Improving Elementary School Students' Creativity with the PjBL Model in Science Learning

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Abstract:
Analyzes the application of a project-based learning approach to foster creativity in sixth-grade students at SDN 03 Selakau, Sambas Regency. The main objective of this study is to compare the level of significance of student creativity that applies the PjBL learning model compared to conventional learning. In line with the increasing challenges of 21st-century education, instilling creativity from an early age is important. The scope of this study is limited to elementary school students with a focus on two main aspects: the application of the PjBL model and increasing student creativity. This analysis was conducted with a quasi-experimental approach, using a research design that is not the same between the control group and the experimental group. These two sample groups were intentionally selected from two different classes. Class A received treatment through a project-based learning (PjBL) approach, while Class B continued using conventional learning. Score collection used descriptive question measuring tools with assessment aspects of question answering skills, expressing ideas quickly, originality, and equipped with observation sheets and product assessments. Creativity test data were analyzed using SPSS statistics using independent sample t-tests. The analysis of this study aims to compare the average scores of the experimental group with the control group. Students who learn with the PjBL model have a higher level of creative thinking skills. Therefore, the PjBL model has been proven effective in developing the creativity of elementary school students. The implications of this study are that teachers systematically implement the PjBL approach to create active and creative.

Keywords: Creativity; PjBL; Science Subject; 21st Century Skills; Elementary School Students

Introduction

Education in the technological era demands that students possess creativity, critical reasoning, communication, and collaborative skills (Rais et al., 2021) . In the context of the elementary school science curriculum, creativity is a competency developed by students from elementary school. It is a fundamental ability for students to construct understanding independently, collaborate in teams, be skilled in two-way or multiple-way communication, actively ask and answer questions, explore ideas, and provide solutions and new perspectives relevant to students' real lives. Therefore, this project-based approach can provide an active, effective, innovative, meaningful, and enjoyable learning experience. Project-based approaches play a role in fostering creative thinking and problem-solving skills in various life contexts. However, current learning practices in elementary schools tend to be oriented towards memorization and conventional methods, often making students passive recipients of information, thus limiting their ability to create, experiment, communicate, ask questions, and

generate ideas. This situation results in students' creative potential not being optimally facilitated. Thus, in reality, the implementation of learning in many schools still tends to use conventional methods (non-PjBL) that are oriented towards delivering material and memorizing concepts only. This gap results in less than optimal development of student creativity. This condition encourages the emergence of innovative project-based learning approaches, which can accommodate the need for systematic creativity development. Through a project-based learning approach, students have the ability to actively engage in the process of creating projects or products, generating new, flexible, and complex ideas in response to various challenges . Creative expression becomes a form of self-actualization that enriches individual relationships with themselves, the environment, and others (Fadillah et al., 2024) . According to (Anggraeni et al., 2023) students' creative thinking skills position them to be actively involved in the learning process through the application of the PjBL model. Students are able to express opinions and solve problems in completing project assignments, thereby improving their creative thinking skills (Chintya et al., 2023) Social, economic, and technological changes in the contemporary world require the education system to develop new teaching and learning models (de Oliveira et al., 2020) , because globally the PjBL learning model is an effective learning strategy in increasing students' positive attitudes towards learning (Rehman et al., 2023) . This model is also considered capable of supporting the mastery of 21st-century skills which include 4 student skills, namely critical thinking, creativity, collaboration, and communication in learning (Asman et al., 2022; Samsudin et al., 2018) . Therefore, PjBL can be a relevant choice for teachers in improving the quality of learning in various subjects (Masbukhin et al., 2023) .

PjBL positions students as the main actors through meaningful projects that begin with fundamental questions, deepen their understanding of the material, produce concrete products, and conclude with reflection and presentation. Involvement in authentic and contextual projects is believed to increase student motivation (because learning becomes meaningful and challenging) while also triggering creativity (because it demands new ideas, flexible thinking, and solution elaboration). According to (Tarigan & Latief, 2022; Warni & Afria, 2023) , the implementation of the PjBL model can increase student activity during the learning process. By selecting curriculum content related to real life, students can experience the process of collaboration in small groups, independent exploration in groups, formulating summaries and evaluating results, mastering necessary knowledge and skills, and improving comprehensive thinking skills and social communication skills (Xiong, 2021) .

Although Project-Based Learning (PjBL) has been extensively researched at higher levels, empirical evidence specifically examining the effects of Project-Based Learning (PjBL) on creativity simultaneously in sixth-grade elementary school students is still relatively limited. This phase is a crucial transition period towards secondary education, so appropriate interventions at this stage have the potential to positively

impact students' learning patterns and creative attitudes. Therefore, a project-based learning approach can overcome the limitations of conventional methods and support the expected creativity achievements in the science curriculum in elementary schools. The focus of this study covers two main questions, namely: (1) Is there a difference in students' creativity levels, through learning with a project-based approach? and (2) How big is the average score of students' creative thinking abilities with a project-based learning approach. This study clearly strengthens the theoretical basis and studies in science learning with a project-based learning approach at the elementary school level, especially in grade 6. In addition, there is clear evidence that this study contributes to the existing literature, especially in West Kalimantan, and in Indonesia in general. So that it can enrich the national literature regarding the application of the PjBL model in science learning in elementary schools, and become a guideline for teachers, schools and researchers to create innovative, creative, effective, meaningful, enjoyable learning that is in accordance with the curriculum in Indonesia.

Method

The method used is quantitative descriptive with a quasi-experimental approach that uses a non-equivalent research design between the control group and the experimental group. According to research (Anggraeni et al., 2023; Nurhaswinda et al., 2023; Widarti et al., 2023) the method used in this study is a quasi-experimental type , namely using a pretest-posttest nonequivalent control group design. and analyzed using an independent sample t-test. The design of this study was to see the difference in the level of creativity of students who received learning with the PjBL model for the experimental class, with the control class that received a conventional approach. This design also measures the impact of the application of the project-based learning model on student creativity in the context of science learning for grade 6 in the odd semester, with the main material of making simple media for the solar system using simple materials and tools. The following are the specific steps for its implementation in elementary school science classes, namely: 1). The teacher begins the lesson by giving a trigger question about the solar system. 2). The teacher explains the project to be carried out, namely making media or a simple model that shows the order of the planets in their orbits and the characteristics of the planets based on science concepts. 3). The teacher divides students into groups and helps them plan the project (including determining the model design, simple materials used, and division of tasks within the group. The research instrument consists of several components, namely). 4). Students carry out the project by making planets, drawing orbits and assembling solar system models, still under the guidance, direction and instructions of the teacher. 5). Each group presents the solar system model that has been made in front of the class. 6). The teacher evaluates the products produced by students and their work processes. The instruments used to measure student creativity are as follows: 1) 5 descriptive questions requiring creative thinking, 2)

Measuring the work process through the Student Worksheet (LKPD) distributed to each group, 3) Assessing the presentation of group work results, and 4) Assessing the product results. The four instruments are suitable for 6th grade elementary school students. This instrument is used with the aim of obtaining comprehensive data regarding the application of the PjBL model and its influence in increasing student creativity. The subjects observed were 6th grade students of SDN 0 3 Selakau totaling 44 students consisting of 2 different classes, (class A) who received treatment received PjBL learning as many as 22 students and the control class (class B) totaling 22 students, the data collection technique was purposive sampling in the science subject of making simple solar system learning media.

Before conducting a difference test, the data needs to be checked for normality, homogeneity, and a difference test of two independent groups with the help of IBM SPSS series 27 software. To determine the significant difference in student creativity between the experimental class and the control class, the table below performs a prerequisite test for data normality and homogeneity.

Table 1. Data Normality Analysis

Normality Test

		Kolmogorov-Smirnov [and]			Shapiro-Wilk		
	Class	Statistics	df	Signature.	Statistics	df	Signature.
Student Creativity Value	Class A	.148	22	.200 *	.928	22	.109
	Class B	.153	22	.195	.960	22	.499

Table 1. Shows the significance value *(P value)* > 0.05, this can be explained that the significance value of class A 0.109 and B 0.499 is more than 0.05 so it can be concluded that this data is normal, this means that this data meets the requirements for normality.

Table 2. Prerequisite Test for Homogeneity of Data Variance
Homogeneity of Variance Test

			Levene Statistics	df1	df2	Sig.
Student Values	Creativity	Based on Average	2,196	1	42	.146
		Based on Median	1,494	1	42	.228
		Based on Median and with adjusted df	1,494	1	39,913	.229
		Based on the trimmed mean	2.103	1	42	.154

Table 2. Shows a sig value (based on the mean) of 0.146 which is greater than 0.05, so it can be explained that this data has a homogeneous variance, meaning that the data assumptions are met.

Results and Discussion

Research result

After the data is analyzed using the SPSS application, it is explained significance value (*p*). greater than the significance level of 0.05, then the data group is declared to meet the requirements for conducting an independent difference test. Before conducting an independent sample t-test, a comparative statistical data analysis of the group comparison is necessary.

Comparative analysis shows significant differences between the project-based learning model application group and the learning group using conventional methods.

Table 3. Comparative Statistics of Students' Creativity Scores

CLASS		N	Mean	Standard Deviation
Class A	PjBL Model	22	85.09	7.640
Class B	Conventional Method	22	66.41	5.812

The average creativity score of class A students using PjBL learning is 85.09 with a standard deviation of 7.640. While the average creativity score of class (B) students using conventional learning is 66.41 with a standard deviation of 5.812. From the statistical data, it can be explained that the average difference is 18.68, this indicates a higher increase in creativity in class A with the application of the PjBL model in learning. To determine the level of significance of the differences between the two samples, an independent sample t-test is needed.

Table 4. Difference test or independent sample t-test

Variable	t	df	Sig. (2-tailed)	Mean	Confidence Interval Difference 95%
MARK CREATIVITY	9,128	42	0.000	18.682	14.552 to 22.812

Based on table 4, the Sig. (2-tailed) value = 0.000 is smaller than the significance level = 0.05, so it can be stated that class A group that applies PjBL learning with class B group that applies conventional methods clearly shows a significant difference. The t value = 9.128 shows a very strong influence with the PjBL approach. The difference in the average value = 18.682 is located in the confidence interval between 14.55 to 22.81, where this difference is consistent. Based on the t test analysis above, it can be concluded that learning with the PjBL model can significantly increase student creativity compared to conventional learning methods. The difference in the average value of 18.68 shows that the application of the PjBL learning model can develop the creativity of 6th grade elementary school students in science subjects.

Discussion

According to (Aiman et al., 2024; Anggraeni et al., 2023; Nurhaswinda et al., 2023) , the implementation of PjBL provides a significant contribution to the development of students' thinking skills. This finding is in line with the opinion of (Leasa et al., 2023) that dimensions of creativity such as fluency, flexibility, originality and elaboration increase after learning with a project-based approach is implemented. According to (Chen et al., 2022; Harizon & Ekaputra, 2023; Rais et al., 2021) in addition to improving creativity and learning outcomes, this model also contributes to the development of the technological era , namely students have creative thinking skills, logical thinking , communication, and collaboration. According to (Baran et al., 2021; Maryanti, 2021) the project-based learning model is effective in training creativity, critical thinking, communication and collaboration in students, even the implementation of PjBL-STEM shows a significant increase in these skills . However, the results of this study differ from those of Nasution et al., 2021 , which reported that Project-Based Learning (PjBL) does not always result in significant improvements in creative thinking skills. This difference may be due to variations in learning contexts, student readiness levels, and suboptimal implementation of PjBL syntax. Nevertheless, this study shows that the implementation of structured PjBL, with contextual and challenging projects, can produce consistent positive impacts on creativity and learning outcomes. Meanwhile, according to research results (Ariyani et al., 2025; Ndiung & Menggo, 2024), seven weeks of project-based learning can effectively enhance students' creative potential in producing original work and have a significant impact on students' creative thinking skills. Although there are conflicting research results, overall, this strengthens the empirical evidence that the PjBL model can enhance student creativity. Therefore, this project-based learning approach needs to be continuously integrated into various subjects in elementary schools so that students' creativity and innovation potential can develop optimally. According to (Leasa et al., 2023; Tarigan & Latief, 2022) shows that authentic projects increase originality because students are encouraged to explore innovation through projects that integrate learning contexts into the real world so that students are encouraged to develop unique project innovations . Based on this research, it is expected that the results of student projects with experiments are more creative and varied. Meanwhile, research according to (Anggraeni et al., 2023; Chen et al., 2022; Aiman et al., 2024) shows that projects that require students to design real products such as solar system models, and encourage students to generate various ideas and be able to present unique solutions detailing the product in more depth. Thus, student freedom in designing projects can theoretically provide space for exploration, and empirically can increase and develop all dimensions of student creativity, and make the learning approach with the PjBL model effective in implementing 6th grade science learning in elementary schools.

Conclusion

This study concludes that project-based learning (PjBL) improves the creativity of sixth-grade students at SDN 03 Selakau. In line with the main objective of this study is to improve students' creativity through the application of project-based learning (PjBL) approaches. Based on the results of statistical analysis, there is a significant difference between the average creativity scores of students who follow learning with a project-based approach and the control class with conventional methods. It can be proven by the results of statistical analysis which show that the average creativity score of students in the experimental class that applies the PjBL model with an average value of 85.09, while the control class that only uses conventional methods obtains an average value of 66.41, so the difference in the average value is 18.68, with a sig. (2-tailed) value of 0.000 smaller than the significance level of 0.05, so there is a significant difference, this can provide strong evidence that the use of a project-based learning (PjBL) approach is very appropriate to improve the creativity of elementary school students in sixth grade. Demonstrates the level of effectiveness in developing creative thinking skills, especially aspects of fluency, originality, and elaboration. In addition, Project-Based Learning (PjBL) provides space for students to actualize their potential through the process of exploration and creation of meaningful products. Therefore, the learning approach with the Project-Based Learning (PjBL) model is worthy of being one of the main approaches in science learning in elementary schools, especially grade VI, to meet the demands of 21st-century skills. Thus, it can be suggested that educators can implement project-based learning (PjBL) effectively and sustainably in various elementary school subjects.

Suggestion

Suggestions for further research that explores project-based learning (PjBL) variables in tangible and measurable forms are as follows:

1. Explore PjBL variables in a real and measurable way.
2. Integrate more variables, such as learning outcomes, learning motivation, student activity, interest in learning, collaboration, communication or thinking skills critical.
3. Expand the context and research subjects, for example involving several schools basis in different places, implementing this PjBL at the lower grade level and high, testing the application of PjBL in other subjects.
4. Using a more varied research design, for example there is an assessment pretest posttest, combining quantitative and qualitative research methods.

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