Meylinda et al., 2024).

Based on the results of teacher interviews, the problems often faced in learning physics at SMA Negeri 1 Jeneponto are the difficulties students face in understanding abstract concepts, which require in-depth understanding. The lecture method does not help students understand the material, especially physics, which requires visualisation and critical thinking skills. In the past year, the physics teacher of class X SMAN 1 Jeneponto used the lecture method and blackboard media in teaching, even though from observations, there were LCDs, projector screens and

laptops owned by teachers, as well as stable internet networks, from the results of document searches, obtained data that the average daily test scores in odd semester tended to be low. Namely, the value of the first daily test was 53.5, While the average of the second daily test was 51.2. The results of interviews from random class X students generally stated that physics subjects are difficult to understand and not interesting to them. However, the teacher tried to make the subject interesting using various techniques and learning methods, such as ice-breaking. However, the learning outcomes of students are still relatively low.

Therefore, a more interactive and relevant learning approach, such as Problem-Based Learning (PBL), is important as it encourages learners to think critically and solve problems related to everyday life. Although PBL effectively trains critical thinking and problem-solving, its application is often limited because the media used is insufficient to explain difficult concepts. AI-based technology such as Canva can help optimise the use of PBL. It can help teachers create visual materials that can help explain difficult physics concepts so that learning becomes more interesting and easily understood by students. Thus, the researcher hopes to overcome problems in physics learning by integrating PBL with Canva AI technology, which allows students to understand abstract physics concepts more easily and improves student engagement and learning outcomes. Learning outcomes are important in learning, and they align with the research results, which state that physics learning outcomes are the results of assessing the student's abilities after carrying out their learning experience or following the learning process on physics materials. (Basri and Khatimah, no date). Based on these problems, this study examines the effectiveness of applying problem-based learning (PBL) models supported by AI Canva in improving physics learning outcomes.

2. METHODS

This research uses a quantitative approach with a pre-experimental research design in the form of a group Pretest-Posttest Design (Christensen, 2017). In this study, students will be given a pretest first so that the final results obtained are more accurate because they can be compared with the initial condition of the students before being given treatment. Then, after being given the treatment, a post-test will be given.

O_1	X	O_2

Figure. 1 Research design

Description:

O_1*: Pretest* score (before treatment)

O_2*: Post-test* score (after treatment)

X: Treatment using the PBL model supported by AI Canva

This research will be conducted on students of class X SMAN 1 Jeneponto. The population in this study is all students of class X SMAN 1 Jeneponto, while the sample used in this study is class X_1, which amounted to 37 people. The sampling technique is *purposive* sampling, namely determining the sample with specific considerations (Dani Nur Saputra, 2022). The sampling

technique is purposive sampling, namely determining the sample with specific considerations (Dani Nur Saputra, 2022), and to determine the sample, namely based on the teacher's recommendation by looking at the material that is suitable for research time in that class, as well as material that has difficulty being understood by students. This research time was carried out for eight (8) meetings on measurement material. Furthermore, the instruments used are tests in the form of essay questions with as many as five numbers and observation sheets to observe the activeness and involvement of students to get more accurate research results. Both of these instruments have been subjected to expert validation, and the test instrument has been tested for reliability using *SPSS Version 29 For Windows.*

The basis for making decisions on instrument reliability testing is by looking at the *SPSS for Windows output* table for *Reliability Statistics, the* value of *Alpha Cronbach's* with a significant level of 5%, rCount> rLabel, then the instrument can be reliable. (Nuryadi, Tutut Dewi Astuti, 2017). The reliability test value is 0.557, which means that the instrument used is reliable, and the validity test from expert validation states that all questions are valid after improving the language and content of essay questions.

The data in this study were processed using descriptive statistics and inferential statistics. Descriptive statistics are used to measure the mean, standard deviation, and variance of the learning outcomes data obtained, while inferential statistics include using the analysis pre-requisite test first, namely the normality test; the normality test is a pre-requisite test that aims to determine whether the data obtained has a normal distribution or not. This test was conducted using SPSS Version 29 For Windows based on Shapiro-Wilk. At a significant level of α = 0.05, if the significant value obtained is more excellent than α, then the sample data is considered to come from a normally distributed population. (Malik, Adam, 2018). The hypothesis test is carried out if the sample is usually distributed. Furthermore, hypothesis testing uses the *t-test* or *paired sample t-test* with a significance level of α = 5%; this test is conducted to determine the significance level on the *pretest* and *post-test.* Then, the n-gain test, the hypothesis submission, and the *N*-gain test are used. The *normalised gain* test (*N-gain*) is carried out to determine the increase in physics learning outcomes after treatment; this increase is taken from the *pretest* and *post-test* scores obtained from students (Moh. Irma Sukarelawa, Toni Kus Indratno, 2024) and the effectiveness test is used to determine the level of physics learning outcomes after treatment. The effectiveness test determines the effectiveness of the PBL model supported by AI Canva used in students. All data were calculated with the help of *SPSS version 29 for Windows* applications (Herlina, 2019).

3. RESULTS AND DISCUSSION

Description Analysis of Physics Learning Outcomes

The study results were presented before learning measurement material was given using a problem-based learning model (Problem-Based Learning or PBL) supported by AI Canva to determine learning outcomes in class X students of SMAN 1 Jeneponto, who were given a pretest. Table 1 shows the value and results of descriptive analysis of pretest and post-test results on class X students of SMAN 1 Jeneponto using the help of SPPS 29, as follows:

Table 1. Descriptive Statistical Values on *Pretest* and *Post-test*

Descriptive Statistics							
	N	**Range**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**Variance**
Pretest	37	30	7	37	21,71	8,806	77,541
Posts	37	27	53	80	64,86	6,460	41,725
Valid N (listwise)	37						

Table 1 shows that the pretest results show the lowest score of 7 and the highest score of 37, with an average of 21.71 and a standard deviation of 8.806. Meanwhile, the post-test results showed the lowest score of 53 and the highest score of 80, with an average of 64.86 and a standard deviation of 6.460. Based on the test results on the learning outcomes of students taught using the PBL model, supported by AI Canva, this study can be concluded to be effective. This can be seen from the difference in scores on the learning outcomes test before and after applying the PBL model, supported by AI Canva, with the average value of learning outcomes after treatment (application of the model) higher than before treatment.

Inferential Analysis

Analysis of the research results used in the pre-requisite test, namely the normality test. The results of the normality test are shown in the following table:

Table 2. Normality Test Results on *pretest* and *posttest*

Tests of Normality						
	Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
	Statistic	Df	Sig.	Statistic	Df	Sig.
PreTest	0,124	37	0,162	0,950	37	0,100
PostTest	0,178	37	0,004	0,948	37	0,082

(Source: Data analysis with *SPSS* Version 29)

Based on Table 2, the normality test using the *Shapairo-Wilk* test obtained a significant value greater than 0.05. A significant value of 0.100 was obtained for the pretest value, while the *post-test* value obtained a significant value of 0.082. It can be concluded that the data is normally distributed so that it can be continued hypothesis testing. The hypothesis test results of the t-test results can be seen in the following table:

Table 3. Results of t-test on *pretest* and *post-test*

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	PreTest - PostTest	-43,126	12,137	1,995	-47,173	-39,080	-21,615	36	0,000

Based on the table of test results above, the t-test result is -21.615; the dependent sample t-test result shows the Signification value is 0.000 because the value of the significance level α = 5%, so there is a difference between the pretest and post-test learning outcomes. So, as a basis for decision-making, it can be concluded that Ho is rejected and Ha is accepted. Furthermore, the results of the N-Gain calculation analysis, to see the percentage of the increase, are shown in the following graph. Based on Figure 1, the average *N-Gain* score is 0.6022 or 60.22%. As for the effectiveness test, which is obtained from the calculation:

$$\frac{Total\ N\ Gain\ Score}{Jumlah\ Peserta\ Didik} \times 100$$

The results of the effectiveness test can be seen below:

$$\text{Effectiveness} = \frac{2230,85}{37} \times 100\% = 60,29\%$$

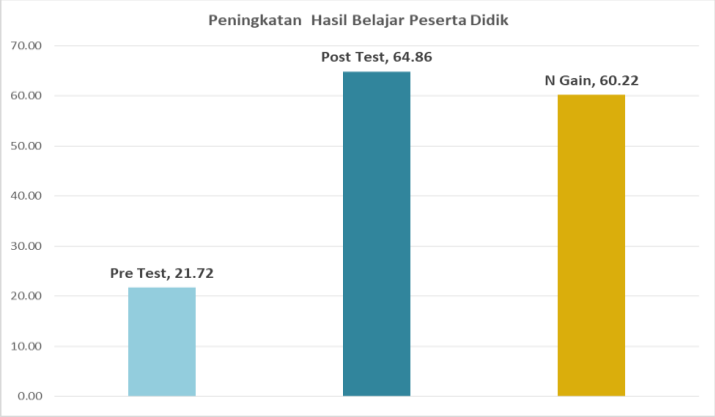

Figure 1: Graph of Improvement in Learning Outcomes

The results of the effectiveness test above show that the effectiveness value of the PBL model using AI Canva is 60.29%, which is in the practical category. Based on the results of the analysis of students' responses, 80.41% of students were active, and the results of observations showed that students were involved and actively asked and answered questions in following the entire learning process while using the PBL model, which AI Canva supported.

Research on the effectiveness of implementing a problem-based learning (PBL) model equipped with AI Canva support in improving physics learning outcomes of grade X students in high school shows positive results. The PBL model provides opportunities for students to learn actively by solving real problems. At the same time, using AI Canva as an interactive visual media helps increase the attractiveness of learning and understanding of the material. This learning model creates a more relevant and in-depth learning experience for learners.

The results showed a significant increase in the average post-test score compared to the pretest, which indicates the effectiveness of applying the PBL model using AI Canva to improve students' learning outcomes. With the help of AI Canva, teachers can present visual learning media that is easily accessible and attractive so that abstract concepts, such as the use of measuring instruments that are not yet available at school, can be explained more clearly. These visualisations not only successfully increase learners' interest but also strengthen their understanding of the material, which significantly impacts learning outcomes. Canva has an artificial intelligence (AI)--based virtual assistant designed to support and provide live advice, answer questions, and provide guidance on using certain features on the Canva platform. (*Implementing AI on Canva*, 2024).

In addition, implementing PBL encourages collaboration among learners, which helps develop critical thinking, problem-solving, and teamwork skills. This is to the results of the literature study research, which states that the PBL model can be carried out by collaborating with other technologies such as digital books, PhET, Canva, and augmented reality, and become a solution to increase students' interest in physics subjects that are difficult to learn. (Pristianti and Prahani, 2023)In addition, a literature study shows that using PBL models can improve critical thinking and problem-solving skills, which, of course, will impact student learning outcomes (Nurmahasih & Jumadi, 2023). (Nurmahasih & Jumadi, 2023).. However, there are some weaknesses in the application of this learning model. Firstly, the effectiveness of PBL supported by Canva AI depends on teachers' ability to integrate technology into learning. Teachers less skilled in using AI Canva may face barriers, which may ultimately reduce the success of this model. Secondly, some learners take longer to adjust to problem-based learning as it demands more independence, initiative and critical thinking skills than traditional learning methods. In addition to character value development, this approach also has weaknesses.

4. CONCLUSION

The main focus of problem-based learning tends to be on problem-solving and mastery of the material, so strengthening character values, such as honesty, cooperation and responsibility, often receives less attention. Suppose there is no clear guidance from the teacher. In that case, these values have the potential not to develop optimally, especially if students are more orientated towards the result than the learning process. The results of this study are supported by previous research, which shows that the PBL model can improve students' learning outcomes, which are oriented towards problem-solving ability and critical thinking skills (Ali, 2019). Meanwhile, research on PBL with the help of AI learning media found that it is one of the solutions to improve students' thinking skills (Simangunsong et al., 2019), as well as the results of the research found that students' responses to physics learning with the PBL model assisted

by Canva animation were classified as good (Meylinda et al., 2024). Thus, integrating the PBL model and Canva AI is an innovative solution relevant to 21st-century learning, although it requires careful planning and support to overcome current and future challenges. Recommendations for future research include integrating character values in the technology-assisted PBL model to achieve more holistic and meaningful learning.

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