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The Effect of The Project Based Learning Learning Model in Improving the Gender-Based Science Learning Creativity of Elementary School

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Abstract

This research was conducted to examine the influence of the Project-Based Learning (PjBL) model on elementary students' creativity in IPAS learning when viewed from gender differences in Sukun District, Malang City. The study was motivated by the limited development of students' creativity, which is often associated with the predominance of teacher-centered instructional practices. As a student-oriented approach, PjBL is believed to encourage active participation, creative thinking, and collaborative engagement in IPAS learning. A quantitative method with a quasi-experimental design was applied in this study. The participants were fourth-grade students drawn from three public elementary schools: SDN Sukun 3, SDN Pisangcandi 1, and SDN Mulyorejo 1. Data were gathered using creativity tests and questionnaires. The analysis employed MANOVA after fulfilling the assumptions of normality and homogeneity. The findings demonstrate that: (1) the PjBL model significantly influences students' creativity in IPAS learning; (2) creativity levels differ between male and female students; and (3) no significant interaction effect was found between the learning model and gender. These results confirm that PjBL effectively enhances creativity while providing equitable learning opportunities for both genders. The study contributes to the development of innovative and gender-responsive IPAS instruction at the elementary level.

Keywords Project-Based Learning, Learning Creativity, IPAS, Gender, Elementary School.

INTRODUCTION

Education in the era of globalization is undergoing rapid transformation along with technological advancements and the increasingly fast flow of information. The challenges of the Industrial Revolution 4.0 toward Society 5.0 require the education system to focus not only on mastery of knowledge but also on the development of 21st-century skills, such as creativity, critical thinking, collaboration, and communication (Fitri dkk., 2021). However, the reality of learning in elementary schools still shows the dominance of conventional, teacher-centered approaches, resulting in students tending to be passive and their learning creativity not developing optimally, particularly in Natural and Social Sciences (IPAS), especially in the social dimension (Prastawa & Radiyanto, 2024)

The post-COVID-19 pandemic situation has further emphasized the need for innovative learning models that can increase student motivation and active engagement. Learning models play a strategic role as conceptual frameworks used by teachers to systematically design and implement instruction in order to effectively achieve learning objectives. Selecting an appropriate learning model significantly influences active and meaningful learning, as well as the development of students' potential, including creativity (Maulidia & Istiqomah, 2023).

One learning model relevant to these demands is Project-Based Learning (PjBL). PjBL is a student-centered learning model that focuses on project activities derived from real-world problems in the surrounding environment (Alwanda, 2025). In its implementation, students are actively involved in the planning, execution, and evaluation of projects, both independently and collaboratively, while the teacher acts as a facilitator who guides and monitors the learning process. This model encourages cognitive, affective, and psychomotor engagement through contextual and meaningful learning experiences (Nugraha dkk., 2023)

Operationally, PjBL is characterized by the use of driving questions, investigative activities, independent learning, and the production of concrete and realistic outcomes (Syahmi dkk., 2024). The stages of PjBL include problem presentation, project planning, activity scheduling, project implementation and monitoring, presentation of results, and reflection and evaluation. Through these stages, PjBL can foster students' critical thinking, problem-solving skills, collaboration, and responsibility in the learning process (Pratama, 2025).

n the context of science learning, creativity is understood as students' ability to generate new ideas, develop ideas, and find original and flexible solutions to learning problems. Learning

creativity is reflected in fluency, flexibility, originality, and elaboration of ideas (Rizki, 2024). This creativity can be observed through students' active involvement in discussions, group work, project development, and their ability to relate scientific concepts to social and environmental phenomena around them. With these characteristics, PjBL is considered aligned with the development of creativity in science learning because it provides space for exploration and encourages divergent thinking (Wicaksono dkk., 2024).

In addition to learning models, gender factors also influence the learning process and outcomes. Gender is understood as a sociocultural construct that differentiates the roles and characteristics of males and females, which may influence learning styles, responses to instruction, and the level of creativity demonstrated (Manasikana dkk., 2024). In the educational context, gender equality emphasizes providing equal opportunities, treatment, and access for all students without discrimination. The implementation of the PjBL model, when incorporating principles of gender equality, provides equal participation opportunities for both male and female students to collaborate, express ideas, and optimally develop their creativity (Sidik & Tahawali, 2024).

The results of preliminary observations in Sukun District, Malang City, revealed variations in the implementation of science learning in three elementary schools, namely SDN Sukun 3, SDN Pisangcandi 1, and SDN Mulyorejo 1, which represent different social, economic, and cultural conditions. Differences in contextual backgrounds have the potential to influence students' learning creativity as well as the effectiveness of implementing the Project-Based Learning (PjBL) model. Therefore, this study aims to analyze the effect of the Project-Based Learning (PjBL) model on students' creativity in science learning based on gender among elementary school students in Sukun District, Malang City. This study is expected to provide empirical contributions to the development of innovative, creative, and responsive science learning strategies that consider gender differences and the diversity of school environmental contexts.

METHOD

This study uses a quantitative approach with a quasi-experimental method. The design applied is a pretest–posttest control group design, in which the research subjects were not randomly assigned. The experimental class received treatment in the form of the implementation of the Project-Based Learning (PjBL) model, while the control class received conventional learning. This study aims to determine the effect of PjBL on students’ creativity in learning science in terms of gender

(Kusumastuti dkk., 2020).

The research population consisted of all elementary school students in Sukun District, Malang City. The research sample comprised 112 fourth-grade students, including 56 students in the experimental class from SDN Sukun 3 Malang and 56 students in the control class from SDN Pisangcandi 1 and SDN Mulyorejo 1. The samples were selected using purposive sampling, considering the equality of academic characteristics and learning conditions. The scope of this research is limited to examining the influence of the PjBL model on the creativity of fourth-grade students in science learning, as viewed from gender differences.(Mukhid, 2021).

The research data consist of primary data obtained through creativity tests (pretest and posttest), learning creativity questionnaires, and observations of student activities during the learning process (Hidayati & Mustaghfiroh, 2024). The research instrument was a learning creativity test designed based on four creativity indicators: fluency, flexibility, originality, and elaboration (Hidayati & Mustaghfiroh, 2024). The instrument consisted of 16 items administered before and after the treatment. Additionally, observations were conducted to assess student engagement, collaboration, and creativity during project-based learning. Validity and reliability tests of the instruments were conducted using SPSS. The validity test employed the Corrected Item-Total Correlation technique, while the reliability test used Cronbach's Alpha. The test results indicated that both the pretest and posttest instruments were valid and reliable, with sufficient to very high levels of reliability (Sihombing, 2022).

The data analysis technique used was Multivariate Analysis of Variance (MANOVA), as the study involved more than one dependent variable. This analysis was conducted to examine the effect of the PjBL model, differences in creativity based on gender, and the interaction between the learning model and gender on students' creativity in science learning. Prior to conducting the MANOVA analysis, the data were tested to ensure that the assumptions of normality and homogeneity of variance-covariance were met.

FINDINGS AND DISCUSSION

Findings

Research analysis was conducted to provide a clear and comprehensive picture of the data collected during the research process. This analysis stage not only aims to describe the characteristics of the data but also to ensure that the data meets all necessary statistical assumptions before

conducting the main test. Therefore, a series of assumption tests, such as normality tests, homogeneity tests, and linearity tests, were first conducted to ensure the data's suitability for further analysis. Once all assumptions were met, the data were then analyzed using MANOVA as the primary analysis technique. Through this stage, the research results are expected to provide a strong, accurate, and scientifically sound basis for concluding.

Before testing the hypotheses using MANOVA analysis, a normality test was performed to ensure the data met the assumptions of a normal distribution. The normality test in this study used the Kolmogorov–Smirnov test, which is appropriate for large sample sizes:

Table 1: Tests of Normality

	Kolmogorov-Smirnov[a]		
	Statistic	**df**	**Sig.**
Pretest_Total	.271	112	.000
Posttest_Total	.107	112	.003
a. Lillie fors Significance Correction			

Source: SPSS Ver 22

Based on the Kolmogorov–Smirnov test, the significance value of the pretest score was 0.000, and the posttest score was 0.003, both of which are less than 0.05, indicating that the student learning creativity data were not normally distributed univariately. However, the MANOVA analysis could still be continued because the large sample size and balanced distribution of subjects between groups made this analysis quite robust against violations of the normality assumption.

Tabel 2. Levene's Test of Equality of Error Variances[a]

Levene's Test of Equality of Error Variances[a]				
	F	df1	df2	Sig.
Fluency_Pre	2.625	3	108	.054
Fluency_Post	2.703	3	108	.049
Flexibility_Pre	1.803	3	108	/.151
Flexibility_Post	2.981	3	108	.035
Originality_Pre	4.094	3	108	.009
Originality_Post	2.730	3	108	.047
Elaboration_Pre	2.367	3	108	.075
Elaboration_Post	3.766	3	108	.013
Tests the null hypothesis that the error variance of the dependent variable is equal across groups.				
a. Design: Intercept + Kelas + Gender + Kelas * Gender				

Source: SPSS Ver 22

The results of Levene's Test show that several variables have homogeneous variance, namely Fluency Pre (Sig = 0.054), Flexibility Pre (Sig = 0.151), and Elaboration Pre (Sig = 0.075). Meanwhile, the variables Originality Pre (Sig = 0.009), Fluency Post (Sig = 0.049), Flexibility Post (Sig = 0.035), Originality Post (Sig = 0.047), and Elaboration Post (Sig = 0.013) show inhomogeneous variance because they have a significance value below 0.05. Despite the violation of the homogeneity assumption, MANOVA analysis can still be carried out because this test is quite robust against inequality of variance, especially with balanced sample sizes between groups.

Table 3. Results of the MANOVA

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Wilks' Lambda	.320	53.582[b]	4.000	101.000	.000
Fluency_Pre	Wilks' Lambda	.993	.172[b]	4.000	101.000	.952
Flexibility_Pre	Wilks' Lambda	.958	1.098[b]	4.000	101.000	.362
Orig_Pre	Wilks' Lambda	.949	1.363[b]	4.000	101.000	.252
Elabor_Pre	Wilks' Lambda	.985	.393[b]	4.000	101.000	.813
Gender	Wilks' Lambda	.974	.664[b]	4.000	101.000	.618
Class	Wilks' Lambda	.202	99.465[b]	4.000	101.000	.000
Gender * Class	Wilks' Lambda	.954	1.221[b]	4.000	101.000	.307

a. Design: Intercept + Fluency_Pre + Flexibility_Pre + Orig_Pre + Elabor_Pre + Gender + Class + Gender * Kelas
b. Exact statistic

Source: SPSS Ver 22

Table 3 Presents the results of the MANOVA test on four indicators of student learning creativity, namely fluency, flexibility, originality, and elaboration, with class, gender, and initial score (pretest) as covariates. The analysis results show that the class variable has a significant multivariate influence on student learning creativity (Sig = 0.000 < 0.05), which indicates a difference in creativity between classes using the Project Based Learning (PjBL) model and conventional learning. In contrast, the gender variable (Sig = 0.618 > 0.05) and the interaction between gender and class (Sig = 0.307 > 0.05) do not show a significant influence. In addition, the initial score (pretest) covariate on all creativity indicators has a significance value above 0.05, so that students' initial abilities do not have a multivariate influence on learning creativity outcomes. Thus, the difference in student learning creativity in the posttest is more due to the application of the PjBL learning model, and the MANOVA analysis is declared worthy to be continued to univariate testing.

Discussion

The Influence of the Project-Based Learning (PjBL) Model on Creativity in Science Learning

The findings indicate that implementing the Project-Based Learning (PjBL) model significantly enhances students' creativity in science learning. The MANOVA results show a significance value of 0.000 (<0.05) for both multivariate and univariate tests across all creativity indicators, fluency, flexibility, originality, and elaboration. This confirms that PjBL does not merely affect one dimension of creativity but contributes comprehensively to its development (Aprianto dkk., 2025).

This finding can be theoretically explained through constructivist learning theory, particularly the views of (Piaget, J., 2002) who argue that knowledge is actively constructed through experience and social interaction. In PjBL, students are not passive recipients of information; rather, they construct understanding through investigation, collaboration, and reflection. Creativity, therefore, emerges as a cognitive process embedded in meaningful learning activities rather than as a spontaneous or innate trait. (Li dkk., 2024).

From the perspective of creativity theory, the results are also consistent with J. P. Guilford's concept of divergent thinking, which includes fluency, flexibility, originality, and elaboration as core components. PjBL naturally stimulates divergent thinking because students are required to generate multiple ideas (fluency), approach problems from different perspectives (flexibility), propose novel solutions (originality), and develop ideas in detail (elaboration). The project cycle problem identification, planning, implementation, presentation, and reflection creates repeated opportunities for these cognitive processes to occur systematically (Eze dkk., 2021).

Empirically, these findings reinforce previous studies showing that PjBL is effective in fostering higher-order thinking and creativity. Prior research has demonstrated that project-based environments enhance meaningful learning because they integrate cognitive engagement with authentic problem-solving contexts. Compared to conventional teacher-centered instruction, which often emphasizes content transmission and procedural completion, PjBL encourages epistemic curiosity, autonomy, and sustained inquiry. The stronger posttest gains in the experimental class suggest that creativity develops more effectively when students are given ownership of learning tasks and opportunities for exploration (Aprianto dkk., 2025).

Importantly, this study extends previous research by confirming that the impact of PjBL is evident across multiple creativity dimensions simultaneously, rather than in isolated aspects. This strengthens the argument that creativity can be systematically cultivated through instructional design, not merely influenced by individual predispositions.

Differences in Creativity in Science Learning Based on Gender

The results reveal differences in creativity levels between male and female students, particularly in posttest scores. Female students demonstrated higher performance across all creativity indicators, especially in elaboration and originality. From a theoretical perspective, these findings can be interpreted using gender socialization theory, which suggests that sociocultural expectations shape cognitive and behavioral tendencies. Female students are often encouraged to develop verbal expression, organization, and attentiveness skills closely aligned with elaborative thinking. Elaboration requires detailed idea development and structured reasoning, competencies that may be reinforced through communicative and reflective learning habits (Arizona dkk., 2025).

However, it is essential to interpret these differences cautiously. As emphasized in creativity research, gender differences in creativity are often domain-specific and context-dependent rather than universal. The observed advantage of female students does not indicate superiority but reflects differences in cognitive style and learning strategies. Male students, while sometimes less detailed in idea development, may demonstrate strengths in exploratory or action-oriented tasks. The improvement in both groups after PjBL implementation indicates that the model supports creativity development regardless of gender (Ramadhani dkk., 2020).

Empirically, these findings align with prior research indicating that females often outperform males in elaborative and verbal creativity dimensions, while differences in fluency and flexibility tend to be smaller. The present study confirms these tendencies within the context of science learning, suggesting that sociocultural and classroom dynamics interact with instructional models to shape creativity outcomes (Malik dkk., 2023).

Interaction Between the PjBL Model and Gender

The MANOVA results show that the interaction between learning model and gender is not statistically significant (Sig > 0.05). This indicates that the effect of PjBL on creativity operates consistently across gender groups. The absence of interaction effects can be interpreted through a social constructivist perspective. In collaborative learning environments such as PjBL, creativity develops through shared inquiry, dialogue, and collective problem-solving. The instructional

structure emphasizes process quality rather than individual characteristics. As a result, the learning design itself becomes the dominant factor influencing creativity development (Ribeirinha dkk., 2024).

This finding is particularly important because it suggests that PjBL functions as an inclusive pedagogical model. While baseline creativity levels may differ between male and female students, the mechanism through which creativity is enhanced remains similar for both. In other words, PjBL provides equitable learning opportunities that allow all students to engage in meaningful exploration and idea development (Nulhikmah dkk., 2025). From a practical standpoint, this implies that teachers do not need to design separate instructional models based on gender. Instead, they should ensure equitable participation, balanced group dynamics, and inclusive project structures. The universality of PjBL's effectiveness reinforces its relevance for diverse classroom contexts (Hartati dkk., 2019).

CONCLUSION

The findings of this study confirm that the implementation of the Project-Based Learning (PjBL) model significantly enhances students' creativity in science learning. Students exposed to PjBL demonstrated higher average creativity scores across all indicators compared to those who experienced conventional instruction. This indicates that structured project-based activities effectively stimulate multiple dimensions of creative thinking. Although slight differences in creativity were observed between male and female students with female students showing marginally higher scores—the interaction analysis revealed that gender does not moderate the effectiveness of the PjBL model. In other words, PjBL contributes to creativity development in a relatively consistent manner across genders. Therefore, PjBL can be regarded as an inclusive instructional model capable of fostering creativity among elementary students regardless of gender differences. Its systematic project cycle provides meaningful learning experiences that support equitable and comprehensive creative growth.

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