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The Effect of the Double Loop Problem Solving (DLPS) Learning Model on the Mathematics Learning Outcomes of Class VIII Students of SMP N 2 Tilatang Kamang

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Abstract

This study is motivated by the results of analysis and observation of the Daily Mathematics Test in eighth-grade classes at SMP N 2 Tilatang Kamang, which showed low students' mathematics learning outcomes and teacher-centered instruction. One alternative strategy to address this issue is the implementation of the Double Loop Problem Solving (DLPS) learning model. This study aims to examine the effect of the DLPS learning model on the mathematics learning outcomes of eighth-grade students at SMP N 2 Tilatang Kamang. A pre-experimental design with a Static Group Comparison Design was employed. The population consisted of all eighth-grade students at SMP N 2 Tilatang Kamang, comprising four classes with a total of 101 students. Sampling was conducted randomly after normality, homogeneity, and mean equivalence tests were performed on the population data. Class VIII.2 was assigned as the experimental group, while Class VIII.1 served as the control group. The research instrument was a posttest designed to measure students' mathematics learning outcomes. Data were analyzed using a t-test. The findings show that the t-count value was 3.696, while the t-table value was 1.67. Since the t-count exceeded the t-table, H_0 was rejected and H_1 was accepted. The SPSS analysis also produced a p-value of 0.01, indicating a statistically significant difference in mathematics learning outcomes between the experimental and control groups. These results demonstrate that the DLPS learning model has a significant effect on students' mathematics learning outcomes. The study contributes to mathematics education by providing empirical evidence that problem-solving-oriented learning can improve students' achievement and reduce reliance on teacher-centered instruction.

Keywords: Double Loop Problem Solving; Mathematics Learning Outcomes; Pre-Experimental Design; Problem-Solving Learning; Junior High School Students

INTRODUCTION

Education serves as a fundamental foundation in the creation of civilization, significantly contributing to the enhancement of human resources, fostering individual capabilities, and cultivating the character of a wise and honorable society. Through deliberate and intentional efforts, education not only focuses on sharing knowledge but also on developing personal traits and competencies that enable individuals to adapt to evolving circumstances. Education is a societal initiative aimed at nurturing personal identity in alignment with community values or serving as a means to assist learners in enhancing and advancing their knowledge, abilities, ethics, mindsets, and behavior that are beneficial for living (Ifnaldi, 2021). A critical method to fulfill these objectives and purposes of education, ensuring their effective implementation, can be achieved through the process of learning (Rosita, 2018). Learning is characterized as any organized and deliberate initiative by educators to establish environments conducive to student participation in educational activities (Asmara & Nindianti, 2019).

Learning is deemed effective when it satisfies the following criteria: (1) the attainment of student learning goals, (2) the efficiency of student participation, meaning that students engage in educational activities within the optimal period defined in the lesson framework, (3) the proficiency of teachers in facilitating effective instruction, and (4) favorable student reactions to the learning process (Harefa, 2023). Education is attainable through school. Within the educational setting, knowledge can be gained through the exploration of different scientific fields, one of which includes mathematics. Mathematics plays an essential role in daily living as it acts as a connector among various types of knowledge in the sciences.

Moreover, mathematics serves as a tool for addressing challenges that arise in everyday situations. Yufri Anggraini posits that the significance of mathematics for learners is due to: (1) its continuous application across all facets of life, (2) the necessity for mathematical abilities in all academic disciplines, (3) its effectiveness as a clear and concise means of communication, and (4) its capacity to convey information through multiple formats. A notable feature of mathematics is its abstract quality. This abstract quality often leads to difficulties for many students when attempting to grasp mathematical concepts (Anggraini, 2021). As a result, the teacher's role becomes vital in helping students to strengthen and enhance their foundational understanding of mathematics. Competent educators consistently reflect on their students' progress and how to direct them effectively to achieve the intended outcomes using a variety of innovative teaching methods. They foster an enjoyable learning atmosphere and empower students to achieve educational objectives by implementing diverse learning models.

According to Dolong, a learning model serves as a framework or guideline that is utilized for planning both classroom and practical educational experiences (Dolong, 2016). Khoerunnisa & Aqwal (2020) state that a learning model functions as a visual representation outlining step-by-step methods for designing learning opportunities to meet educational goals, and it acts as a guide for educators and planners in coordinating, organizing, and executing teaching and learning processes. Enhancement of mathematics education at every level can be achieved by encouraging active participation from students in all learning activities that connect the subject matter to their own experiences (Imamuddin, 2022).

To address the issues at SMP N 2 Tilatang Kamang, the research team carried out preliminary observations starting on July 24, 2025, in classes VIII. 1 and VIII. 2, followed by class VIII. 3 on July 25, 2025, and class VIII. 4 on July 29, 2025. The findings indicated that students had difficulty comprehending and retaining the information presented. As a result, when the teacher posed questions, some learners managed to answer them, while the majority faced challenges.

The researcher then continued with additional observations on November 22, 2025, in classes VIII. 1 and VIII. 2, and on December 2, 2025, in classes VIII. 3 and VIII.

4. These observations indicated that the approach to learning remained primarily centered around the teacher. The session commenced with the instructor presenting the material via a lecture and offering example questions. Subsequently, students were directed to take notes, after which the teacher assigned exercises related to the discussed content. During the exercise phase, while some students successfully completed the tasks, a larger number struggled and tended to replicate the answers of their classmates. A portion of students was unable to complete the assignments. Finally, the teacher requested that those who had completed the exercises submit their work and then check the answers individually.

Additionally, researchers conducted interviews with mathematics educators, Ms. Reni Susanti, S. Pd., on November 22, 2025, and Ms. Mirma Ade Suryani, S. Pd., on December 2, 2025. The conversations revealed that conventional teaching methods remain prevalent, encompassing lectures, interactive Q&A sessions, and hands-on demonstrations. The instructors also noted that students' academic achievement often appeared to be inadequate. Learning outcomes depend on the abilities and understanding that students acquire through their educational experiences during the learning activities (Rahmadani et al., 2023).

Educational outcomes signify changes in students' behavior, attitudes, knowledge, and abilities obtained after participating in learning tasks. As stated by Solikah and Yulianto (2020), learning outcomes reflect the achievements quantified in numerical values or scores after a learning assessment is conducted at the conclusion of each instructional unit. Muharmansyah & Imamuddin (2023) emphasize that in educational environments, learning outcomes are vital indicators for assessing the efficacy of the teaching and learning process. This is where information is transmitted from the instructor to the student. Learning outcomes are fundamental within the educational framework; Consequently, various instructional models have been implemented to enhance students' academic performance (Wulandari et al., 2024).

Learning outcomes are often known as assessment results presented as numerical values or statements that indicate the students' understanding of the material (Sari et al., 2024). To achieve student learning outcomes that match their abilities, it is crucial to have support from both the students and the school. In addition to creating effective lessons, educators must also set Learning Objective Achievement Criteria (KKTP) that students are expected to fulfill. Teachers use examinations as a method to assess student learning outcomes. An example of this evaluation is the questions posed during the Daily Test (UH), which correspond to the implemented KKTP, specifically set at 70 for mathematics.

Table 1. Students' Mathematics UH (Daily Test) Scores Conducted by Teachers in Class VIII of SMP N 2 Tilatang Kamang

No	Class	Jumlah			Percentage (%)	
		Student	**< 70**	**≥ 70**	Above KKTP	Below KKTP
1	**VIII 1**	6	22	4	15,4	84,6
2	**VIII 2**	6	23	3	11,5	88,5
3	**VIII 3**	24	22	2	8,3	91,7
4	**VIII 4**	25	21	4	16	84

Source: (Mathematics VIII subject teacher, SMPN 2 Tilatang Kamang)

Table 1 illustrates that the mathematics academic achievements of students at SMP N 2 Tilatang Kamang remain fairly low. Numerous students still fall short of the minimum competency standard (KKTP). In simpler terms, a larger number of students have not attained the KKTP compared to those who have. This indicates that the mathematical achievement of the eighth-grade students at SMP N 2 Tilatang Kamang falls short of expectations. In light of these difficulties, teachers need to adopt methods that improve math learning results, with one option being the choice of an appropriate learning model, such as Double Loop Problem Solving (DLPS). This model encourages students to actively participate in thinking, discussions, and sharing opinions, which subsequently improves their social skills and confidence in conveying ideas, both in group environments and during classroom presentations.

The Double Loop Problem Solving (DLPS) educational framework is a method of problem-solving that emphasizes discovering the root causes of issues. According to Prayitno, DLPS can be applied in group settings, enabling students to converse with each other, work together to solve problems, and engage more openly with their peers or groups, while simultaneously improving their thinking, behavior, and verbal communication (Prayitno, 2023). Adopting the Double Loop Problem Solving (DLPS) strategy will result in changes for students, affecting both their academic performance and their holistic personal development. The DLPS-centered learning framework can also improve students' emotional and cognitive learning outcomes. The advantages of the Double Loop Problem Solving (DLPS) learning model can illuminate its effectiveness in facilitating enhancements in student learning.

The utilization of the Double Loop Problem Solving (DLPS) educational framework has proven to greatly improve teaching and learning approaches, particularly in boosting student academic achievement. This finding is backed by the study by Iskandar & Akbar, (2025, which shows that both descriptive and inferential analyzes demonstrate a beneficial effect of the double loop problem-solving model on the mathematical reasoning abilities of eighth-grade students at SMP Negeri 3 Campalagian. Considering the context provided, the researcher intends to conduct a study named "The Impact of the Double Loop Problem Solving (DLPS) Learning Model on the Mathematics Learning Outcomes of Class VIII Students at SMP N 2 Tilatang Kamang."

METHODS

This study utilized an experimental method incorporating a static group comparison design. A static group comparison framework involves dividing a single cohort into two separate groups: one allocated for the experimental intervention and the other acting as the control group that does not receive treatment (Nurdiana et al., 2026). The study was conducted with two different groups: one labeled as experimental and the other as control. The experimental group was taught using the Double Loop Problem Solving (DLPS) learning framework, while the control group utilized conventional teaching approaches. The population of interest included all 101 eighth-grade students from SMP N 2 Tilatang Kamang in the 2025/2026 academic year. A basic random sampling technique was used to select the sample, resulting in class VIII. 2 identified as the experimental group and class VIII. 1 serving as the control group

For the measurement in the study, a post-test was employed, which was subject to rigorous assessments of validity, reliability, difficulty, and discrimination ability. Data collection was completed via an examination of learning results following the intervention. The following data analysis was carried out using prerequisite tests to assess normality and homogeneity. Moreover, a t-test was used to assess hypotheses and determine variations in educational results between the two groups. The analysis revealed a significant difference between the experimental and control groups, indicating that the DLPS learning model has a beneficial effect on students' mathematics performance.

RESULTS

Following the test, information regarding the mathematics learning results in the sampled class was gathered, as shown in the table below:

Table 2 Calculation of Results from the Mathematics Learning Outcome Test

Class	N	Max	Min	$\overline{x}$	S
Experiment	26	100	40	76,885	15,7996
Control	26	100	34	58,077	20,583

Based on the data presented in Table 2 earlier, a significant difference was observed in the mean scores of the experimental group at 76.885, in contrast to the control group's average of 58.077. As a result, the average score of the experimental group surpasses that of the control group. This is demonstrated in the following table:

Table 3 Percentage of Student KTTP in the Experimental Group and Control Group

Class	Amount	KKTP ≥ 70		KKTP < 70	
		Amount	**Percent**	**Amount**	**Percent**
Experiment	26	18	69%	8	31%
Control	26	6	23%	20	77%

Table 3 shows that a greater number of students in the experimental class obtained scores exceeding the minimum competency criteria (KKTP) in comparison to the control class. In the experimental group, 18 students scored above the KKTP, representing 69%, whereas 8 students scored below it, accounting for 31%. Conversely, in the control group, only 6 students surpassed the KKTP, representing 23%, whereas 20 students did not meet it, totaling 77%. The proportions of KKTP for the selected classes can be represented in the chart below:

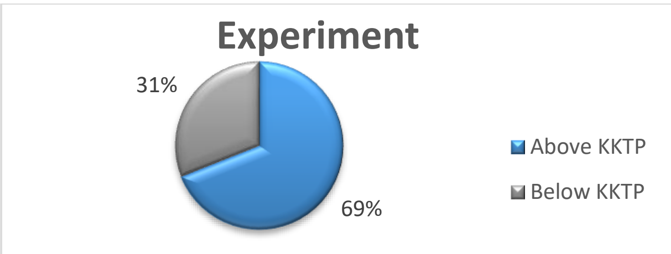

Figure 1. Percentage of Experimental Class

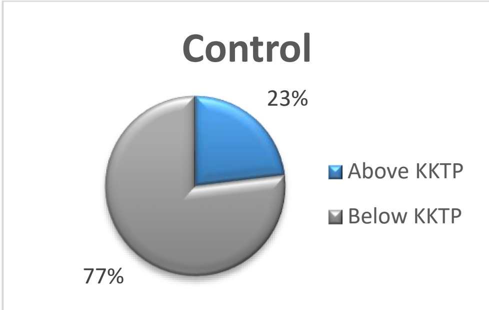

Figure 2. Percentage of Control Class

Figures 1 and 2 show a comparison of the learning outcomes between the students in the experimental group and those in the control group. The students in the experimental group, taught with the Double Loop Problem Solving (DLPS) method, achieved higher percentages in mathematics compared to those in the control group, who experienced conventional teaching methods. The outcomes of the data examination are as follows:

1. Normality Test

The results of the normality test at a significance level of α=0.05 are shown in the table below:

Table 4 Outcomes of the Normality Assessment for Mathematics Learning Results in the Experimental and Control Groups

Class	α	Sig	Conclusion
Experiment	0,05	0,200	normally distributed
Control	0,05	0,106	normally distributed

According to Table 4, the Sig value >α=0.05 was found for both the experimental class and the control class, indicating that the data follows a normal distribution.

2. Homogeneity Test

The outcomes of the homogeneity test using the F test at a significance level of α=0.05 are presented in the table below:

Table 5 Outcomes of the Homogeneity Test for Mathematics Learning Results in the Sample Class

α	$Sig.$	f_{table}	f_{count}	Conclusion
0,05	0,245	1,95	1,697	homogen

As shown in Table 5 above, the f_{count} value being less than or equal to f_{table} indicates that the variances of the two samples are indeed homogeneous.

3. Hypothesis Test

Once it was established that both sample classes exhibited normal distribution and had uniform variances, a hypothesis test was performed using the t-test. The outcome of the hypothesis test calculation using the t-test on both sample classes revealed that tcount = 3.696 and ttable = 1.67; hence, since tcount > ttable, we reject H0 and accept H1. Thus, it can be inferred that the mathematics learning results of students using the Double Loop Problem Solving (DLPS) model are superior to those of students engaged in traditional learning methods in class VIII at SMP N 2 Tilatang Kamang.

DISCUSSION

The results of the study revealed a significant difference in math achievement levels between students taught using the Double Loop Problem Solving (DLPS) method and those educated via traditional instruction. This variation was demonstrated by the experimental group's average score of 76.885, exceeding the control group's average score of 58.077. The experimental group's learning completion rate was 69%, whereas the control group achieved only 23%. Moreover, the hypothesis testing showed a significance level of 0.001, which is lower than the 0.05 threshold. Consequently, it can be inferred that the DLPS approach significantly impacts mathematics students' learning outcomes. The power of the DLPS method lies in its educational framework, concentrating on problem-solving and the examination of root causes, enabling students to achieve a deeper understanding (Ayu et al., 2021). This dual-stage cognitive process promotes active student engagement in discussions, sharing thoughts, and reflecting on the discovered solutions, resulting in a more valuable learning experience rather than just a routine process (Kusnandar & Mirza, 2025).

The results of this study indicate that the DLPS educational model enhances performance in mathematics, shown by the superior average scores and completion rates among students in the experimental group versus those in the control group. In relation to past studies, these results exhibit both similarities and differences that enhance the contribution of this research. Research conducted by Putri, (2022) indicated that the problem-solving approach can enhance student outcomes but still concentrates on solving issues without a significant focus on extensive reflection. On the other hand, Jusniani, (2018) discovered that incorporating error analysis in learning can enhance understanding of concepts, yet it does not regularly include the identification of underlying problems like DLPS does.

The study by Iskandar & Akbar, (2025) also indicated that innovative learning models based on discussion promote student engagement, but they do not specifically highlight double-loop thinking. Therefore, this research presents an edge over prior investigations as it not only focuses on the problem-solving aspect but also emphasizes causal analysis and reflection, thus maximizing learning outcomes (Syah et al., 2022). This distinction illustrates that DLPS offers a more holistic contribution to mathematics education by combining cognitive, metacognitive, and reflective elements into a unified learning approach.

The results of this research indicate that the DLPS model is an effective method for enhancing students' performance in mathematics. It is recommended that educators incorporate this model into their teaching practices as it has the potential to boost students' engagement, teamwork, and critical analysis capabilities. Additionally, applying DLPS can transition education from a focus on teachers to a focus on students, allowing for greater student participation in the educational experience. From a policy standpoint, educational institutions can promote the adoption of creative learning frameworks like DLPS to elevate the standards of mathematics education.

Nonetheless, this research has multiple constraints. To begin with, the methodology applied was pre-experimental, which means it could not regulate all the outside factors that could affect the outcomes. Additionally, the small sample consisting of just two classes implies that the findings cannot be universally applied. Furthermore, students encountered challenges at the beginning phase of applying the DLPS model, as they were not yet familiar with a learning approach that demands engagement and self-reflection, which necessitated a longer adjustment time. Consequently, it is suggested that future studies should employ a more rigorous experimental framework and include a larger sample size for more thorough results.

CONCLUSION

Summary of Research Results

The Double Loop Problem Solving (DLPS) learning model is a form of problem-solving-oriented learning that focuses on identifying the root cause of the issue. The Double Loop Problem Solving (DLPS) learning model offers insights into how learning can enhance student learning outcomes. According to the findings from the hypothesis test conducted with the t-test, tcount was determined to be 3.696 and ttable was 1.67, thus tcount > ttable indicates the rejection of H0 and the acceptance of H1. Thus, it can be inferred that the mathematics achievement of students engaged in the Double Loop

Problem Solving (DLPS) learning model surpasses the mathematics achievement of those participating in conventional learning in class VIII of SMP N 2 Tilatang Kamang.

Contribution to Science

This research provides important theoretical and practical insights for improving mathematics education. From a theoretical perspective, it contributes to the investigation of learning models centered on problem-solving by presenting the Double Loop Problem Solving (DLPS) method, which emphasizes not just resolving issues but also examining root causes and contemplating the cognitive processes of learners. This approach improves understanding of how combining higher-order thinking with metacognitive strategies can result in better results in mathematics education.

Recommendations for Further Research

Future research could benefit from implementing a more rigorous research framework, such as a true experimental design, to improve control over external factors and produce more dependable outcomes. Future research should include a larger and more diverse participant group to enable broader generalization of results.

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