JURNAL ABSIS
Jurnal Pendidikan Matematika dan Matematika
Vol. 8 No. 3, December 2025

THE EFFECT OF THE DISCOVERY LEARNING MODEL ON STUDENTS' MATHEMATICAL REFLECTIVE THINKING SKILLS

Fadhel Ahmad Meizano[1], Nurhanurawati[2], Mella Triana[3]
[1,2,3] Universitas Lampung, Indonesia
fadhelbaturaja891@gmail.com

ABSTRACT Mathematical reflective thinking is an essential higher-order thinking skill that supports students in analyzing, evaluating, and drawing conclusions during problem solving. This study aims to examine the effect of the Discovery Learning (DL) model on students' mathematical reflective thinking skills. The research employed a quantitative approach using a quasi-experimental design with a pretest–posttest control group. The population consisted of all Grade VIII students of SMP Negeri 9 Bandar Lampung in the 2024/2025 academic year, with two classes selected as the experimental and control groups through cluster random sampling. Data were collected using a mathematical reflective thinking skills test and analyzed using N-Gain analysis and an independent sample t-test. The results show that students taught using the DL model achieved higher posttest scores and greater improvement in mathematical reflective thinking skills compared to students taught through conventional learning. The average N-Gain of the experimental class was higher than that of the control class, and hypothesis testing indicated a significant difference between the two groups. These findings indicate that the Discovery Learning model has a positive and significant effect on students' mathematical reflective thinking skills and can be effectively implemented in mathematics learning.

Keywords: Discovery Learning, mathematical reflective thinking, mathematics learning, junior high school

ABSTRAK Kemampuan berpikir reflektif matematis merupakan salah satu keterampilan berpikir tingkat tinggi yang penting dalam pembelajaran matematika, terutama dalam menganalisis, mengevaluasi, dan menarik kesimpulan saat menyelesaikan masalah. Penelitian ini bertujuan untuk mengetahui pengaruh model Discovery Learning (DL) terhadap kemampuan berpikir reflektif matematis peserta didik. Penelitian ini menggunakan pendekatan kuantitatif dengan desain kuasi-eksperimen berbentuk pretest–posttest control group design. Populasi penelitian adalah seluruh peserta didik kelas VIII SMP Negeri 9 Bandar Lampung tahun ajaran 2024/2025, dengan dua kelas yang dipilih sebagai kelas eksperimen dan kelas kontrol melalui teknik cluster random sampling. Pengumpulan data dilakukan menggunakan tes kemampuan berpikir reflektif matematis

https://doi.org/10.30606/absis.v8i3.3444

dan dianalisis menggunakan perhitungan N-Gain serta uji t. Hasil penelitian menunjukkan bahwa peserta didik yang belajar menggunakan model Discovery Learning memperoleh skor posttest dan peningkatan kemampuan berpikir reflektif matematis yang lebih tinggi dibandingkan dengan peserta didik yang belajar menggunakan pembelajaran konvensional. Nilai rata-rata N-Gain kelas eksperimen lebih tinggi dibandingkan kelas kontrol, dan hasil uji hipotesis menunjukkan adanya perbedaan yang signifikan. Dengan demikian, dapat disimpulkan bahwa model Discovery Learning berpengaruh positif dan signifikan terhadap kemampuan berpikir reflektif matematis peserta didik dalam pembelajaran matematika.

Kata-kata kunci: Discovery Learning, berpikir reflektif matematis, pembelajaran matematika, SMP

INTRODUCTION

In 21st-century learning, several essential competencies are emphasized, commonly referred to as the six core abilities: character, citizenship, critical thinking, creativity, collaboration, and communication (Setiyowati et al., 2023). To succeed in this rapidly evolving and dynamic era, individuals are required to master a wide range of skills that enable them to adapt to complex social and professional demands (Septikasari & Frasandy, 2018). These 21st-century skills are highly relevant not only in educational settings but also in community life and the world of work; therefore, systematic efforts are needed to cultivate them through education (Srirahmawati et al., 2023). In this context, 21st-century learning aims to prepare individuals who are capable of responding effectively to contemporary challenges and societal changes.

One field of study that plays a strategic role in developing 21st-century skills is mathematics. Mathematics education in the 21st century is expected to emphasize creative thinking, communication, collaboration, and critical thinking skills (Nahdi, 2019). Among these competencies, creative, critical, and reflective thinking are closely interrelated and mutually reinforcing (Jayanti, 2018). Mathematical reflective thinking, in particular, has a significant relationship with students' critical and creative thinking abilities. Hasanah et al. (2024) found that reflective thinking enables students to re-examine their reasoning and problem-solving strategies, thereby supporting more effective critical and creative thinking processes. Similarly, Hudaini and Lestari (2023) reported that students with strong reflective thinking skills tend to demonstrate higher levels of mathematical creativity when generating solutions. In line with these findings, a meta-analysis by Altın and Saracaloğlu (2020) concluded that reflective thinking emerges from the integration of critical and creative thinking, where the generation of new ideas becomes the foundation for mature analytical reasoning. From a scientific perspective, mathematical reflective thinking is used to define, analyze, and solve problems systematically within mathematical contexts (Fuady, 2016). Thus, reflective thinking serves as a bridge connecting critical and creative thinking while also supporting the development of metacognitive awareness, which is essential in 21st-century mathematics education.

https://doi.org/10.30606/absis.v8i3.3444

Despite its importance, the development of mathematical reflective thinking skills among students has not yet been optimal. Empirical evidence indicates that many students still experience difficulties in this area. Syadid and Sutiarso (2021) reported that students' limited ability to analyze and communicate mathematical problems reflects weak reflective thinking skills. This limitation is often caused by students' inability to identify problems clearly and connect them with prior knowledge (Masamah, 2017). Supporting this view, Ramadhani and Aini (2019) found that students' mathematical reflective thinking skills remain relatively low, as demonstrated by difficulties in relating problems to known concepts and drawing appropriate conclusions. Collectively, these findings illustrate the persistent challenges faced by Indonesian students in developing strong mathematical reflective thinking skills.

This condition is further reflected in international assessments. According to the 2022 Programme for International Student Assessment (PISA) report, Indonesia ranked 69th out of 81 participating countries, with an average mathematics score of 366, which is well below the global average of 468 (OECD, 2023). PISA results indicate that many Indonesian students are still unfamiliar with problem solving, logical reasoning, and higher-order mathematical thinking. Reasoning ability is widely recognized as a core component of higher-level mathematical thinking (Kurniawati et al., 2019) and is closely related to students' ability to apply mathematical concepts in problem-solving situations (Fiqri et al., 2018). Syadid and Sutiarso (2021) emphasized that mathematical reflective thinking is essential for generating creative ideas, solving problems, and formulating effective solutions. Therefore, students' reflective thinking skills in mathematics are implicitly assessed through international benchmarks such as PISA.

At the school level, similar issues were identified at SMP Negeri 9 Bandar Lampung. Preliminary findings revealed that students' mathematical reflective thinking skills were still limited. Test results showed that many students had difficulty applying prior knowledge and experience when solving mathematical problems. In addition, students often failed to draw logical conclusions based on the strategies they used, indicating weaknesses in reflective reasoning processes.

These problems are consistent with the findings of Mutamam et al. (2022), who reported that one major factor contributing to the underdevelopment of students' mathematical reflective thinking skills is the lack of learning stages that provide opportunities for reflection. In conventional classroom practices, students tend to receive information directly from teachers, which can lead to dependency and limit opportunities for independent understanding. As a result, students' mathematical thinking skills may not develop optimally (Lishani et al., 2025).

To address this issue, it is necessary to design learning activities that encourage students to compare previously acquired knowledge with new problems and reflect on their problem-solving processes. One instructional approach that is expected to enhance mathematical reflective thinking skills is the discovery learning model. This model emphasizes student-centered learning by allowing learners to actively explore, analyze, and discover concepts through logical, critical, and analytical thinking processes (Karlinawati & Rahmawati, 2020; Kadarisma & Dewantara, 2025). Discovery learning has been shown to increase student engagement, motivation, and cognitive development while maximizing students' learning potential (Khasinah, 2021). According to Hartati (2020), the implementation of discovery learning consists of six stages: stimulation, problem formulation, data collection, data processing, verification, and generalization. These stages provide structured opportunities for students to actively construct knowledge and develop problem-solving skills.

Previous studies have demonstrated that discovery learning is effective in facilitating students' mathematical reflective thinking skills (Fiqri et al., 2018; Listyotami et al., 2024). In this study, the discovery learning process was supported by structured student learning worksheets containing guiding questions designed to stimulate reflection, evaluate problem-solving strategies, identify errors, and connect learning experiences to deeper conceptual understanding. Such instructional materials serve as practical tools that guide students through learning activities, clarify learning objectives, and support independent learning. The use of structured learning materials has been shown to enhance instructional effectiveness and improve learning outcomes (Trisandi et al., 2024). Consequently, integrating discovery learning with reflective learning materials can foster students' metacognitive awareness and support the development of mathematical reflective thinking skills in alignment with 21st-century learning goals.

SMP Negeri 9 Bandar Lampung is one of the schools that actively seeks to improve the quality of mathematics instruction, particularly in enhancing students' mathematical reflective thinking skills. Therefore, it is necessary to conduct research that examines how the discovery learning model contributes to the development of these skills. Accordingly, this study aims to investigate the effect of the discovery learning model on students' mathematical reflective thinking skills during the even semester of the 2024/2025 academic year.

METHODS

This study employed a quantitative research methodology. The research population consisted of all eighth-grade students of SMP Negeri 9 Bandar Lampung in the 2024/2025 academic year, totaling 310 students distributed across ten classes (VIII-A to VIII-J). A cluster random sampling technique was applied, in which intact classes were randomly selected as research samples. The sample selection process was assisted by a name spinner, resulting in class VIII-C being selected as the experimental class and class VIII-D as the control class. This study was categorized as quasi-experimental research and utilized a pretest–posttest control group design.

 https://doi.org/10.30606/absis.v8i3.3444

The research procedure consisted of three main stages: preparation, implementation, and final analysis. During the preparation stage, preliminary observations and data collection were conducted to identify school conditions, student characteristics, learning materials, and the research sample. At this stage, the research instruments were also developed and tested. In the implementation stage, a pretest was administered to both classes prior to treatment. Subsequently, the experimental class received mathematics instruction using the Discovery Learning (DL) model, while the control class was taught using conventional learning methods. After the instructional treatment, a posttest was administered to both groups. In the final stage, the data obtained from the experimental and control classes were processed and analyzed. The quantitative data analyzed in this study included pretest scores, posttest scores, and N-Gain values from both classes.

The data collection technique used in this study was a test method. Both initial and final data on students' mathematical reflective thinking skills were obtained through testing. The instrument used was a mathematical reflective thinking skills test consisting of three descriptive questions based on the content of systems of linear equations in two variables (SPLDV). The test items were developed according to the indicators of mathematical reflective thinking skills, namely reacting, comparing, and contemplating, as proposed by Kusuma et al. (2020).

The validity of the instrument in this study was established through content validity, which was evaluated by a partner teacher using a checklist (√). This evaluation focused on the suitability of the test language with students' language proficiency and the alignment of the test content with the test blueprint. Based on the content validity assessment, the test instrument was declared to have met the required validity criteria.

Furthermore, the test instrument was considered practical for use, as it satisfied the criteria for validity, reliability, discriminating power, and difficulty level. A summary of the test instrument analysis results is presented in Table 1.

Table 1. Recapitulation of Test Instrument Results

Item	Validity	Reliability	Differentiating Power	Difficulty Level
1	Valid	0.76 (Reliable)	0.22 (Enough)	0.76 (Easy)
2			0.25 (Enough)	0.68 (Medium)
3			0.47 (Good)	0.60 (Medium)

Before conducting hypothesis testing, a normality test was performed as a prerequisite analysis. In this study, the Chi-square (x^2) test was used to examine data normality at a significance level of $\alpha = 0.05$. The results of the normality test for students' N-Gain scores of mathematical reflective thinking skills are presented in Table 2.

Table 2. Results of the Normality Test of N-Gain Scores of Students' Mathematical Reflective Thinking Skills

Class	x^2count	x^2critical	Test Results
Experimental	2.01	7.81	H_0 accepted
Control	4.05	7.81	H_0 accepted

The results of the normality test indicated that the data from both the experimental and control classes were normally distributed. Afterward, a homogeneity test was conducted to determine whether the variances of the two samples were equal. The homogeneity test used in this study was the F-test. Based on the analysis, the calculated F value was 1.065, while the critical F value was 2.092 at a significance level of $\alpha = 0.05$. Since Fcalculated < Fcritical, the null hypothesis (H_0) was accepted, indicating that the variances of the two groups' mathematical reflective thinking skills were homogeneous.

Based on the results of the normality and homogeneity tests, a parametric hypothesis test was deemed appropriate. Therefore, this study employed a two-mean comparison test (independent samples t-test) to examine differences in students' mathematical reflective thinking skills between the experimental and control classes.

FINDING AND DISCUSSION

The results and discussion section presents the findings obtained from the implementation of the Discovery Learning (DL) model and examines their implications for students' mathematical reflective thinking skills. This section systematically discusses the outcomes of the data analysis, including pretest and posttest results, N-Gain scores, and hypothesis testing, to evaluate the effectiveness of the DL model compared to conventional instruction. The discussion further interprets these findings by relating them to the theoretical framework of mathematical reflective thinking and relevant previous studies, thereby providing a comprehensive understanding of how the DL model contributes to the development of students' reflective thinking skills in mathematics.

Based on the results of the pretest and posttest, students' mathematical reflective thinking skills can be seen in Table 3.

Table 1. Recapitulation of Initial and Final Students' Mathematical Reflective Thinking Skills Scores

Class	Pretest Average	Pretest Minimum	Pretest Maximum	Pretest Standard Deviation	Posttest Average	Posttest Minimum	Posttest Maximum	Posttest Standard Deviation
Experiment	3.57	0	6	1.10	19.47	13	26	3.20
Control	2.71	0	5	1.57	15.97	10	24	3.37

https://doi.org/10.30606/absis.v8i3.3444

according to Table 3. Students' growth and reflective thinking abilities in mathematics may differ between the two classes. It is evident that the final score of students' mathematics reflective thinking abilities is impacted by the treatment of diverse learning in both sessions. For students in the DL model class, the average final score for their mathematical reflective thinking abilities was greater than the average final score for students in the conventional learning class.

Table 4 displays the N-Gain index score of improvement in students' mathematical reflective thinking abilities based on the pretest and posttest results of students' mathematical reflective thinking abilities in the experimental and control classes.

Table 2. Improvement Score (N-Gain) Students' Mathematical Reflective Thinking Skills

Class	Number of Students	Average N-Gain	Minimum N-Gain	Maximum N-Gain	Standard Deviation
Experiment	30	0.68	0.42	0.95	0.14
Control	31	0.55	0.32	0.86	0.13

In terms of the average score of improvement (N-Gain) in students' mathematical reflective thinking abilities, Table 4 shows that the experimental class fared better than the control class. Additionally, the experimental class's N-Gain score for students' reflective thinking abilities in mathematics displayed a higher standard deviation than the control group. This implies that the experimental class using the DL model had a little more varied range of N-Gain scores for students' mathematical reflective thinking skills than the control group getting conventional learning.

Following the completion of the prerequisite tests, the normality and homogeneity tests, it was determined that the experimental class's and the control class's scores of improvement (N-Gain) in mathematical reflective thinking abilities were drawn from a normally distributed population with the same variance. The t-test is used to assess the hypothesis regarding the improvement score (N-Gain). The results of the hypothesis test with a significance level of 0.05 were obtained that the calculated t value = 3,873 and tcritical = 1,6759. Since tcalculates > tcritical, H0 is rejected and H1 is accepted. This indicates that students who engaged in the DL model saw an average development in their mathematical reflective thinking abilities that was greater than that of those who engaged in conventional learning. This suggests that students' mathematical reflective thinking abilities are impacted by the DL methodology.

Additionally, the pretest and posttest findings show that students have met the markers of their mathematical reflective thinking abilities. Table 5 displays the findings of the comparison between the experimental class using the DL model and the control class using traditional learning methods in terms of the attainment of indicators of students' mathematical reflective thinking abilities.

Table 3. Achievement of Indicators of Mathematical Reflective Thinking Skills

Indicators	Experimental Classes		Control Class	
	Pretest	Posttest	Pretest	Posttest
Reacting	24%	83%	20%	71%
Comparing	15%	82%	9%	66%
Contemplating	0%	51%	1%	40%
Average	13%	72%	10%	59%

based on Table 5. It is evident that both classrooms have seen improvements in indicators of mathematics reflective thinking abilities. The efficiency of the DL model is demonstrated by the attainment of the previously specified indicators of students' mathematical reflective thinking skills. The results of the analysis showed that the experimental class, which used the DL model, improved indicator success by an average of 59%, whereas the control class, which used conventional learning, improved indicator success by 49%.

With the experimental class utilising the DL model demonstrating a 67% improvement and the control class using conventional learning demonstrating a 57% improvement, the comparison indicator revealed the biggest improvement in both classes. The least amount of progress was seen in the contemplating indicator, which was 51% in the experimental class using the DL model and 39% in the control class using traditional learning. This shows that in every measure of students' mathematics reflective thinking abilities, the experimental class employing the DL model fared better than the control class using conventional learning. The results of this study are in line with the research conducted by Safitri et al. (2019) which states that the DL model has a positive influence on students' mathematical reflective thinking skills.

When the DL model was used, it gave students more chances to actively participate in the learning process, which was one of the factors that led to the experimental class with the model improving more than the control class with traditional learning in terms of their capacity for mathematical reflection. Through group discussions, contextual problem investigation, and cooperative problem-solving with group companions, the DL model's learning stages give students several chances to actively participate in the learning process. Through these exercises, students can think more thoroughly on their learning, examine the problem's content, compare previously taught information to solve the problem, and draw conclusions from their completed work. This is in line with the opinion of Safitri et al. (2019) who asserted that the development of mathematical reflective thinking skills can be facilitated by a learning model that allows students to find their own understanding through the process of learning by presenting them with interesting contextual problems, letting

 https://doi.org/10.30606/absis.v8i3.3444

them know what they already know and what they need from the problem, allowing them to work together, and allowing them to draw conclusions from problems.

The first stage is stimulation. This stage aims to foster students' curiosity to conduct investigations related to problems. This is shown that when giving stimulus, students seem enthusiastic and curious about the problems presented. Many students try to understand by asking questions related to the problem given. This is in line with Muyassaroh et al. (2023) & Noviyanto and Wardani (2020), at the stimulus stage, students are faced with a problem that causes confusion so as to encourage students' interest in investigating the problem more deeply. The stimulus provided is in the form of asking problems or questions so that students can explore the data or information they want to solve the problem (Oktavioni, 2017). Through this stage, students can develop mathematical reflective thinking skills, namely on reacting indicators.

The second stage is problem statement. At the problem identification stage, students try to analyze the information that is known and asked about the problem. Students write down data or information in the form of points based on the problems presented. In line with this, Noviyanto and Wardani (2020) & Marisya & Sukma (2020) revealed that at this stage students are encouraged to identify problems that occur according to the information contained in the questions, formulate questions contained in the problems, and formulate questions into statements or as temporary answers to the questions asked. Through this stage, students can develop mathematical reflective skills, namely in reacting indicators. This ability indicator is developed when students try to identify problems by writing down what they know, ask questions, and relate the problem to the problems they have faced, as well as determining the temporary solution of the given problem.

The third stage is data collection. At the data collection stage, students actively discuss in their groups. Students exchange opinions, compare information, and ask questions when experiencing difficulties. In line with that, Musyassaroh et al. (2023) & Safitri et al. (2019) state that at this stage students gather various relevant information to support or prove the provisional answers they have made at the previous stage. At this stage, students will learn to find something related to the problem (Marisya & Sukma, 2020). Through this stage, students can develop mathematical reflective thinking skills, namely on comparing indicators. This ability indicator is developed when students interact and work in groups to consider every data or information that has been obtained and connected with the ideas they have, then students can detect the truth and correct errors from the hypotheses that have been made.

The fourth stage is data processing. This stage aims to reconstruct students' knowledge with the information obtained to form general principles that can help students examine the truth of the hypothesis and find solutions to the given problems. At the time of data processing, students begin to compile previously obtained data or information into the form of mathematical models. Students also actively cooperate with their groups to try various ways to process the data or information obtained such as doing calculations, comparing several possible answers, and re-checking the results of the answers they have found. In line with this, Ilmiati (2024) & Budiastuti et al. (2023) stated that at this stage students learn to be able to analyze and process previously obtained data to answer or find solutions to the problems presented. Through this stage, students can develop mathematical reflective thinking skills, namely on comparing indicators. This ability indicator is developed when students consider every data or information that has been obtained from the data collection, double-check the answers, realize mistakes, and choose the most appropriate steps to find solutions related to the given problems.

The fifth stage is verification. At this stage, students carefully examine the truth of the hypothesis that has been made with the results of the answers obtained from data processing. When proofing, students work together with their groups to rematch the answers they find with the problems presented. Students replace the values they have found into the mathematical model used. Students recalculate to prove that the answers obtained are appropriate. In line with this, Ilmiati (2024) stated that at this stage, students can relate data processing to the results of the initial hypothesis to prove whether the initial hypothesis is in accordance with the data found. In addition, Budiastuti et al. (2023) argue that at this stage, students prove the results of the findings and data processing that have been discussed, which aims to find solutions from various sources who have different opinions. Through this stage, students can develop mathematical reflective thinking skills, namely on contemplating indicators. This ability indicator is developed when students review, evaluate, and verify the results of the answers independently or in groups to prove the correctness of the answers from data processing.

The last stage is generalization. At this stage, students draw conclusions from the problems that have been solved. This conclusion made will be a general principle in solving problems. The teacher helps to reinforce the conclusions given by students to suit the learning objectives. When making generalizations, students try to write conclusions from the results of previous work such as writing general formulas and making a flow of solutions based on their own learning experiences. Students also convey the results of generalizations orally in front of the class. In line with that, Dari & Ahmad (2020) stated that at this stage the teacher asks students to conclude what has been understood and the teacher provides reinforcement to the conclusions that have been conveyed by the students. At this stage, formulating conclusions is a must in the learning process, so that students can find understanding after going through the process of thinking in searching for data (Marisya & Sukma, 2020). Students are trained to develop mathematical reflective thinking skills to draw conclusions regarding new knowledge or experience that has been acquired. Through this stage, students can develop mathematical reflective thinking skills,

 https://doi.org/10.30606/absis.v8i3.3444

namely on contemplating indicators. This ability indicator is developed when students draw conclusions and interpret concepts in their entirety to reconstruct their understanding.

The process of implementing the DL model learning carried out at SMP Negeri 9 Bandar Lampung experienced several obstacles. At the first meeting, students seemed unfamiliar with the math learning method that required them to discuss and work in groups. When the group division was carried out, some students did not agree with the division of group members that had been determined, making the classroom atmosphere less conducive. During learning, students experience confusion when working on the LKPD so that the time to work on the LKPD becomes a little longer than the predetermined time. At this meeting, there was also no group willing without being told to present the results of their group discussions in front of the class.

At the second meeting, some students were still unfamiliar with the DL learning model. They feel less confident in the results of their work so they still need guidance from teachers to gain confidence in what they have obtained. However, at this second meeting there was a positive development from several students who began to be able to take responsibility for their groups. This makes group discussions smoother and presentations in front of the class can also run better compared to previous meetings.

At the next meeting to the fifth meeting, students began to get used to learning using the DL model. This can be seen from students being able to collect information independently, such as reading books and discussing with their groupmates. In addition, group discussions run better and are more directed with guidance from teachers. When the group presents the results of the LKPD in front of the class, all members in the group can answer the questions asked by the teacher.

In the class that participated in learning with the DL model, students were trained to analyze the given problems in order to identify and obtain what information was contained in the problem, compare the knowledge that had been learned by the previous students to find solutions to the problems given, and make conclusions from the results of the work that had been done based on the understanding obtained by the students, so that from these things they made the ability to think Mathematical reflective students can develop. This is in line with the research results of Hidayanto et al. (2024) & Listyotami et al. (2024) which stated that the application of the DL model can develop students' mathematical reflective thinking skills.

On the other hand, classes that use conventional learning conduct teacher-centered learning so that it does not provide opportunities for students to develop their mathematical reflective thinking skills. The stages of conventional learning focus on procedural mastery and solving routine problems, so students have fewer opportunities to explore concepts, formulate questions, or reflect on the problem-solving strategies used. In conventional learning, teachers explain the material directly to students. So that students tend to be more passive during the learning process, only rely on explanations given by teachers, and have less interest in acquiring knowledge independently. During the conventional learning process, most students only rely on the royal procedure that has been explained by the teacher before to answer the questions given. Students are used to looking at examples of work first and solving problems according to the examples given by the teacher. As a result, students' mathematical reflective thinking skills are not optimally developed and have an impact on the achievement of students' mathematical reflective thinking skills that are lower than those in the classes that follow the DL model.

A comparison between the DL model and conventional learning indicates that the conventional classroom learning approach is less likely to enhance students' capacity for mathematical reflective thought. This is supported by the opinion of Fiqri et al. (2018) that the application of the DL model can provide more opportunities to improve students' mathematical reflective thinking skills compared to conventional learning.

The aforementioned explanation makes it abundantly evident that employing the DL model in place of conventional teaching techniques has a higher chance of improving students' ability to think reflectively about mathematics. The findings of the hypothesis test, which show that students who used the DL model enhanced their mathematics reflective thinking skills more than those who used the conventional learning approach, support this. Because of this, it can be concluded that the use of the DL model affects the mathematical reflective thinking skills of grade VIII students of SMP Negeri 9 Bandar Lampung even semester of the 2024/2025 school year.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of data analysis and discussion, it can be concluded that the Discovery Learning (DL) model has a significant effect on students' mathematical reflective thinking skills. Students who learned mathematics through the DL model showed higher improvement in mathematical reflective thinking abilities compared to students who received conventional instruction. This improvement is evidenced by higher posttest scores, greater average N-Gain values, and statistically significant differences based on the t-test results. The implementation of the DL model effectively facilitated the development of mathematical reflective thinking indicators, namely reacting, comparing, and contemplating. Students in the experimental class demonstrated stronger abilities to identify problems, relate prior knowledge to new situations, evaluate solution strategies, and draw conclusions through structured learning stages. The learning process encouraged active student participation, collaborative discussion, critical analysis, and reflective evaluation, which are essential components of mathematical reflective thinking.

Therefore, the Discovery Learning model can be considered an effective instructional approach for enhancing students' mathematical reflective thinking skills and can serve as an alternative learning model in mathematics classrooms, particularly at the junior secondary school level. Based on the findings of this study, several recommendations can be proposed. Teachers are encouraged to apply the Discovery Learning model consistently in mathematics instruction to provide students with greater opportunities to develop reflective thinking skills through active exploration and problem solving. Future researchers are advised to examine the implementation of the Discovery Learning model on different mathematical topics or educational levels to broaden the scope of its effectiveness. In addition, further studies may incorporate longer intervention periods or integrate supporting learning media to strengthen students' reflective thinking processes and learning outcomes.

REFERENCES

Altın, M., & Saracaloğlu, A. S. (2020). Critical, reflective, creative thinking and their reflections on academic achievement. *Thinking Skills and Creativity, 37*, Article 100683. https://doi.org/10.1016/j.tsc.2020.100683

Budiastuti, P. N., Rosdiana, R., & Ekowati, A. (2023). Analysis of discovery learning model steps in lesson plans for inspirational narrative texts in grade IX junior high schools. *Triangulasi: Jurnal Pendidikan Kebahasaan, Kesastraan, dan Pembelajaran, 3*(1), 39–45. https://doi.org/10.55215/triangulasi.v3i1.5129

Dari, F. W., & Ahmad, S. (2020). Discovery learning model as an effort to improve elementary students' critical thinking skills. *Jurnal Pendidikan Tambusai, 4*(2), 1469–1479.

Fiqri, M. J. A., Gunowibowo, P., & Noer, S. H. (2018). Effectiveness of the discovery learning model in terms of reflective thinking skills and self-confidence. *Jurnal Pendidikan Matematika Universitas Lampung, 6*(6), 520–534.

Fuady, A. (2016). Reflective thinking in mathematics learning. *JIPMat: Jurnal Ilmiah Pendidikan Matematika, 1*(2), 104–112. https://doi.org/10.26877/jipmat.v1i2.1236

Hartati, P. (2020). Effectiveness of discovery learning in terms of students' critical thinking skills. *Didactical Mathematics, 2*(2), 27–34.

Hasanah, N. R., Turmudi, T., & Juandi, D. (2023). Systematic literature review: Students' reflective thinking skills in mathematics learning. *Catha Scientifica, 2*(2), 1–20. https://doi.org/10.32699/cathasaintifica.v2i2.7093

Hidayanto, E., Pradana, A. B., Budiono, E., & Cahyowati, E. T. D. (2024). Implementation of guided discovery learning assisted by fast track to develop reflective thinking skills. *Jurnal Kajian Pendidikan Indonesia, 1*(1), 23–33. https://doi.org/10.62947/jkpi.v1i1.2

Hudaini, N., & Lestari, K. E. (2023). The effect of mathematical reflective thinking skills on students' mathematical creative thinking skills. *Didactical Mathematics, 5*(2), 413–421. https://doi.org/10.31949/dm.v5i2.6365

Ilmiati, A. (2024). The implementation of discovery learning model on science literacy in physics learning. *Jurnal Citra Pendidikan, 4*(2), 1768–1776. https://doi.org/10.38048/jcp.v4i2.2989

Jayanti, J. (2018). Learning using critical, creative, and reflective thinking abilities and students' mathematical reasoning skills. *Prosiding Seminar Pendidikan Nasional Universitas PGRI Palembang, 18*, 9–22.

Kadarisma, G., & Dewantara, J. A. (2025). Learning models to improve higher-order thinking skills in mathematics: A systematic literature review. *Jurnal Absis: Jurnal Pendidikan Matematika dan Matematika, 8*(1), 254–265. https://doi.org/10.30606/absis.v8i1.3317

Karlinawati, K., & Rahmawati, R. (2020). The effect of environmental media-based discovery learning on students' critical thinking skills. *Jurnal Edukasi dan Sains Biologi, 9*(2), 44–49.

Khasinah, S. (2021). Discovery learning: Definition, syntax, strengths, and weaknesses. *Jurnal Mudarrisuna: Media Kajian Pendidikan Agama Islam, 11*(3), 402–413. https://doi.org/10.22373/jm.v11i3.5821

Kurniawati, K., Noer, S. H., & Gunowibowo, P. (2019). The effect of guided inquiry learning model on reflective thinking skills and self-efficacy. *Jurnal Pendidikan Matematika Universitas Lampung, 7*(1), 65–77.

Kusuma, I. C., Noer, S. H., & Caswita, C. (2020). Development of mathematics learning with TPS stages to improve reflective thinking skills and self-efficacy. *Jurnal Cendekia: Jurnal Pendidikan Matematika, 4*(2), 870–885. https://doi.org/10.31004/cendekia.v4i2.321

Lishani, J. E., Yuniarti, T., & Gunowibowo, P. (2025). Exploring students' mathematical communication in guided inquiry and STAD cooperative learning models. *Jurnal Absis: Jurnal Pendidikan Matematika dan Matematika, 8*(1), 232–244.

Listyotami, M. K., Anwar, Y., & Bramana, S. M. (2024). Effectiveness of discovery learning model based on mathematical connection, reflective thinking, and representation abilities in online learning. *Trigonometri: Jurnal Matematika, 1*(1), 6–12.

Marisya, A., & Sukma, E. (2020). The concept of discovery learning model in integrated thematic learning in elementary schools. *Jurnal Pendidikan Tambusai, 4*(3), 2189–2198.

Masamah, U. (2017). Improving students' mathematical reflective thinking skills through problem-based learning in terms of initial mathematical ability. *Jurnal Penelitian Pendidikan Matematika, 1*(1), 1–18. https://doi.org/10.32502/jp2m.v1i1.680

Mutamam, A. N., Susilawati, W., Maryono, I., & Nuraida, I. (2022). Students' abstract mathematical reflective thinking skills through contextual learning. *Gunung Djati Conference Series, 12*, 68–72.

Muyassaroh, F. A., & Waluya, S. B. (2023). Mathematical representation ability in discovery learning model (2018–2023). *Prosiding Seminar Nasional MIPATI, 2*(1), 138–154.

Nahdi, D. S. (2019). Mathematical skills in the 21st century. *Jurnal Cakrawala Pendas, 5*(2), 133–140.

Noviyanto, W. Y., & Wardani, N. S. (2020). Meta-analysis of the effect of discovery learning approach on students' critical thinking skills. *Thinking Skills and Creativity Journal, 3*(1), 1–7.

OECD. (2023). *PISA 2022 results: The state of learning and equity in education*. OECD Publishing. https://doi.org/10.1787/53f23881-en

Oktavioni, W. (2017). *Improving students' curiosity through discovery learning model in science learning* (Undergraduate thesis). Universitas Jambi.

Ramadhani, N. F., & Aini, I. N. (2020). Students' mathematical reflective thinking skills in solving problems related to solid figures. *Prosiding Sesiomadika, 2*(1), 1–8.

Safitri, A., Noer, S. H., & Gunowibowo, P. (2019). Effectiveness of guided discovery learning in terms of mathematical reflective thinking skills and beliefs. *Jurnal Pendidikan Matematika Universitas Lampung, 7*(1), 51–64.

Septikasari, R., & Frasandy, R. N. (2018). 21st-century 4C skills in elementary education learning. *Tarbiyah Al-Awlad: Jurnal Kependidikan Islam Tingkat Dasar, 8*(2), 107–117.

Setiyowati, A., Apriyani, D. C. N., & Qudsiyah, K. (2023). Development of 6C-oriented teaching material design in trigonometry. *Jurnal Edumatic, 4*(2), 44–53. https://doi.org/10.21137/edumatic.v4i2.804

Srirahmawati, A., Deviana, T., & Wardani, S. K. (2023). Improving 21st-century (6C) skills through project-based learning in elementary schools. *Pendas: Jurnal Ilmiah Pendidikan Dasar, 8*(1), 5283–5294.

Syadid, A. C. I., & Sutiarso, S. (2021). The relationship between mathematical reflective thinking skills and mathematical problem-solving skills. *Jurnal Kajian Pendidikan Matematika, 6*(2), 327–336.

Trisandi, Y. P., Kartini, K., & Saragih, S. (2024). Development of discovery learning-based worksheets to facilitate students' mathematical understanding. *Jurnal Absis: Jurnal Pendidikan Matematika dan Matematika, 6*(2), 860–869. https://doi.org/10.30606/absis.v6i2.2321