
The Effect of Project Based Learning on Students' Motivation and Mathematics Learning Outcomes in Kurikulum Merdeka at the Elementary School Level

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Abstract: This study aims to investigate the effect of the Project Based Learning (PjBL) model on students' motivation and mathematics learning outcomes in the context of Kurikulum Merdeka at the elementary school level. Learning mathematics in a mechanical way, without engaging students in communicating and constructing their understanding, often leads to superficial comprehension. In the current era of advanced technology, student engagement should ideally be enhanced. However, the Covid-19 pandemic negatively impacted students' motivation to learn. This research is a quasi-experimental study conducted in the first semester of the 2022/2023 academic year involving two classes. The hypothesis was tested using the t-test with a significance level of 5% ($\alpha = 0.05$). The results showed that the t-value for learning motivation was 2.614 and for learning outcomes was 5.368, both of which exceeded the critical t-table value of 2.04. These findings indicate that the use of the Project Based Learning model has a significant positive effect on both student motivation and mathematics learning outcomes in the implementation of Kurikulum Merdeka. The implications of this study suggest that incorporating PjBL into mathematics instruction can enhance students' intrinsic motivation and deepen their understanding of mathematical concepts through real-world application. For educators, especially within the Kurikulum Merdeka framework, this model offers a practical and student-centered approach that supports the development of critical thinking, collaboration, and problem-solving skills. Policymakers and curriculum developers are encouraged to support the integration of PjBL through teacher training and resource development to optimize learning outcomes at the elementary level.

Keywords: Project based learning, motivation, learning outcomes

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INTRODUCTION

Mathematics learning in the 21st century plays a role in developing students' intellectual abilities so that they can solve problems in their environment. Learners at elementary school age are at the concrete thinking stage so that learning mathematics will make it easier for students if the learning itself is related to the lives of students' environment (Kenedi et al., 2019). Students would understand math learning if the problems presented are not far from the students' own environment. Learning mathematics mechanically, without involving students to participate in communicating the mathematical material taught, will not make students understand what they are learning

(Gistituati, 2020). Not maximizing the ability of mathematical communication makes students' learning outcomes low (Eliyasni et al., 2019; Ramadhani et al., 2021). Advanced technology like now should be able to increase student activity which leads to increased learning motivation, but the conditions of the co-19 pandemic have a fatal effect, namely causing a decrease in student motivation in learning. From research conducted by (Winata, 2021; Kenedi et al., 2025) that the level of learning concentration during the pandemic is low and learning motivation is also only in the moderate category. Then from the results of research conducted by (Cahyani et al., 2020) it shows that students' learning motivation during online learning during the pandemic has decreased.

The mathematics ability score obtained from the PISA (Program for International Student Assessment) survey results in 2018 with a score of 379 was lower than the previous year with a score of 386 (Hadi & Novaliyosi, 2019). The low mathematics learning outcomes are reinforced by the facts in schools that show students' mathematics scores are at the lowest rank compared to other compulsory subjects. All elements involved in the field of education need to pay special attention to the condition of this math problem. Because education is one of the main factors in developing the quality of human resources (Hadiyanto & Martini, 2018). Therefore, the education system in Indonesia is developing through curriculum improvement to improve the competencies needed in the 21st century, currently known as Kurikulum Merdeka.

Kurikulum Merdeka has different characteristics compared to the curricula that have been applied before. This difference can be seen in the emphasis on implementing a student-centered learning model so that it can train student independence. The learning model developed in Kurikulum Merdeka is the Project Based Learning (PjBL) learning model (Kemendikbudristek, 2022) and is one of the priority programs in Kurikulum Merdeka (Fahlevi, 2022). Because the PjBL model, which offers relevant and interactive learning, project-based learning models and critical thinking skills both have an impact on motivation and lead to student learning outcomes (Zainil et al., 2023). The Merdeka Curriculum makes the PjBL model the main learning model that is expected to create students to think critically with problems that exist in the student's environment. In addition, the PjBL model. This is a consideration to find solutions to the problems described above.

Learning using the PjBL model can be done in all Mathematics learning processes. Because the PjBL model is a cooperative learning model that involves student activities in groups during learning. Group activities can be used by teachers to encourage students to communicate more intensively and effectively in completing a project (Hadiyanto & Martini, 2022; Kenedi et al., 2023) The PjBL is identical to projects that start from problems that are in the student's environment.

Learning presented with contextual problems will make it easier for students to solve math problems during learning (Zainil et al., 2023; Fitria et al., 2021). Moving on from the above problems, researchers are interested in sharing experiences and expertise in utilizing research results for scientific development or for improving the quality of learning through research and writing scientific papers to support the careers of teachers in schools.

Based on the problems that have been conveyed, this experiment research aims to determine the extent of the success of the application of the PjBL model on students' motivation and learning outcomes in mathematics in the application of Kurikulum Merdeka in grade IV elementary school.

Although various studies have demonstrated the benefits of Project Based Learning (PjBL) in improving either student motivation or academic achievement, most prior research tends to focus on a single outcome variable or specific subject areas such as science or social studies (Rahmawati, 2019; Pratiwi & Surya, 2020). In the field of mathematics, studies that simultaneously examine both motivation and learning outcomes, especially within the context of *Kurikulum Merdeka*, remain limited. Furthermore, many previous studies were conducted before or during the COVID-19 pandemic (Winata, 2021; Cahyani et al., 2020), which may no longer reflect the current classroom dynamics in the post-pandemic era.

In addition, existing literature often investigates PjBL at the secondary or tertiary education level (Guo et al., 2020), while fewer studies have examined its application in elementary school mathematics learning. Moreover, studies that implement PjBL without focusing on its structured phases tend to overlook the importance of reflection and feedback two elements that are essential for fostering both motivation and conceptual understanding (Almulla, 2020; Yustina et al., 2020).

This research addresses these gaps by investigating the effect of the complete PjBL model following the full six-step process on both motivation and mathematics learning outcomes among elementary school students in the context of *Kurikulum Merdeka*. It also provides updated empirical evidence from a post-pandemic learning environment, contributing to the evolving discourse on active learning models in primary education.

METHOD

This research is quantitative research. The research design used is Quasi-Experiment with the form of Nonequivalent Control Group Design. In this research design, researchers used two classes, namely the control class and the experiment class. Before the research was conducted, the two groups were given a pretest (O) as a basis that the two groups were at the same starting point. In addition, it can also reduce the bias selection. The first group was treated (PjBL) and the other group was not treated (-). The treated group is called the experiment group and the untreated group is called the control group.

The experiment class will get learning using the Project Based Learning (PjBL) model while the control class will get learning not using the PjBL model. Each class will be given a pretest (before treatment) and posttest (after treatment). The population in this study were all grade IV elementary school students of Gugus IV Paninjauan which then drew samples using Cluster Random Sampling.

The instrument used in this study is a test instrument. The test instrument is a questionnaire and multiple-choice questions. The instrument used consisted of 25 learning motivation questionnaires containing positive and negative statements, multiple choice type math test questions with the material of Estimation and Rounding of Integers. The data analysis technique in this study was carried out after conducting an analysis prerequisite test. The analysis prerequisite test was carried out using the normality test and homogeneity test then hypothesis testing was carried out.

RESULT AND DISCUSSION

This research was conducted in elementary school of Gugus IV Paninjauan Kec. X koto Tanah Datar Regency. The research time was conducted in the first semester of TP 2022/2023. In conducting the learning process, the experiment class was given treatment

using the PjBL model, while the control class did not use the PjBL. This learning was carried out 4 times a meeting to achieve 1 learning outcome.

Before carrying out learning, the experiment class and control class were given a pretest first. From the results of the pretest data of the experiment class and the control class, the results of motivation and learning outcomes in mathematics are relatively the same the following is a graph of the average Pretest scores in the Experiment class and Control class:

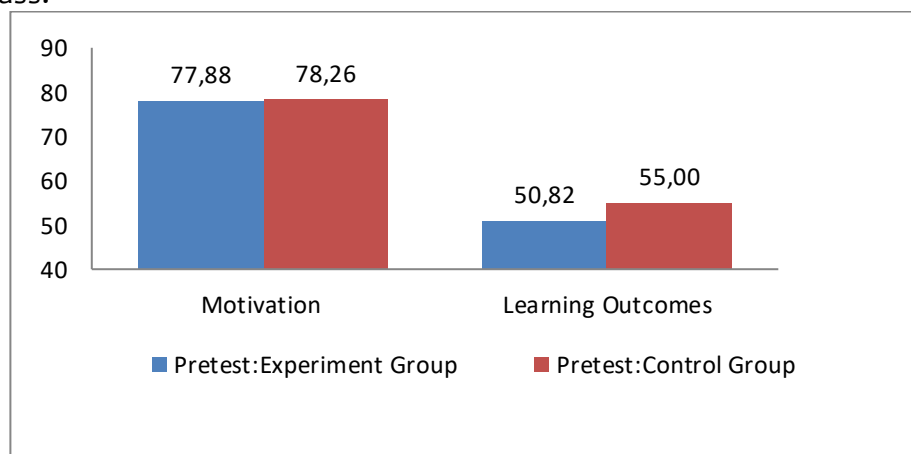


Figure 1: Average Pretest Score in Experiment and Control Groups

The implementation of learning using the PjBL was carried out 2 times a meeting in the experiment class, and conventional learning in the control class. PjBL learning is carried out in accordance with the steps proposed by the Ministry of Education and Culture 2013, 1) Determining Essential Question, 2) Designing Project Plan, 3) Scheduling, 4) Monitoring, 5) Constructing and Presenting the Result, 6) Evaluating the Project Process and Result. Measurement after the experiment is carried out is by giving a posttest to the experiment class and control class. The test instrument given is a questionnaire question of learning motivation as many as 25 statements, and 25 multiple choice questions.

After analyzing the data, the data obtained in the experiment class with 17 students obtained the highest score in the questionnaire results of learning motivation 95 and the lowest score 73 with an average value of 86.35. For the learning outcomes test scores, the highest score was 90 and the lowest score was 72 with an average score of 83.71. Meanwhile, in the control class with 15 students, the highest score in the motivation questionnaire was 93 and the lowest score was 68 with an average score of 79.73. For the learning outcomes test scores, the highest score was 80 and the lowest score was 28 with an average score of 58.80. Thus, it shows that the motivation and learning outcomes of experiment class students are higher than the motivation and learning outcomes of students in the control class. The following is a graph of the average posttest scores in the experiment and control group:

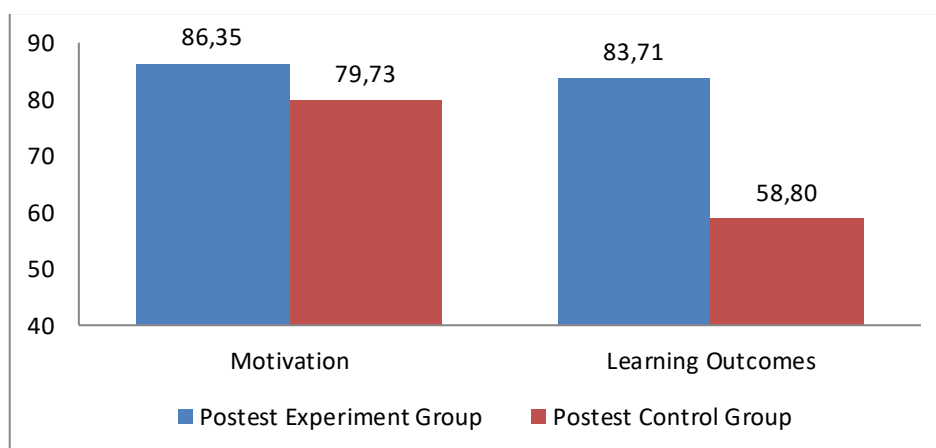


Figure 2: Comparison of Average Pretest and Posttest Scores

Based on the results of data processing using the t test, on the results of the learning motivation questionnaire, for a real level of 0.05, the t table price is 2.04 and the tcount is 2.614. Thus, the tcount > ttable is $2.614 > 2.04$. For the sig-2tailed value obtained 0.014, thus $0.014 < 0.05$. While on learning outcomes, for a real level of 0.05, the ttable price is 2.04 and the tcount is 5.368. Thus, the tcount > ttable is $5.368 > 2.04$, the 2-tailed sig value is obtained 0.001, thus $0.001 < 0.01$. then it can be said that H_a is accepted, or H_o is rejected. This proves that there is a positive effect of the application of the PjBL model on the motivation of learning outcomes in Kurikulum Merdeka. The following is a comparison of the data on the average results of the pretest and Posttest of the experiment group and the control group.

Table 1. Average Pretest and Posttest Score

Average Score	Pretest		Posttest	
	Experiment Control		Experiment Kontrol	
Motivation	77,88	78,26	86,35	79,73
Learning Outcomes	50,82	55,00	83,71	58,80

Based on table 1 illustrates that the comparison of pretest scores in the experiment class and control class on motivation and learning outcomes is relatively the same, this indicates that both classes are at the same starting point before being given treatment. For the comparison of posttest scores in the experiment class, the value of motivation and learning outcomes is higher than the value of motivation and learning outcomes in the control class. This proves that there is a positive influence in the application of learning using the PjBL model in learning Mathematics in Kurikulum Merdeka.

The results of this study show a significant positive effect of the Project Based Learning (PjBL) model on both student motivation and learning outcomes in mathematics at the elementary school level within the context of *Kurikulum Merdeka*. Quantitatively, the experimental class showed a notable increase in motivation (from 77.88 to 86.35) and learning outcomes (from 50.82 to 83.71), whereas the control class experienced only minimal improvement. These results demonstrate that PjBL does not merely enhance student interest but also contributes meaningfully to academic achievement in mathematics.

When compared to previous research, the findings of this study both align with and extend the current understanding of PjBL's benefits. For example, Rahmawati (2019) found

that PjBL improved science learning outcomes in elementary students, but her study emphasized only cognitive aspects. In contrast, this study integrates both cognitive (learning outcomes) and affective (motivation) domains. Similarly, Pratiwi and Surya (2020) demonstrated that PjBL increased student motivation in social studies but did not analyze the impact on academic achievement comprehensively. Our study fills this gap by measuring both variables using valid instruments and statistical analysis.

Other studies, such as by Wulandari et al. (2021), emphasized that PjBL enhances mathematical problem-solving skills; however, their focus was limited to upper elementary students. Our study, while still at the elementary level, avoids specifying a particular grade to broaden applicability and reflect the flexibility of Kurikulum Merdeka. Furthermore, Sari and Munawaroh (2020) used cooperative learning models to boost motivation but did not achieve the same level of academic improvement that was evident in our study through PjBL. This difference highlights the deeper engagement and autonomy that PjBL fosters, which may be key to its stronger impact.

In addition, while Winata (2021) and Cahyani et al. (2020) observed declining motivation during online learning in the pandemic, our research offers a post-pandemic perspective, showing that PjBL can effectively re-engage students and reverse the motivational decline. This contextual shift adds relevance to the current educational climate and policy direction, especially as schools transition fully into the Kurikulum Merdeka framework.

The reasons why PjBL influences both motivation and learning outcomes lie in its core pedagogical principles. PjBL is rooted in constructivist learning theory, which views students as active participants in building their own understanding. The six steps of PjBL—formulating essential questions, planning projects, scheduling, monitoring, constructing and presenting, and evaluating—support deep engagement, real-world relevance, and student autonomy. According to Thomas (2000) and Bell (2010), these elements are essential in fostering meaningful learning experiences. Moreover, Deci and Ryan's Self-Determination Theory (2000) explains that when students feel autonomous, competent, and connected to others, their intrinsic motivation increases. PjBL meets all three needs by allowing students to make decisions, solve problems collaboratively, and produce authentic outcomes. In mathematics, which is often seen as abstract and rigid, PjBL brings concepts to life and increases students' willingness to engage with challenging material.

Thus, this study not only confirms previous findings but also provides a more comprehensive and current view of how PjBL can be effectively implemented in the elementary mathematics classroom under Kurikulum Merdeka. The use of both motivation and learning outcomes as variables strengthens the contribution of this research. However, the study's limitations, including a relatively small sample size and short intervention period, suggest the need for further research with broader scope and longer duration to validate these findings more broadly.

CONCLUSION

This study concludes that the Project Based Learning (PjBL) model has a significant and positive effect on both student motivation and mathematics learning outcomes at the elementary school level within the framework of Kurikulum Merdeka. The experimental class, which implemented PjBL, showed consistently higher scores in both motivation and achievement compared to the control group. These results confirm that PjBL is not only

effective in improving academic performance but also in fostering students' intrinsic interest in learning mathematics.

Conceptually, these findings support the notion that learning becomes more meaningful and impactful when students are actively involved in solving real-world problems through structured project activities. PjBL embodies key principles of constructivist learning theory, which holds that knowledge is best constructed through active engagement and social interaction. Through the stages of planning, creating, presenting, and reflecting, students in the PjBL environment take ownership of their learning, leading to deeper understanding and greater retention. These outcomes align with Self-Determination Theory, where motivation thrives when learners experience autonomy, competence, and relatedness.

In the context of Kurikulum Merdeka, which emphasizes student-centered and contextual learning, PjBL is a highly compatible strategy. It addresses the competencies expected in 21st-century education—critical thinking, collaboration, creativity, and communication—while also nurturing students' ability to connect mathematical knowledge to real-life contexts. As such, PjBL does not simply improve scores; it cultivates lifelong learners who are motivated, reflective, and prepared to face complex challenges in the future.

Based on the findings, it is recommended that elementary school teachers adopt the PjBL model as an alternative to traditional methods, especially in mathematics learning. Schools should provide training and support for teachers to design and implement effective project-based activities that align with the competencies of Kurikulum Merdeka. Future researchers are encouraged to conduct longitudinal studies with larger and more diverse samples to examine the long-term impact of PjBL on student learning and motivation across different subjects and educational levels.

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