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PROJECT BASED LEARNING MODEL: ITS EFFECT IN IMPROVING STUDENTS' CREATIVE THINKING SKILLS

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ABSTRACT

Creative thinking skills are one of the primary skills in 21st-century. The purpose of this research was to determine the PjBL Model's effect on students' creative thinking skills in physics. This research was a quasi-experimental research. The population of this research was all tenth-grade science students of SMA N 2 Bandar Lampung. The instrument in this study was test instrument to measure students' creative thinking skills. Based on the data, the PjBL model affected the creative thinking skills of students in physics materials evidenced by the results of data analysis with a sig value of 0.00, which was lower than 0.05. Therefore, H_1 was accepted or there were differences in students' creative thinking skills. Therefore, it can be concluded that the PjBL model affects students' creative thinking skills on physics material. It is recommended for further researchers to apply the PjBL model to other learning materials.

MODEL *PROJECT BASED LEARNING*: PENGARUHNYA DALAM MENINGKATKAN KEMAMPUAN BERPIKIR KREATIF SISWA

Kata Kunci:

Kemampuan berpikir kreatif
Materi fisika
PjBL
Model *project based learning*

ABSTRAK

Kemampuan berpikir kreatif salah satu kemampuan yang menjadi kecakapan utama dalam kehidupan di abad 21. Tujuan penelitian ini yaitu untuk mengetahui pengaruh model PjBL terhadap kemampuan berpikir kreatif peserta didik pada materi fisika. Penelitian ini merupakan *quasy experiment*. Populasi penelitian ini seluruh peserta didik kelas XI MIA SMA N 2 Bandar Lampung. Instrumen pada penelitian ini adalah instrumen tes untuk mengukur kemampuan berpikir kreatif peserta didik. Berdasarkan penelitian yang telah dilaksanakan diperoleh data yang menunjukkan bahwa terdapat pengaruh model PjBL terhadap kemampuan berpikir kreatif peserta didik pada materi fisika. Hal ini dibuktikan dengan hasil analisis data dengan nilai sig sebesar 0,00 yang berarti sig < 0,05 sehingga H_1 diterima atau terdapat perbedaan perbedaan kemampuan berpikir kreatif. Oleh karena itu dapat disimpulkan pembelajaran model PjBL berpengaruh terhadap kemampuan berpikir kreatif peserta didik pada materi fisika. Disarankan kepada peneliti selanjutnya untuk dapat menerapkan model PjBL pada materi pembelajaran lainnya.

1. INTRODUCTION

In PISA 2021, creative thinking is described as the ability to be productively involved in developing, assessing, and enhancing ideas that can provide novel and effective solutions, progress knowledge, and express imagination that influences the learning process. In truth, the creative thinking ability of Indonesians remains very poor. The ranking of Indonesian creativity based on the Global Creativity Index in 2010 shows that Indonesia is placed 81 out of 82 countries. Tolerance, talent, and technology in science and technology, business and management, health, education, culture, and entertainment are among the aspects evaluated. This problem is considered to exist because education in Indonesia is primarily focused on memorization and answering questions correctly. Therefore high-level thinking processes, including creative thinking, are rarely addressed.

Research has been conducted on momentum and impulse by assessing students' challenges in interpreting momentum and impulse ideas and applying them to various scenarios [1]. Other research has found that students' conceptual grasp of momentum kinetic energy is still limited to rote memorization and cannot be extended to varied contexts [2]. This research aims to examine the level of knowledge of students' concepts on the momentum material, as well as the elements that influence that understanding. Students must strengthen their creative thinking skills to solve physics challenges.

One of the most crucial thinking abilities for understanding physics is creative thinking. Furthermore, Johnson defines creative thinking as the ability of pupils to produce new ideas as a result of new understandings [3]. Students who can think creatively will be able to identify solutions in novel ways [4]. Students' creative thinking skills must be cultivated to tackle physics challenges [5]. Students can solve physics problems well if their creative thinking skills develop well. According to Sambada, students' creative thinking skills are comparable to their capacity to solve physics problems. The better the students' creative thinking skills, the higher the students' ability to solve problems [6].

The data shows students' creative thinking skills are low when learning physics. Students can still not generate fresh ideas or solve physics problems in novel ways [7]. Students merely follow the instructions presented by the teacher, answer only by counting, and do not perceive the problem as a whole, resulting in low creative thinking skills [8]. When presented with a physics problem, most students provide responses not supported by reasoning linked to the physics subject being studied [9].

Previous research also indicates that there are still low physical and creative thinking skills, as evidenced by numerous achievement indicators that have not been developed or are still in the low category [10]-[11]. Furthermore, physics education does not encourage students to participate actively in learning and applying content to real-world situations. The learning process will be more meaningful if students participate actively. Students have also not fully learned to apply physics concepts in creating a practical job [12], for example, the working principle of impulse-momentum [13]. Students must strengthen their creative thinking skills to do so. To address this issue, educators must be proficient at applying successful learning models as facilitators [14]. Aside from using learning models, learning media is another key factor in promoting creative thinking [15]. Problem-based learning [16], [17], guided inquiry model [18], [19], and project based learning are examples of learning models. Project based learning is one of the learning strategies that is thought to be excellent for increasing creative thinking skills.

Project based learning is a type of project-based learning in which students create learning themes/topics by carrying out realistic project tasks. According to Stripling, one of the hallmarks of the project based learning learning paradigm is the ability to think creatively and critically and seek knowledge to conduct investigations, make conclusions, and produce products. Using PjBL in truly learning physics subjects can encourage students to explore their creative abilities to produce good and valuable project results. PjBL can help you strengthen your creative thinking talents. Several prior studies discovered this link, including [20], [21], which discovered that PjBL was beneficial in boosting creative thinking skills.

According to Mihardi's research, project-based learning promotes the creative thinking process of physics education students, and the activities performed favorably in addressing physics problems. Some of the findings of these studies suggest that learning activities are vital for developing creative thinking skills. In PjBL, students spend most of their time working alone or in small groups, finding independent learning sources of knowledge, completing independent research, and receiving independent feedback [22]. Poster media is the requested project.

The poster combines a bold design, colors, and messaging to attract students' attention [23]. It is possible to give engaging and effective learning elements with poster learning media, both within and outside the classroom, with functions that may be tailored to the demands either as a supplement (extra), complement (complementary), or alternative (complementary) for previously used learning activities in the classroom [24].

A previous study on the effect of the PjBL model on creative thinking skills has found that students become more involved in asking, answering, and discussing problems in groups. PjBL learning becomes a meaningful experience because it allows students to understand a subject, solve an issue through project completion, and create opportunities for creative thinking, communicating, and creativity, with students' cognitive, creative, and affective components developing [2]. Because of the stages of the teacher guiding students in a collaborative project that interprets various subjects (materials) in learning, the author employs the PjBL model. Students can see numerous primary elements and principles in a discipline when queries are answered directly. Given that each student has a unique learning style, project-based learning allows students to investigate the content uniquely and perform collaborative experiments.

There have been many studies on the PjBL model, one of which is connected to the PjBL model on creative thinking abilities [11][15][36][37]. However, prior studies only investigated the profile of creative thinking abilities. The peculiarity of this study is that it examines not only the profile of creative thinking abilities but also the creative thinking abilities of each indicator concerning momentum and impulse. Based on the research findings, the researchers found that the PjBL learning model is extremely beneficial to both instructors and students during the learning process. The distinction between this study and other studies is that this study examines the level of influence of the learning model employed and the materials and factors employed in this research. The purpose of this research was to determine the PjBL model's effect on students' creative thinking skills in physics.

2. METHOD

This research employed the quasi-experimental method with a nonequivalent control group design involving the experimental and control classes. Momentum and impulse are the materials employed in this study. This population consisted of all tenth-grade students of SMA Negeri 2 Bandar Lampung. The sample consisted of 36 students

from class X MIPA1 as an Experiment class and 36 from class X MIPA2 as the control class. The samples were selected using the random sampling technique. Tests, observations, and interviews were used as data-collecting techniques. The Nonequivalent Control Group Design was employed in the investigation. The flowchart of the research is as follows.

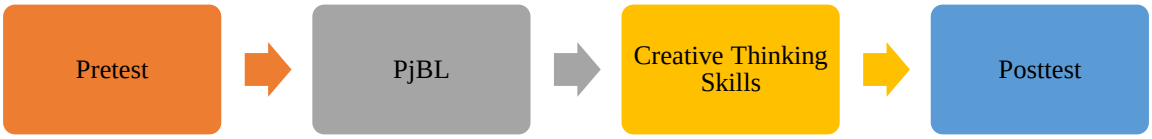

Figure 1. Research Procedure

An assessment sheet for students' creative thinking skills was used as the research instrument. The normality test, homogeneity test, hypothesis testing, and N-Gain were utilized in this study to analyze the data. This research covered quantitative research, which collects data using statistical methods. The level of significance was 5% or 0.05. Data analysis was utilized to measure students' scientific literacy by calculating the average N-Gain score with [25]:

$$\text{N-Gain} = \frac{posttest\ score - pretest\ score}{maximum\ score - pretest\ score} \qquad (1)$$

The normalized N-Gain is classified into three categories:

Table 1. N-Gain Classification [26]

N-Gain Value	Criteria
g< 0,3	Low
0,3≤g<0,7	Moderate
g≥0,7	High

value α of 5% or 0,05. The SPSS assisted in the calculation. The result was determined if (0.05 < significant value > 0,05), then $H_{0\ is}$ rejected, and H_1 is accepted.

The normality test was used to determine whether or not the sample data investigated were normally distributed. The Liliefors test was employed to determine normality [27]. The following is the statistical test procedure: H0 indicates that the sample is normally distributed; H1 indicates that the sample is not normally distributed. The Kolmogorov-Smirnov formula was used for the decision-making.

Table 2. The Criteria of the Normality Test [28]

Sig	Criteria
Sig > 0,05	Normal
Sig < 0,05	Not normal

The variance homogeneity test of the two groups was conducted once the data were normally distributed. The significance threshold in this study was 0.05. The following is the hypothesis: H0 = uniformly distributed, H1 = not uniformly distributed. The following formula was used in this study [29].

$$F = \frac{Largest\ variance}{Smallest\ variance} \qquad (2)$$

The homogeneity was determined using the homogeneity of variance.

Table 3. The Criteria of the Homogeneity of Variance [30]

Probability	Description	Conclusion
Sig > 0,05	Ho is accepted	Homogeneous
Sig < 0,05	Ho is rejected	Not Homogeneous

The hypothesis was tested using the normally distributed and homogeneous data. The independent sample t-test was used to examine hypotheses. The t-test is a statistical test that compares two mean scores and determines the likelihood (probability) that the difference between the two mean values is significant [30].

Table 4. Hypothesis Testing Criteria [31]

Sig	Description
Sig > 0,05	H_0 is accepted H_1 is rejected
Sig < 0,05	H_0 is rejected H_1 is accepted

3. RESULTS AND DISCUSSION

This study aimed to see how the PjBL (Project-Based Learning) affects students' creative thinking skills in physics. This research employed two classes as samples, each with 36 students. The data was gathered using a creative thinking skills test comprised of ten valid questions. Furthermore, an observation sheet was used for the implementation of PjBL.

The research data comprised information on students' creative thinking skills. Table 5 shows the average score of students' N-Gain test scores.

Table 5. N-gain Calculation[32]

Class	N	N-Gain	Criteria
Experimental	36	0,583971	Moderate
Control	36	0.345093	Moderate

According to Table 5, the N-Gain test values of the two classes differed even though they were in the moderate group. However, the experimental class outperformed the control class. Figure 1 shows the scores for the creative thinking skills for each indicator, both the experimental and control groups.

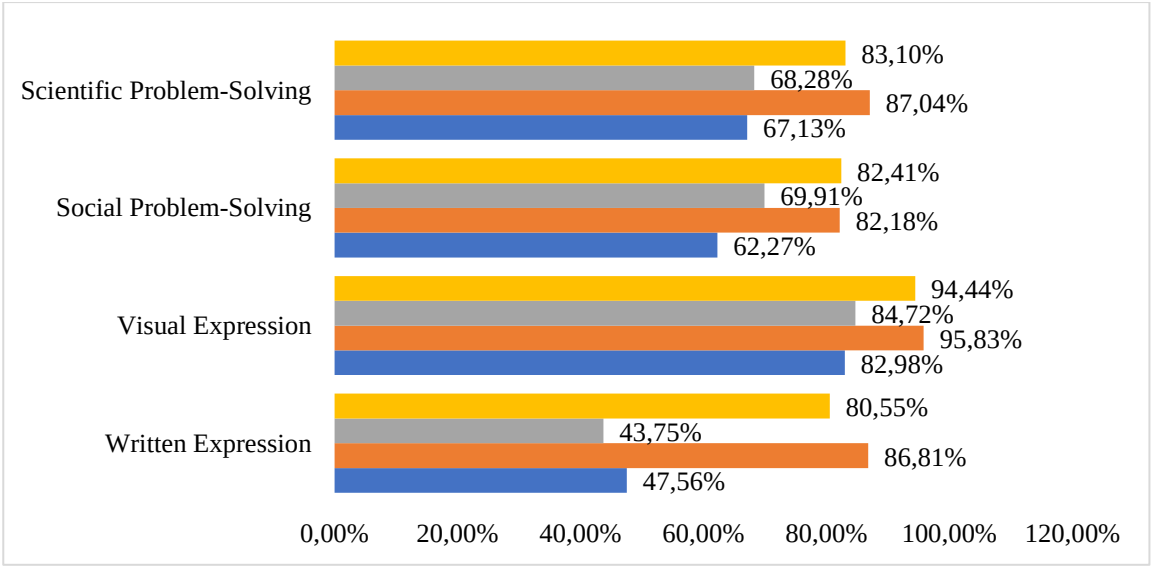

Figure 2. The Percentage of Each Creative Thinking Aspect

According to the creative thinking data analysis results, as shown in Figure 1, the visual expression indicator has the highest score for both the experimental and control classes. This study used a data analysis test to determine the validity of the hypothesis that will be proposed in the investigation. The t-test was used to examine the hypothesis.

The normality test determines whether or not the data is normally distributed. Table 6 depicts the recapitulation of the normality data analysis test.

Table 6. Normality Test Result

Class		Significance	Description
Experimental	Pretest	.095	Normal
	Post-test	.022	Normal
Control	Pretest	.112	Normal
	Post-test	.200	Normal

Table 6 reveals that the results of the normality test on the creative thinking skills of students in the experimental class based on the pretest and posttest data indicated a significance of 0.95 in the pretest data and 0.22 in the posttest data. The control class's normality test findings had a significance of 0.112 in the pretest data and a significance of 0.200 in the posttest data. The pretest and posttest data in the experimental and control classes revealed a significant value greater than 0.05, implying that the data gathered in the experimental and control classes were regularly distributed.

The homogeneity test was used to assess whether or not the data investigated had the same variance (homogeneous). The creative thinking skills results from the experimental and control classes were homogeneously tested. Table 7 displays the results of the homogeneity test of creative thinking skill data.

Table 7. Homogeneity Test Results

Statistics	Experimental and control classes
Sig	0,071
A	0,05
Description	Homogeneous

Table 7 displays the results of the homogeneity test on students' creative thinking skills in the experimental and control classes in the pretest and posttest. The calculated significance value was 0.071, implying that the data obtained in the experimental and control classes had the same variance or were homogeneous.

If the data is normally distributed and homogeneous data, a t-test can be performed at a significance level of 0.05. If sig is higher than 0.05, H_0 is accepted, and H_1 is rejected; otherwise, H_0 is rejected, and H_1 is accepted. The hypothesis testing was done to see if there were any changes in the experimental class students' creative thinking skills. Table 8 shows the results of the hypothesis test.

Table 8. Hypothesis Test Result

		Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Creative thinking skills	73.590	12.520	1.043	71.528	75.653	70.531	143	.000

Table 8 reveals that the hypothesis test finding of students' creative thinking skills was 0.000, which was lower than 0.05. It meant that H_0 was rejected and H_1 was accepted. Therefore, there were differences between the experimental and control classes before treatment. According to the findings of the relationship analysis utilizing process posters, there was a very good association between PjBL and students' creative thinking skills.

According to the PjBL relationship analysis results using the poster method, there was a very good association with students' creative thinking skills. The students were given project assignments in the form of poster creation. The project led to all the creative thinking skills required. Students can build valuable knowledge from real-world experience. This result is consistent with Utammi's research, which found that project-based learning can boost creative thinking skills by immersing students in real-world situations [33].

Meanwhile, the Project Based Learning model, according to Kumalasari, impacts the ability to think creatively because students are allowed to discover their knowledge through project-based learning. Students' knowledge will be much more significant. However, teachers are responsible for analyzing the outcomes so that there are no misconceptions [34]. This is consistent with Bruner's theory, according to Irwantoro and Suryana, who stated that learning theory is divided into three stages: enactive, iconic, and symbolic. The enactive stage is the stage of learning in which students are given a chance directly, the iconic stage is the stage of learning in which students transform physical things into pictures, and the symbolic stage is the stage of learning in which students manipulate images into symbols. This is consistent with the findings of a study undertaken by researchers utilizing the PjBL model and the subsequent project, posters. It is suggested that future studies be able to apply the PjBL model to different types of learning resources.

4. CONCLUSION

The research concludes that the PjBL model affects creative thinking skills in physics learning, as shown by the average pretest and posttest through the improved N-Gain test. The t-test obtained a value of 0.000 with a significant level of 0.05. Based on the t-test, H_0 was rejected, and H_1 was accepted. Thus, the average results of students' creative thinking abilities who receive treatment using PjBL learning have increased.

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