



Correlation of the flipped classroom learning and motivation on Mathematics learning outcomes

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ABSTRACT

Improving students' learning motivation should be a consideration for teachers when implementing learning activities. The objectives of this study were to 1) determine the relationship between the flipped classroom learning method and Mathematics learning outcomes; 2) determine the relationship between motivation and Mathematics learning outcomes; 3) determine the relationship between the flipped classroom learning method and motivation together with Mathematics learning outcomes. This study involved sixth-grade students from several elementary schools in Bekasi City: SDN 02 Babelan (96 students), SDN 03 Babelan (48 students), and SDN 09 Babelan (84 students). The research approach used in this study was a preliminary survey, with regression and correlation analyses. The data collection techniques used in this study consisted of two: a Mathematics learning outcome test in the form of questions and a Likert-scale questionnaire. The results of the study showed that 1) there was a positive relationship between the application of the flipped classroom learning method and Mathematics learning outcomes; 2) there was a positive relationship between motivation and Mathematics learning outcomes; 3) there was a positive relationship between the flipped classroom learning method and motivation, together with Mathematics learning outcomes. The flipped classroom creates an environment where existing motivation is leveraged, and low motivation is addressed through engaging classroom activities and direct teacher support.

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ABSTRAK

Meningkatkan motivasi belajar siswa perlu menjadi pertimbangan bagi guru dalam menerapkan kegiatan pembelajaran. Tujuan penelitian ini adalah untuk 1) mengetahui hubungan antara metode pembelajaran kelas terbalik dan hasil belajar Matematika; 2) mengetahui hubungan antara motivasi dan hasil belajar Matematika; 3) mengetahui hubungan antara metode pembelajaran kelas terbalik dan motivasi secara bersama-sama dengan hasil belajar Matematika. Penelitian ini melibatkan siswa kelas VI di beberapa sekolah dasar di Kota Bekasi, yaitu SDN 02 Babelan dengan jumlah siswa 96 siswa, SDN 03 Babelan dengan jumlah siswa 48 siswa, dan SDN 09 Babelan dengan jumlah siswa 84 siswa. Pendekatan penelitian yang digunakan dalam penelitian ini adalah metode survei pendahuluan dengan teknik regresi dan korelasi. Teknik pengumpulan data yang digunakan dalam penelitian ini terdiri dari dua, yaitu tes hasil belajar matematika berupa soal-soal dan angket berupa skala Likert. Hasil penelitian menunjukkan bahwa 1) terdapat hubungan positif antara penerapan metode pembelajaran kelas terbalik dan hasil belajar matematika; 2) terdapat hubungan positif antara motivasi dan hasil belajar matematika; 3) terdapat hubungan positif antara metode pembelajaran kelas terbalik dan motivasi secara bersama-sama terhadap hasil belajar matematika. Kelas terbalik menciptakan lingkungan di mana motivasi yang sudah ada dimanfaatkan dan motivasi rendah diatasi melalui aktivitas kelas yang menarik serta dukungan langsung dari guru.

Kata Kunci: luaran pembelajaran; Matematika; model kelas terbalik; motivasi belajar

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INTRODUCTION

Advances in technology place demands on the education sector to continually evolve to meet current needs. The needs of teachers and students in education are changing as various systems, methods, and technologies used in learning activities evolve. These developments are expected to help students consistently experience learning experiences that can improve their academic performance. Education today demands that schools change their learning approach from teacher-centered to student-centered (Banarsari et al., 2023). Therefore, a suitable method is needed to suit these needs.

Various research methods and models have been developed to keep up with current developments in the educational and digital realms, including the flipped classroom learning method. The flipped classroom method prioritizes learning that does not focus solely on lecture methods and materials, but emphasizes active participation, collaborative discussions, and the use of creative media (Yana & Sunnah, 2025; Yusuf, 2025). The flipped classroom is also considered to have a positive impact on students, including increased preparation for class, greater involvement in learning activities, deeper understanding, and increased self-confidence (Yusuf, 2025). The flipped classroom method is considered to have a positive impact on learning, including in Mathematics.

Mathematics is a compulsory subject for students. Mathematics learning focuses on students' understanding of numbers and logic so they can be used to solve real-world problems. The goal of Mathematics is to help students understand geometry, algebra, and arithmetic, thereby improving their thinking and logical thinking skills (Alimah et al., 2023). Mathematics plays a crucial role in solving everyday problems. However, students' Mathematics learning outcomes in schools are generally not really good yet.

In a study conducted in the 2019/2020 academic year with sixth-grade students at SD Negeri 1 Kaliasem, Banjar, it was found that student learning outcomes in Mathematics remained below the school's Minimum Completion Criteria standard score (Suandi, 2022). Then, the results of observations conducted in 2018 by teachers at SD Negeri 3 Dompu showed that student learning outcomes in arithmetic operations were low (Pujiarti et al., 2024). The results of observations in 2021 at SD Nuril Islam Pacitan showed that some students did not understand the Mathematics material being taught because they did not like the subject, so their desire to learn, read, and understand the material was very low (Ardhyantama et al., 2022). The problem of students' poor learning outcomes should be an opportunity for teachers to innovate in learning. School learning activities need improvement, and this is the task of schools and teachers.

In addition to adjusting and improving learning methods, teachers must also ensure students have sufficient motivation to learn Mathematics. Students who are motivated to learn tend to achieve good learning outcomes (Fernando et al., 2024). Students who lack motivation tend to be less able to perform learning activities effectively (Hikmah & Saputra, 2023). Therefore, improving student motivation to learn must also be a consideration for teachers when implementing learning activities. A study describes the factors related to students' low Mathematics learning outcomes, as shown in **Table 1**.

Table 1. Factors that Contribute to Students' Low Mathematics Learning Outcomes

Internal Factors	External Factors
1. Student physical health	1. Learning methods
2. Learning motivation	2. Learning media
3. Student interest in learning	3. School environment
4. Lack of attention	4. Family environment
5. Psycho-emotional	

Source: [Nahdania & Ain, 2024](#)

Based on Table 1, it can be seen that factors influencing students' Mathematics learning outcomes include learning motivation. Student motivation needs to be improved to boost Mathematics learning outcomes. Motivation is related to students' desires and interests in learning.

The advantages of the flipped classroom method, which is believed to impact learning activities, include increased student motivation and the potential to increase student interest in Mathematics and address low student learning outcomes in Mathematics. The flipped classroom is a potential solution for education as an interactive teaching strategy ([Danuri & Choirunisa, 2023](#)). Researchers aim to use the flipped classroom model to improve student learning and thereby increase their motivation to learn Mathematics.

Therefore, this study aims to investigate the following relationships in depth: 1) The relationship between the Flipped classroom learning method and Mathematics learning outcomes; 2) The relationship between motivation and Mathematics learning outcomes; 3) The combined relationship between the Flipped classroom learning method and motivation with Mathematics learning outcomes.

LITERATURE REVIEW

Education and Learning Process

Education is an absolute necessity that must be provided to improve the quality of human resources. Education today is a place to grow and develop, especially in terms of intellectual and quality of life ([Arafah et al., 2023](#)). Education provides a learning environment and process for students to develop their potential actively, fostering a religious spirit, self-control, personality, intelligence, noble character, and the necessary skills. Education in schools is made effective and of high quality by integrating technology into its implementation, so that students can become superior human resources.

Learning is a process in which behavioral changes occur from ignorance to understanding, encompassing knowledge, attitudes, and skills ([Rahmalia & Sabila, 2024](#)). The learning goal is success in achieving the desired learning outcomes. Of course, some factors influence achieving the desired success in learning. These factors fall into two categories: internal and external. Therefore, Indonesia is developing quality education through schools.

In the learning process, there is an objective. Learning outcomes are the abilities students possess, expressed as scores or numbers, after engaging in Mathematics learning activities ([Harefa, 2023](#)). The cognitive, affective, and psychomotor perspectives are part of the process of determining success. Good learning outcomes determine the success of the learning process, and vice versa: poor learning outcomes become a benchmark for its failure. Students' Mathematics learning outcomes remain below optimal levels.

Mathematics Learning

One of the sciences developed in formal education is Mathematics learning. Developing mathematical creative thinking skills is an important goal in modern education because these skills enable students to approach complex problems innovatively and adapt to various challenges (Mariani & Dewi, 2025). Mathematics is a pattern of thinking, organizational patterns, and logical proof. Mathematics learning is a learning and teaching activity that studies Mathematics to build mathematical knowledge useful for everyday life (Mardian & Hamdunah, 2023). The difficulty of understanding Mathematics lessons is thought to be related to the way teachers teach in class, which does not make students feel happy and sympathetic towards Mathematics (Fauzi et al., 2022).

Teachers in teaching do not provide real examples, so students find it difficult to reason or understand when applying the material they have received (Arya et al., 2024). Teachers' approach does not yet connect Mathematics learning to students' everyday problems. Students become passive targets in the learning process because the teacher provides only formulas and examples of their application, without explaining how students acquire the concept behind the formula, and then directs students to memorize them (Novianti et al., 2020). This has implications for student learning outcomes that are low or not aligned with the learning process targets.

Mathematics learning not only needs to be linked to students' daily life problems, but also to include real examples so that students can imagine what is written as real. Teachers must actively involve students in the learning process, and the concepts to be taught must be related to students' prior knowledge so that students can follow the lesson without obstacles (Rahmah & Lubis, 2024). Students have difficulty learning Mathematics because educators do not connect learning to students' daily activities and do not make the learning concrete enough so that students do not perceive Mathematics as difficult (Novianti et al., 2020). One cause is students' lack of interest in learning Mathematics. Students think that Mathematics is just a headache and nothing more than counting and playing with formulas and numbers (Novianti et al., 2020).

In Mathematics, every abstract concept that students have just understood needs to be immediately reinforced so that it settles and lasts a long time in the student's memory, becoming embedded in their thinking and action patterns. Therefore, it is necessary to learn through understanding the process and meaning so that students will not easily forget it.

Flipped Classroom Learning

One learning model that integrates information technology into the learning process is the flipped classroom. Technological advances, especially in the 21st century, have led to the emergence of various learning models and methods, including the flipped classroom (Egara & Mosimega, 2024). The Flipped classroom learning model combines online and offline learning, training students to be active participants in their learning. The flipped classroom is a learning model that uses a reverse approach, where activities that are generally only carried out in class can be done from home, and activities at home can be done in class (Fakhri et al., 2023). In its implementation, this learning combines classroom and out-of-classroom learning, using ICT and the UKBM (Independent Learning Activity Unit). Students are also given time to provide feedback on the material they are studying, both independently and through group problem-solving.

The flipped classroom model has the teacher present tasks to help students understand the material they will study at home. Teachers provide teaching materials, learning videos, and references to support knowledge acquisition and initial capital before studying, thereby creating a flexible, personalized learning environment enabled by technological advances. The flipped classroom strategy primarily uses learning

methods and content to enable students to study independently outside the classroom and to learn actively in a face-to-face classroom setting.

Kurikulum Merdeka's view regarding the role of information technology and communication in the learning process continues to develop rapidly; one aspect we often hear about is the flipped classroom learning model. The flipped classroom learning model has features that teachers can use to monitor and control students' access to lesson materials. Outside of class, students are encouraged to actively learn new material by reading or watching recorded lectures (Baig & Yadegaridehkordi, 2023).

Motivation Learning

Motivation to learn is very important for students; therefore, teachers need to understand students so they can take appropriate action. Motivation is a factor that has a strong positive influence on students' learning process, alongside other determinants of learning success such as teachers' abilities and the teaching materials used (Pranawengtias, 2022). Motivation can come from within the student as well as from external sources, enabling them to meet learning needs. High learning motivation is really important for students, as it helps them achieve learning outcomes. This learning motivation will encourage someone to do something to achieve their goals. If students are encouraged to learn, effective learning will occur, ultimately producing high learning outcomes.

Motivation drives most human activities, including foreign language learning, and it is affected by several intrinsic and extrinsic factors (Ali et al., 2023). Motivation to learn is also part of improving learning outcomes. With motivation, students will study harder, be more tenacious and persistent, and maintain full concentration during the learning process. Motivating learning is one of the things that needs to be emphasized in school learning efforts. Motivation is one factor that influences the success of student learning activities.

Learning motivation can significantly influence students' learning strategies (Yu, 2022). Without motivation, the learning process will be difficult to achieve optimum success. Learning motivation plays a very important role in the learning process; high motivation can help students achieve outstanding learning outcomes. Meanwhile, low learning motivation can hinder students from achieving satisfactory learning outcomes.

METHODS

This research aims to determine the relationship, partially or jointly, between the Flipped classroom learning model and motivation in Mathematics learning outcomes. This research uses a survey method with regression and correlation techniques, meaning the variables studied are not treated as continuous.

The target population comprises all class VI students of State Elementary Schools (SDN) in Bekasi Regency, specifically in the Babelan sub-rayon, totaling 228 people. In contrast, the accessible population consisted of class VI students at SDN 02 Babelan (96 students), SDN 03 Babelan (48 students), and SDN 09 Babelan (84 students), totaling 228 students. The calculation of the minimum number of respondents uses the Slovin formula, so the minimum sample size in this study is 145 students. Slovin's formula is a method for calculating the sample size.

Data collection techniques in this research included test and questionnaire methods. The instrument used in the form of a test is a Mathematics learning outcomes test. Mathematics learning outcomes are the cognitive abilities obtained by students after following the Mathematics learning process which is measured by the student's ability to solve a mathematical problem in the form of multiple choice questions which have a score of 1 for the correct answer and a score of 0 for the wrong answer which consists of

three cognitive levels, namely level 1 (L1) consists of the ability to remember and understand, level 2 (L2) consists of the ability to apply and level 3 (L3) consists of the ability to analyze.

RESULTS AND DISCUSSION

After conducting a validation test using point-biserial correlation, it was found that 26 of the 30 questions were deemed valid and very reliable, making them suitable for research. This research uses a closed-ended questionnaire to determine the effectiveness of the flipped classroom learning model and student motivation in learning. The Flipped classroom learning model is a teaching model in which a lesson is planned by the teacher, with in-class student activities serving as practice and preceded by activities outside the classroom as an independent learning process, using technological facilities to increase student involvement in learning.

The questionnaire uses a Likert scale from 1 to 4. Based on validity testing using the product-moment correlation coefficient, the 25-item Flipped classroom learning model questionnaire was found to be valid and highly reliable, making it suitable for research. Motivation is a score that describes the encouragement that arises both from within and outside the student, which can generate enthusiasm and enthusiasm for learning and provide direction to learning activities so that learning goals can be achieved, which students obtain after answering a questionnaire using a Likert scale with a score range of 1 to 4. To determine the validity of the motivation questionnaire, the product-moment correlation formula was used, yielding only 27 of the 30 questions as valid and in a very good, reliable range, making them suitable for research.

The data analysis technique in this research uses prerequisite test analysis with normality tests and linearity tests, as well as hypothesis test analysis with simple and multiple correlations. Researchers will use the Kolmogorov-Smirnov test to determine whether the data comes from a normally distributed population. The linearity test is performed by examining the equation of the regression line of the independent variable on the dependent variable. Based on the regression line, the significance of the regression coefficient and the linearity of the regression line are then tested. Hypothesis testing is carried out to determine the coefficient of determination, the simultaneous test, and the partial test.

The research hypotheses consist of 3: the first states that there is a significant relationship between the use of Flip Classroom media and Mathematics learning outcomes; the second states that there is a significant relationship between motivation and Mathematics learning outcomes. There is a jointly significant relationship between media use. Flip Classroom and motivation with Mathematics learning outcomes.

Normality Test

The normality test using the Kolmogorov-Smirnov-Z technique.

Table 1. Normality Test

Variable	Normality (Sig.)	Additional Information
Mathematics Learning Outcomes	0,200	Normally Distributed
Flipped classroom Learning Models	0,074	Normally Distributed
Learning Motivation	0,084	Normally Distributed

Source: Research 2025

Table 1 shows that all three variables are normally distributed since their significance levels (Sig.) are greater than 0.05.

Linearity Test

The ANOVA results in **Table 2** confirmed the linear relationship between the independent variables and the dependent variable.

Table 2. Linearity Test

Variable	Linearity (Sig.)	Additional Information
Flipped classroom (X1) on Learning Outcomes (Y)	0,467	Linear
Effect of Learning Motivation (X2) on Learning Outcomes (Y)	0,077	Linear

Source: Research 2025

Hypothesis Testing Results

The summary of regression analysis results is shown in **Table 3** below.

Table 3. Summary of Regression Analysis Results

Hypothesis	Relationship	Coefficient (β)	P-value
H ₁	$X_1 \rightarrow Y$	0.423	0.000
H ₂	$X_2 \rightarrow Y$	0.404	0.000
H ₃	$X_1, X_2 \rightarrow Y$	-	0.000

Source: Research 2025

Based on the regression analysis results shown in **Table 3**, all proposed hypotheses in this study are accepted. The Flipped classroom learning model (X₁) partially had a positive and significant effect on Mathematics learning outcomes ($\beta = 0.423$; $p < 0.05$). Similar results were found for the Learning Motivation variable (X₂), which also demonstrated a significant influence ($\beta = 0.404$; $p < 0.05$).

Furthermore, the simultaneous test results indicate that when both variables are integrated, the resulting regression model is $Y = 39.638 + 0.277X_1 + 0.212X_2$. Although the contribution coefficients shift within the multiple regression model, the joint influence remains highly significant ($p = 0.000$). This model yields a Coefficient of Determination (R^2) of 0.647, indicating that the Flipped classroom model and Learning Motivation explain 64.7% of the variance in Mathematics learning outcomes. In comparison, the remaining 35.3% is attributed to other factors not examined in this study.

Discussion

In implementing Mathematics learning under the Kurikulum Merdeka, teachers recognized that students' diverse needs require different learning support (Sumandya et al., 2023). Therefore, it was necessary to trial different learning methods appropriate to each student. The findings show a significant positive effect of the Flipped classroom model ($\beta=0.423$; 57.3% individual contribution) on Mathematics Learning Outcomes, highlighting its benefits. This makes the Flipped classroom method have a significant impact.

The Flipped classroom, characterized by externalizing content delivery (videos) and internalizing active learning (problem-solving, discussion), addresses the primary challenge in Mathematics: the need for guided practice and personalized feedback. The combination of dare learning and flipped classrooms produces higher learning outcomes than traditional teaching methods (Pimdee et al., 2024). The in-class time transforms from passive listening to active mastery and skill development (Pratiwi, 2021). This active approach is effective in increasing conceptual understanding and problem-solving skills in Mathematics (Walidah et al., 2020). Consequently, this method has demonstrated positive outcomes in learning

activities. The Flipped classroom increases self-confidence, improves academic achievement, student interest, and satisfaction, engages students in interactive learning and activities, and enhances student retention and overall performance (Kazeminia et al., 2022).

Motivation in education can decrease significantly among some student groups, so appropriate interventions are needed (Vu et al., 2022). The results strongly reinforce the fundamental role of motivation ($\beta = 0.404$; 52% individual contribution) as a determinant of success in Mathematics. A high motivation level serves as the student's internal drive, compelling them to engage more deeply with abstract, often challenging mathematical concepts. Students with higher motivation tend to exhibit greater persistence, self-regulation, and willingness to overcome difficulties, all crucial traits for mathematical mastery (Zay & Kurniasih, 2023). This finding serves as a reminder that technological or methodological innovation alone is insufficient; the student's affective state remains paramount. Students' emotional intelligence also positively affects their learning motivation (Chang, 2022). The flipped classroom method affects student motivation, thereby altering learning outcomes.

The most crucial finding is the synergistic relationship revealed by the simultaneous analysis, in which the combined variables explain 64.7% of the variance in learning outcomes ($R^2=0.647$). This magnitude is substantially higher than the individual contributions, suggesting that the Flipped classroom model and motivation mutually reinforce each other. Flipped classroom methods can be used to improve learning motivation and also outcomes at certain levels of education (Köpeczi-Bócz, 2024). A simultaneous increase in motivation can impact student learning outcomes.

Some teachers chose to utilize video in the flipped classroom method (Cevikbas & Kaiser, 2023). The chosen learning methods and media can influence learning outcomes. The Flipped classroom creates an environment where pre-existing motivation is leveraged, and low motivation is mitigated through engaging in-class activities and immediate teacher support. Therefore, this study confirms that the Flipped classroom is not just a delivery method, but an educational intervention that effectively stimulates student engagement (motivation) and translates that engagement into superior learning outcomes. This synthesis is strongly supported by systematic reviews indicating the Flipped classroom's positive impact on both motivation and outcomes (Waritsman, 2020). The individual regression coefficients in the multiple model ($\beta X_1 = 0.277$; $\beta X_2 = 0.212$) further clarify that, while both variables contribute uniquely, the greatest overall impact is achieved through their intentional integration. Based on the research, the flipped classroom method has a significant impact on learning, especially in Mathematics classes.

CONCLUSION

The conclusion of this study is formulated based on the answers to the three hypotheses regarding the relationship between the Flipped classroom Learning Model and Learning Motivation with Mathematics learning outcomes among sixth-grade students at SDN Babelan, Bekasi Regency. There is a positive and significant relationship between the implementation of the Flipped classroom Learning Model and students' Mathematics Learning Outcomes. This confirms that innovative, student-centered teaching methods make a tangible contribution to improving academic achievement.

There is a positive and significant relationship between learning motivation and students' mathematics learning outcomes. This finding reinforces the critical role of affective factors in predicting students' success in mastering mathematical material. There is a positive and significant simultaneous relationship between the flipped classroom learning model, learning motivation, and Mathematics learning outcomes. The combined contribution of these two variables indicates a strong synergy between pedagogical innovation and students' internal drive in achieving optimal learning results.

The subsequent research is advised to conduct a deeper study of the mediation or moderation mechanisms between the flipped classroom and learning outcomes, by including additional variables such as critical thinking ability, self-regulated learning, or self-efficacy, to uncover a more complex causal pathway. Research could also be extended using experimental methods to compare the effectiveness of the flipped classroom in a causal manner.

AUTHOR'S NOTE

The author also confirms that all data, analysis, and content contained within this article are original and free from plagiarism (*free from plagiarism*). All sources used have been accurately cited and referenced in accordance with applicable scientific writing standards.

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