The impact of the case-based learning model and learning motivation on learning outcomes

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Abstract: This study aims to explore the impact of implementing the case-based learning (CBL) model and student motivation on academic achievement in mathematics. The background of this research is the low interest and motivation of students in mathematics learning, which affects their academic performance. The research design uses an experimental method with a post-test approach. The subjects of the study consisted of 40 eighth-grade students from a junior high school, divided into experimental and control groups. The findings indicate that the application of the CBL model significantly improved students' learning outcomes compared to conventional learning, with a significance value of 0.000. On the other hand, students with high motivation showed better results than those with low motivation (significance value of 0.010). However, no significant interaction was found between the learning model and motivation in influencing learning outcomes. Based on these findings, it can be concluded that CBL is effective in improving mathematics learning outcomes, while motivation also plays an important role in students' academic achievement.

Keywords: Case Based Learning, mathematics, learning motivation, learning outcomes

Abstrak: Penelitian ini bertujuan untuk mengeksplorasi dampak dari penerapan model *Case Based Learning* (CBL) serta motivasi belajar terhadap pencapaian akademik siswa di bidang matematika. Rendahnya minat dan motivasi siswa terhadap pembelajaran matematika, yang berimbas pada pencapaian hasil belajar mereka merupakan dasar yang melandasi penelitian ini. Desain penelitian menggunakan metode eksperimen dengan pendekatan post-test. Subjek penelitian melibatkan 40 siswa kelas VIII SMP yang dikelompokkan menjadi dua kelompok, yakni eksperimen dan kontrol. Temuan penelitian menunjukkan bahwa penerapan model CBL memberikan peningkatan yang signifikan terhadap hasil belajar siswa dibandingkan dengan pembelajaran konvensional, dengan nilai signifikansi 0,000. Di sisi lain, siswa yang memiliki motivasi belajar tinggi menunjukkan hasil yang lebih baik dibandingkan dengan yang memiliki motivasi rendah (nilai signifikansi 0,010). Namun, tidak ditemukan adanya pengaruh interaksi yang signifikan antara model pembelajaran dan motivasi terhadap hasil belajar. Berdasarkan hasil ini, dapat disimpulkan bahwa CBL efektif dalam meningkatkan hasil belajar matematika, sementara motivasi belajar juga memainkan peran penting dalam pencapaian akademik siswa.

Kata kunci: Pembelajaran Berbasis Kasus, matematika, motivasi belajar, hasil belajar

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INTRODUCTION

Education, a vital factor in personal growth, is now confronted with new challenges due to the swift advancement of technological innovations in this digital age. The current digital revolution has brought about considerable transformations in education, driven by technological innovations (Selwyn, 2010). Technology offers students the chance to engage in independent learning through the use of the internet, e-books, and various learning applications, improving both the quality and productivity of their educational experience (Sun & Pan, 2021). Educators must continuously adapt, especially when it comes to creating effective strategies for teaching mathematics. Properly planned mathematics instruction is essential in developing students' abilities in logical reasoning and critical thinking

(Cresswell & Speelman, 2020). The integration of innovative and relevant mathematics learning into the curriculum is a crucial step in addressing this need.

Mathematics is often regarded as one of the most challenging subjects for many students. Many of them lose interest due to uninspiring teaching methods and limited access to supportive resources (Sihombing et al., 2021). A survey conducted by the national council of teachers of mathematics (NCTM) in 2021 revealed that nearly 60% of students expressed a dislike for mathematics (Passarella, 2021). This situation reflects a complex and multidimensional challenge, which is not only caused by learning factors but is also exacerbated by the negative stigma attached to it (Wijaya et al., 2019). The common perception that mathematics is a field reserved for individuals with exceptional intelligence further reinforces the psychological barriers that prevent students from actively engaging in mathematics learning (Mangarin & Caballes, 2024). This situation demands a more inclusive and innovative model to ensure that mathematics is perceived as a relevant and engaging subject for all students.

Another issue encountered is the negative stigma associated with mathematics, which can affect students' interest in the subject (Ainurrohmah & Mariana, 2018). The stigma that mathematics is a difficult subject, suitable only for those who are exceptionally intelligent or have a special talent, can make students feel discouraged and lose interest in learning mathematics (Purbaningrum et al., 2023). Therefore, efforts are needed to change the public perception of mathematics and educate them about its importance in daily life and future careers. Another factor contributing to the low interest in mathematics is the teaching methods, which are often perceived as unengaging and monotonous (Putra et al., 2022). Teaching methods that focus too heavily on direct instruction, without incorporating interactive and creative elements, can cause students to quickly become bored and lose interest in the subject.

A similar situation was observed during the researcher's visit to a junior high school in Malang Regency, where a low level of interest and motivation among students in mathematics learning was evident, which significantly affected their attendance rates. This situation highlights the necessity for innovative teaching approaches to provide students with a more interactive and meaningful learning experience. One model that can be implemented is case-based learning, a teaching method that uses real-world cases to help students gain a deeper understanding of concepts while simultaneously enhancing their critical thinking skills (Vani et al., 2022). Case-based learning motivates students to engage actively in their education by analyzing, discussing, and solving problems derived from real-world cases (Wijnia et al., 2024). This model motivates students to engage in deeper learning. It also helps students connect the learning material to real-world situations, thereby making the relevance of mathematics in daily life more apparent (Dewi & Rahayu, 2024).

The low interest and motivation of students in mathematics learning highlight the urgent need for more engaging and relevant teaching methods. Learning outcomes represent the effectiveness of the learning process, where students gain not only knowledge but also enhance their skills and attitudes (Robert & Owan, 2019). Learning motivation is essential for achieving educational goals and acts as a key motivator for students to engage in learning with enthusiasm (Sutanto & Suhermanto, 2024). Numerous studies have demonstrated that the use of case-based learning (CBL) can notably enhance student

learning outcomes (Aulia et al., 2023). Case-based learning enables students to relate course material to real-life situations, increasing their interest and participation in the learning process. The positive impact of this approach on student motivation and engagement makes it an effective strategy for improving the overall quality of education in schools.

Case-based learning is an instructional method that incorporates authentic scenarios cases or simulated scenarios to enhance students' conceptual understanding and foster critical thinking skills (Sapeni & Said, 2020). This approach motivates students to participate actively in learning by examining, debating, and resolving the given cases. According Irwanto et al. (2024), in the case-based learning model, learners are introduced to complex problems that often do not have a single correct answer, which encourages them to explore various solutions. This process not only requires an understanding of theory but also the capacity to implement it effectively in practical, real-life contexts.

The implementation of case-based learning (CBL) not only focuses on enhancing students' conceptual understanding and critical thinking skills but also holds significant potential in influencing overall learning outcomes (Mamahit et al., 2024). When students engage in analyzing and solving real-world cases, they do not simply learn to understand theoretical concepts (Lavi & Marti, 2023). Students also develop the ability to apply knowledge in relevant contexts. The learning experiences derived from this method are reflected in student learning outcomes, which serve as indicators of educational success. Learning outcomes encompass changes in students' abilities to think, act, and respond to situations more effectively (Hilmiatussadiah & Budiwati, 2023).

Learning outcomes are a tangible manifestation of a successful learning process, in which individuals experience changes in their thinking, actions, and responses to situations in a more effective manner (Duong & Le, 2021). These changes are not limited to the knowledge acquired but also encompass skills and attitudes that evolve over time. Through an effective learning process, individuals are equipped to face challenges in a more thoughtful manner, aligned with the expected educational goals. Students not only grasp theoretical concepts but also apply them in real-life situations, making the learning experience relevant and meaningful.

According to Degeng and Sudana (2013), learning outcomes are classified into three main aspects: effectiveness, efficiency, and appeal. Effectiveness denotes how well learning objectives are fulfilled, where students master the material and are able to apply it. Efficiency is related to the optimal use of resources, such as time and effort, to achieve learning outcomes. Appeal reflects how engaging and enjoyable the learning process is, which can influence students' motivation and involvement. Together, these three aspects determine the overall quality of learning outcomes.

One of the most influential factors in the effectiveness, efficiency, and appeal of the learning process is student motivation (Satynskaya et al., 2020). Motivation serves as the primary driver that encourages students to actively engage in learning and strive to achieve their academic goals (Nawaz, 2023). If learners feel motivated, they become more prone to becoming committed to the engaging in educational activities and the desired outcomes. Understanding the dynamics of student motivation is crucial for optimizing learning results and creating an effective learning environment. By comprehending students' motivations, educators can design appropriate learning models that enhance student engagement and achievement.

Learning motivation represents a key element contributing significantly to an essential impact in determining how successfully an individual can achieve their learning goals. This motivation can be likened to the "fuel" that drives and energizes individuals to learn diligently, enthusiastically, and persistently. Intrinsic and extrinsic influences which motivate a person to participate in active learning strongly affect educational outcomes achieved. Motivation is not merely a desire to learn, it is also a force that helps focus attention, enhance perseverance, and stimulate creativity in the learning process (Shin & Bolkan, 2020). When an individual possesses high motivation, they are more likely to persist in the face of challenges, retain information more easily, and apply the knowledge they have acquired more effectively (Alj & Bouayad, 2024). Furthermore, motivation plays a crucial role in boosting self-confidence. The success achieved through effort driven by strong motivation further strengthens an individual's belief in their learning ability.

Previous research has shown that learning models that implement case-based learning can enhance learner performance. A study conducted by Cen et al. (2021) showed that case-based learning (CBL) effectively enhances medical students' academic performance and case analysis skills compared to traditional teaching methods. Another study by Aulia et al. (2023) also revealed that employing the case-based learning model led to a more significant improvement in students' cognitive learner performance in contrast to the control group

This research emphasizes the crucial influence of learning motivation on students' academic achievements. The goal of this study is to explore and evaluate the effect of the case-based learning (CBL) approach and learning motivation on student performance in mathematics. The CBL method actively involves students in analyzing, discussing, and solving real-world cases, which deepens their understanding of mathematical concepts. Learning motivation fosters greater focus and enthusiasm among students throughout the learning experience. It is expected that this study will offer valuable insights for creating more effective teaching strategies in schools.

METHOD

This research is classified as quantitative research, aimed at collecting and analyzing numerical data to understand the relationship between the variables being studied. The method used is a quasi-experimental design, chosen to allow the research to be conducted in a natural setting without requiring full randomization. The design employed in this study is a non-equivalent control group design, where the treatment and comparison groups are not randomly assigned but share similar characteristics (Miller et al., 2020). This design enables the assessment of the impact of the treatment, even without full control over external variables that may influence the outcomes (Buluş, 2021). The implementation is carried out in a structured manner, with the investigation being carefully designed to obtain valid and accurate answers to the research questions. This study aims to investigate the differences in learning outcomes between the case-based learning method and traditional teaching approaches in mathematics at junior high schools in Malang Regency using an experimental research design. Additionally, the study seeks to compare the academic performance of students with elevated and minimal levels of motivation for learning within these schools. The research also examines the relationship between the case-based learning model and students' motivation for learning in influencing their educational achievements.

In this study, the variables that have been examined include (1) the variable of implementing case-based learning, (2) the moderating variable, which is learning motivation, and (3) the dependent variable, which is learning outcomes. The study categorizes these variables into two primary types: the treatment variable, which refers to the application of the case-based learning model, and the moderating variable, which is learning motivation, divided into low and high motivation levels. The classification of learning motivation levels is shown in Table 1.

Table 1. Learning motivation levels

Score	Level
1-8	Low Motivation
9-16	High Motivation

The questionnaire used to measure learning motivation consists of 16 statements designed to assess students' motivation levels. This study involves junior high school students as the research participants. The subjects consist of eighth-grade students from Junior High School in Malang Regency, a total of 40 participants. The sampling technique used is cluster sampling, where two classes are selected: one class consists of 20 students as the experimental group, and the other class consists of 20 students as the control group. In the initial meeting, both groups were administered a test and a questionnaire to measure their learning outcomes and motivation. The test used to measure the evaluation of educational results comprised 10 multiple-choice items and 5 essay-type questions. The instruments used in this study were validated through expert judgment to ensure content validity, while reliability testing was conducted using Cronbach's alpha, yielding a reliability coefficient of 0.85, indicating high reliability. Subsequently, the control group underwent instruction using the conventional teaching model, while the experimental group utilized the case-based learning model in mathematics, specifically on the topic of probability. A two-way ANOVA was used as the data analysis technique to test the hypotheses. Before the analysis, prerequisite tests, including normality and homogeneity tests, were conducted.

RESULTS AND DISCUSSION

Before proceeding with the data analysis using the two-way ANOVA technique, prerequisite tests are necessary to ensure the authenticity and reliability of the analysis results. The normality test aims to confirm that the data follows a normal distribution, in accordance with the fundamental assumption of parametric statistical analysis. The Shapiro-Wilk test is used due to its high sensitivity for small to moderate sample sizes. The outcomes of the normality test provide the foundation for the next procedures in data analysis. The normality test results for the variable score distribution are presented in Table 2.

Table 2. Test of normality

Data	Shapiro-Wilk		
	Statistic	Df	Sig.
Post-test	0.976	40	0.555

The normality test revealed a significance level of 0.555 for the learning outcomes, which is above 0.05. This result indicates that the data conforms to a normal distribution. The analysis was then continued by performing a homogeneity test to determine the equality of variances in the dependent variable based on specific variations of the independent variable. The equality of variances is an essential prerequisite before proceeding to the next stage of statistical analysis. The findings of the test for homogeneity are shown in Table 3.

Table 3. Test of homogeneity of variance

Data	Levene			
	Statistic	df_1	df_2	Sig.
Post-test	0,862	3	36	0.470

The homogeneity test shows that the Levene's Statistic value is 0.862 with degrees of freedom 3 and 36, and a significance level of 0.470. A significance value greater than 0.05 indicates that the variance of the post-test data is homogeneous. This homogeneity of variance satisfies the assumption necessary to proceed with the two-way ANOVA statistical analysis.

The goal of mathematics education is not only to focus on the mastery of concepts but also on the development of students' abilities to think logically, analytically, and creatively to solve problems. Additionally, mathematics education aims to train students to make informed decisions based on data and to apply the concepts learned in various real-life situations. Learning outcomes serve as essential indicators of the success of the educational experience, including mastery of the content, the utilization of concepts, and enhancing critical thinking abilities. An appropriate approach is crucial to ensure that students grasp the material and are able to overcome various learning obstacles. The educator's function is vital, acting as both a guide and a motivator to help students address any learning challenges they may face. This study examined the variations in academic performance among learners taught through the application of the case-based learning model and those taught through the conventional learning model in mathematics. These results confirm that the case-based learning model leads to significantly higher learning outcomes compared to the conventional learning model.

Table 4. Significance test of learning models

Variable	df_1	df_2	Mean Square	F	Sig.
Case Based Learning	1	36	744.467	24.5	0.000

The findings from the first statistical analysis indicate a notable disparity in the academic performance of learners instructed with the conventional method in comparison to those using the case-based learning approach in mathematics. The average academic performance for students receiving conventional instruction was recorded at 67.263, which is lower than the average for those using the case-based learning approach, which was 75.934. These results underscore that the case-based learning method is more effective and superior in improving student academic performance compared to the conventional approach.

This conclusion aligns with the perspective of Ramadani and Yuni (2022), who states that case-based learning is an innovative and effective teaching method that helps students develop their knowledge, leading to improved learning outcomes. Furthermore, case-based learning not only strengthens conceptual understanding and furthermore provides a more interactive and relevant educational experience (Raza et al., 2020). The implementation of learning models such as case-based learning holds significant potential to improve the quality of education, particularly in subjects that require deep understanding, such as mathematics. On the other hand, the conventional approach, which tends to be teacher-centered and lacks active interaction, needs to be re-evaluated and adjusted to be more responsive to the demands of modern education. This opens up opportunities for further research on optimizing various innovative teaching strategies to enhance the effectiveness of student learning outcomes.

Learning motivation is a key factor influencing students' success in achieving optimal learning outcomes (Howard et al., 2021, Nasir et al., 2023). Every student has a different level of learning motivation, which ultimately affects how they respond to the learning process, whether in understanding the material, completing assignments, or facing evaluations (Liu et al., 2020). High motivation generally encourages students to be more diligent, persistent, and enthusiastic about learning, while low motivation often leads to a lack of initiative and effort in absorbing the material.

Learning motivation is closely linked to an individual's personal development and does not develop in isolation (Kamalruzaman et al., 2023). During childhood, learning motivation is influenced by the family environment, including parenting styles, family economic conditions, parental education levels, occupations, and relationships with siblings (Younas et al., 2021). These factors contribute significantly to the formation of students' learning motivation. This study's findings highlight that students with higher learning motivation generally attain better learning outcomes compared to those with lower motivation.

This study investigated the gaps in learning outcomes among learners with high learning motivation and those with low learning motivation. These findings confirm that learning motivation significantly influences students' learning outcomes. The results in Table 5 show that students' motivation levels have a significant impact on their academic performance.

Table 5. Significance test of learning motivations

Variable	df1	df2	Mean Square	F	Sig.
Learning Motivation	1	36	226.467	7.45	0.010

The outcomes of this research suggest that variations in the learning achievements of students are closely related to their level of learning motivation. Learning motivation serves as an internal force that shapes students' willingness to take an active role in the learning process (Urhahne & Wijnia, 2023). Students with high learning motivation are typically more eager to grasp the material, complete tasks, and engage in class activities. On the other hand, students with low learning motivation often display less initiative in their studies, which affects their academic performance. Therefore, understanding the factors influencing learning motivation is a crucial step in improving student learning outcomes.

Utilizing the right learning strategies has been shown to be successful in enhancing student academic performance (Donker et al., 2014). Learning strategies designed with consideration for students' needs can help develop a more dynamic and engaging study environment. One such strategy that can be an effective solution is case-based learning. This model is designed to present real-life cases that are relevant to the material, encouraging students to contribute more actively to the educational process. This approach allows students to directly engage in understanding and analyzing the material, which ultimately improves their learning outcomes. With active student involvement, case-based learning creates a more focused and directed learning process, especially in helping students achieve the established learning objectives. This strategy is relevant to improving students' academic performance, especially in the context of varying learning motivations.

Students who were instructed using the case-based learning model demonstrated significantly higher learning outcomes compared to those taught through traditional teaching methods (Maia et al., 2023). The case-based learning model, which encourages active engagement through problem-solving and real-world scenarios, seemed to foster a deeper understanding of the material and promoted greater retention. In contrast, students in the conventional learning model showed less improvement, possibly due to the more passive nature of traditional teaching strategies that primarily focus on direct instruction (Ramadani & Yuni, 2022). The study also emphasized that case-based learning significantly contributes to students' academic achievement. As a result, the implementation of case-based learning has proven to significantly enhance learning outcomes for students, regardless of their motivation levels, whether high or low. This finding emphasizes the effectiveness of case-based learning as a more impactful alternative to traditional teaching methods. Das et al. (2021), and Tsekhmister (2023) also stated in their research that the choice of learning model affects learning outcomes, with case-based learning being more effective than conventional methods. This is in line with the research by Hassan et al. (2023) who found that students engaged in case-based learning demonstrated significant improvements in motivation and participation compared to those who followed conventional learning. This model allows students to apply theory in real-life situations, thereby increasing the relevance of learning and motivating them to be more active participants (Kurniawanti et al., 2023; McCabe et al., 2009).

This research explored how the case-based learning model and learning motivation interact in influencing students' academic performance. The results show that these two factors do not interact in affecting students' learning outcomes. These findings imply that the effects of learning models and motivation on outcomes might function separately, without a significant interaction between them.

Table 6. Significance test of learning model and learning motivation

Variable	df1	df2	Mean Square	F	Sig.
CBL Model * Learning Motivation	1	36	2.184	0.072	0.790

This aligns with the research by Siregar (2023) which highlighted the crucial role of learning motivation in students' achievement. Although an increase in learning motivation can positively impact learning outcomes, this impact was not found to be significant. Similar

findings were reported by Suharyadi and Sukoco (2022) who also found no significant effectiveness of learning motivation and instructional strategies on academic performance. Both studies indicate that while motivation is a fundamental aspect of the learning process, its influence may not directly translate into measurable improvements in academic performance. Therefore, motivation should be viewed as one of many contributors to learning, rather than a sole determinant of success.

Another study by Khan (2024) revealed that the interaction effect between teaching methods and learning motivation tends to manifest indirectly through mediating variables such as the amount of student interaction in the classroom. This suggests that motivation and learning models may influence outcomes through their combined effects on students' behavior and participation. The impact of teaching models on learning outcomes is often stronger when combined with other factors, such as metacognitive skills or support from the learning environment (Parwata et al., 2023). These findings emphasize the importance of a holistic approach in education that integrates various elements to achieve optimal learning outcomes. Consequently, the absence of direct interaction should not undermine the significance of motivation and teaching models in shaping educational experiences.

 While some studies indicate that learning motivation does not significantly influence learning outcomes, this factor remains essential in the educational process (Wardani et al., 2020). Learning motivation represents an internal desire that can fluctuate based on life experiences, including interactions with peers and the surrounding environment (Tu & Chu, 2020). These life experiences can affect students' motivation, either positively or negatively, making learning motivation dynamic. Additionally, without sincere effort, learning motivation will not effectively support learning success (Schoon & Ng-Knight, 2017). The internal nature of learning motivation makes its measurement challenging and contributes to the complexity of its relationship with learning outcomes. Thus, motivation should still be nurtured, even if its effects are not immediately evident in measurable outcomes.

CONCLUSION

Based on the results and discussions presented earlier, several important conclusions can be made. A notable difference in student learning outcomes exists between those who were taught using the case-based learning model and those who received instruction through traditional methods. Students who learned through the case-based learning model tend to demonstrate better academic performance compared to those who followed the conventional model. Additionally, a significant difference in learning outcomes is observed between students with low learning motivation and those with high learning motivation, highlighting the crucial role of motivation in shaping academic success. However, no significant interaction was observed between the case-based learning model and learning motivation regarding student learning outcomes. This indicates that although both the learning model and motivation individually affect student performance, they do not interact to create a combined impact on learning results.

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