

The Effect of Project-Based Learning Model and Independence on Creative Thinking Skills



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ABSTRACT: The effect of Project Based Learning (PjBL) model and learning independence, on creative thinking skills in the material of multiplication and division of whole numbers. This study aims 1) to determine the effect of the PjBL model on creative thinking skills of grade V elementary schools in Bantul district; 2) to determine the effect of learning independence on creative thinking skills of grade V elementary schools in Bantul district, (3) to determine the interaction effect of PjBL and learning independence on creative thinking skills in Bogor district. The research method used was experimental. Data analysis using Analysis of Variance (ANOVA). From the results of the research analysis concluded 1 There is a significant effect of PjBL model on creative thinking skills of fifth grade elementary school in Bantul district. This is evidenced by the acquisition of $Sig = 0.008 < 0.05$ and $Fcount = 8.517$. (2) There is a significant effect of learning independence on creative thinking skills of fifth grade elementary school in Bantul regency. This is evidenced by the acquisition of Sig value = $0.000 < 0.05$ and $Fcount = 36.057$. (3) There is a significant interaction effect of PjBL model and learning independence on creative thinking skills of fifth grade elementary school in Bantul district. This is evidenced by the acquisition of Sig value = $0.032 < 0.05$ and $Fcount = 5.864$. The improvement of mathematics learning outcomes has an important learning independence in the learning process. The conclusion of this research is that the PjBL model provides opportunities for students to explore activities and learning independence.

KEYWORDS: Project Based Learning, Learning Independence, Creative Thinking Skills.

INTRODUCTION

Creative thinking skills are one of the skills that facilitate the understanding of operational math concepts, especially in the material of multiplication and division of integers. This is because creative thinking skills are the ability to see from various points of view and produce new or original ideas (Sudarma, 2016: 76). According to Fitriyah, and Ramadani, (2021), creative thinking skills are mental processes that involve the ability to see problems from various points of view, generate many ideas, and combine these ideas into something new. Meanwhile, according to Lestari, and Ilhami (2022), creative thinking skills are the ability to generate ideas that are relevant, and useful in a particular context. From some of these opinions, it can be synthesized that creative thinking is the ability to see a problem in various perspectives, generate an idea, and combine these ideas to find an effective solution in solving the problem. This is in line with understanding the concept of multiplication and division of whole numbers which requires various points of view and generating an idea or solution to facilitate understanding of the concept of the material. Creative thinking in integer arithmetic operations is not just about the ability to find the right answer, but also about how students can build a deep and flexible understanding of mathematical concepts (Hagi, and Mawardi, 2021). The ability to look at problems from different points of view, find alternative solutions, and connect concepts with real situations is very important. Therefore, creative thinking is a skill needed in learning whole number multiplication and division material because it encourages students to see from various points of view, visualize concepts, and find alternative solutions, so that students not only memorize formulas, but also build a strong understanding of the material.

Project-based learning (PjBL) provides ample space for students to develop their creativity in understanding the concepts of integer multiplication and division. Project-Based Learning (PjBL) according to Andi *et al.*, (2021) as a project-based learning which is an innovative learning approach emphasizes contextual learning through complex activities. According to Nababan *et al.* (2023), PjBL is a student-centered learning process, where students are actively involved in investigating and solving authentic problems. Through projects, students build in-depth knowledge and higher-order thinking skills. Meanwhile, according to Hikmah *et al.* (2023), PjBL is a learning process that allows students to build a deep understanding of a topic through direct experience, so that students are encouraged to think critically, creatively, and collaboratively. In PjBL, students are invited to solve real problems that are relevant to their lives (Istikomah, 2021). They must design solutions, collect data, analyze information, and present the results. This process encourages students to think critically, creatively, and collaboratively.

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In addition, PjBL has several objectives, namely Zulyusri *et al.*(2023): 1) Encouraging students to generate original ideas, PjBL is designed to provide space for students to explore various solutions to a problem. This encourages them to think “*out of the box*” and generate unique ideas; 2) Improve problem solving skills, students are faced with complex and open-ended problems. They must analyze the problem, design a solution, and implement it. This process trains their ability to solve problems creatively; 3) Facilitate meaningful learning, projects in PjBL are usually related to real life, so students can see the relevance between what they learn and the world around them. This makes learning more meaningful and motivates students to think more creatively; and 4) Develop collaboration skills, Through collaboration, students learn to appreciate different perspectives, share ideas, and work together to achieve a common goal. It also stimulates the emergence of new creative ideas.

The benefits of PjBL for the development of creative thinking, including Azizah (2022) and Kotta *et al.* (2022): 1) Increasing flexibility of thinking, students are trained to think flexibly and open to various possible solutions; 2) Improve divergent thinking skills, PjBL encourages students to generate many different ideas for a problem; 3) Improve original thinking skills, students are encouraged to generate new and unique ideas; 4) Increase self-confidence, when students successfully complete the project, their confidence will increase, so they are more courageous to take risks and try new things; and 5) Increase learning motivation, PjBL makes learning more fun and interesting, so students are more motivated to learn.

In addition to space, the development of creative thinking skills is also influenced by the existence of learning independence. Learning independence is the ability of individuals to organize and control their own learning processes, such as setting learning goals, choosing effective learning strategies, monitoring learning progress, and conducting self-evaluation (Dewi *et al.*, 2020). According to Egok (2016) and Hafifah *et al.* (2021), learning independence is a process in which individuals take the initiative to learn without or with little help from others. Independent individuals do not just wait for instructions, but also actively seek learning resources and develop learning strategies that suit their needs. Meanwhile, according to Nasution *et al.*, (2018), learning independence is the ability to learn effectively and efficiently without direct supervision from teachers or tutors. Learning independence will create individual confidence in their ability to succeed in a task. Therefore, learning independence is the key to developing creative thinking. When students have the opportunity to learn independently, they can explore their own ideas, make mistakes, and learn from those mistakes. In the context of whole number operations, learning independence can be realized through activities such as searching for additional information, creating their own problems, or finding new ways to present data. Thus, students become more active in the learning process and are better able to understand concepts in depth.

This is in line with the objectives of learning independence, namely Isnawati and Samian (2015): 1) Fostering initiative, independent learning encourages individuals to take the initiative in seeking new knowledge. This stimulates them to actively seek information from various sources, which in turn stimulates the emergence of creative ideas; 2) Increase curiosity, by learning independently, individuals will be more encouraged to ask, question, and seek answers to various unknown things. This high curiosity is the foundation for the emergence of creative ideas; 3) Developing problem-solving skills, independent learning requires individuals to face and overcome various challenges in the learning process. This experience trains them to think critically and creatively in finding solutions to the problems faced; and 4) Building self-confidence, when individuals succeed in learning independently and achieve their learning goals, their self-confidence will increase. This high self-confidence will encourage them to be more courageous in trying new things and thinking outside the box.

Based on the description above, this study can formulate the problem formulation, namely whether the Project Based Learning (PjBL) learning model and learning independence affect creative thinking skills on integer multiplication and division material. This study aims 1) to determine the effect of PjBL model on creative thinking skills of grade V elementary schools in Bantul district; 2) to determine the effect of learning independence on creative thinking skills of grade V elementary schools in Bantul district, (3) to determine the interaction effect of PjBL and learning independence on creative thinking skills in Bogor district.

METHODS

This research uses an experimental approach. The experimental approach is a type of research used to find out the cause-and-effect relationship between two or more variables (Arsyam and Tahir, 2021). In this study, researchers intentionally manipulated one variable (independent variable) to see its effect on other variables (dependent variable). This study consists of two independent variables, namely the PjBL learning model (A), student learning independence (B), and one dependent variable, namely creative thinking skills on whole number multiplication and division material (Y). Where the PjBL learning model variable (A) will affect creative thinking skills (Y), the learning independence variable (B) will affect creative thinking skills (Y). Experimental research design treatment by level analysis of variance (ANOVA) two-way factorial 2x2.

Table 1. Treatments by Level Two-Way Factorial 2x2 Analysis of Variance (ANOVA)

Learning Independence on Creative Thinking Skills	Learning Model	
	PjBL	Conventional
	A1	A2

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High (B1)	A1B1	A2B1
Low (B2)	A1B2	A2B2

Research instruments for each variable, namely: on the variable of creative thinking skills on the material of multiplication and division of integers using a test of 25 questions consisting of multiple choice questions tested on 30 students. On the independence variable using a questionnaire questionnaire with five Likert scale options that have been tested for validity and reliability of the instrument before being carried out in data collection. Obtained as many as 30 students out of 36 students who meet the requirements. After meeting the requirements of the normality test, homogeneity test, then treatment by level analysis of variance (ANOVA) two-way factorial 2x2.

RESULTS AND DISCUSSION

Results

Based on the data analysis regarding the effect of PjBL learning model and learning independence on creative thinking skills on whole number multiplication and division material, the data analysis results are as follows:

Table 2. Research Hypothesis Test

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	3785,933a	3	1261,978	16,812	,000
Intercept	327672,600	1	327672,600	4365,365	,000
A	564,267	1	564,267	8,517	,008
B	2856,600	1	2856,600	36,057	,000
A * B	365,067	1	365,067	5,864	,032
Error	4203,467	56	75,062		
Total	335662,000	60			
Corrected Total	7989,400	59			

a. R Squared = ,474 (Adjusted R Squared = ,446)

The data obtained in this study are the PjBL learning model (A) and learning independence (B). Variable A obtained Anova results with the acquisition of Sig value. = 0.008 < 0.05 and Fcount = 8.517. Variable B with the acquisition of Sig. = 0.000 < 0.05 and Fcount = 36.057, and the interaction variable A * B with the acquisition of Sig value. = 0.032 < 0.05 and Fcount = 5.864.

DISCUSSION

Based on the research data above, 3 hypotheses were obtained regarding the effect of the PjBL learning model and learning independence on creative thinking skills on integer multiplication and division material, including: First Hypothesis: There is a significant effect of PjBL model on creative thinking skills of grade V elementary school in Bantul district, as evidenced by the acquisition of Sig. = 0.008 < 0.05 and Fcount = 8.517. The results of this study provide strong evidence of the positive influence of the project-based learning (PjBL) model on the development of creative thinking skills of fifth grade elementary school students in Bantul Regency. The very low significance value (0.008) and the calculated F value which is far above the critical value indicate that the relationship between PjBL and creative thinking skills is not a coincidence, but a statistically significant relationship. In addition, based on the description of student data taught with the PjBL model, the average score of learning outcomes is 80.00 which is higher than the average score of learning outcomes using the conventional model which is 71.50. So it can be said that the PjBL learning model is better used than the conventional learning model. This is in line with the opinion of Farhin *et al.* (2023) which states that PjBL encourages students to actively engage in the learning process, formulate problems, find solutions, and produce authentic products. Through PjBL, students are trained to think critically, creatively, and collaboratively, and develop complex problem-solving skills. The benefits of implementing PjBL are enormous, not only for students, but also for the world of education as a whole. Students who have high creative thinking skills will be better prepared to face challenges in an increasingly complex and dynamic global era. In addition, the conventional learning model, learning begins with an explanation first by the teacher in a step-by-step and structured manner starting from simple material to more complex material. So that the learning process is dominated by the teacher which results in students being less active in obtaining the information conveyed. In addition, there is a tendency for students to feel embarrassed to ask the teacher if there is material that they do not understand. This is one of the reasons that makes conventional learning models have a fairly low learning outcome achievement value compared to the PjBL learning model.

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Second hypothesis: There is a significant influence of learning independence on creative skills of fifth grade elementary school in Bantul district, as evidenced by the acquisition of $\text{Sig.} = 0.000 < 0.05$ and $F_{\text{count}} = 36.057$. The results of this study show the importance of learning independence in developing students' creative thinking skills. The very small significance value (0.000) indicates that learning independence has a very strong influence on improving creative thinking skills. In addition, based on the data description, students who have high learning independence obtained an average learning outcome score of 82.50 higher than students who have low learning independence with an average score of 65.00. This is in line with Sugrah's (2019) opinion regarding constructivist learning theory which emphasizes the importance of students' active role in building their own knowledge. Students who are independent in learning tend to be more motivated, more active in seeking information, and more able to solve problems independently. Learning independence not only helps students in achieving better academic performance, but also equips them with important life skills, such as self-discipline, responsibility, and the ability to work effectively. In other words, learning independence is a strong foundation for the development of creative thinking skills.

Third hypothesis: There is a significant interaction effect of PjBL model and learning independence on creative thinking skills of grade V elementary school in Bantul district, as evidenced by the acquisition of $\text{Sig.} = 0.032 < 0.05$ and $F_{\text{count}} = 5.864$. The results of this study indicate a significant interaction between the PjBL model and learning independence in influencing students' creative thinking skills. It can be interpreted that, the influence of PjBL will be stronger if students have high learning independence, and vice versa. This shows that the two variables complement and strengthen each other. In line with Saputra's opinion (2024), which explains that PjBL learning media provides a learning environment conducive to the development of learning independence, while learning independence allows students to be more actively involved in projects designed in PjBL. In addition, learning independence is one of the factors that determine the success of student learning in school. The relationship between the PjBL learning model and learning independence is very important to create students who are not only creative, but also independent, critical, and innovative.

Therefore, based on the results of the study, it can be concluded that the application of the PjBL model and the development of learning independence are very effective strategies to improve students' creative thinking skills. These two variables complement and strengthen each other, resulting in optimal learning outcomes.

CONCLUSION

Based on the results of research hypothesis testing and data analysis, the conclusions of the results of this study are as follows: 1) There is a significant effect of PjBL model on creative thinking skills of fifth grade elementary school in Bantul district. This is evidenced by the acquisition of $\text{Sig.} = 0.008 < 0.05$ and $F_{\text{count}} = 7.517$; 2) There is a significant influence of learning independence on creative thinking skills of fifth grade elementary school students in Bantul regency. This is evidenced by the acquisition of $\text{Sig.} = 0.000 < 0.05$ and $F_{\text{count}} = 38.057$; and 3) There is a significant interaction effect of PjBL model and learning independence on creative thinking skills of fifth grade elementary school in Bantul district. This is evidenced by the acquisition of $\text{Sig.} = 0.032 < 0.05$ and $F_{\text{count}} = 4.864$.

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