



IMPROVING MATHEMATICS LEARNING OUTCOMES THROUGH THE DISCOVERY LEARNING METHOD

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Abstract

Mathematics is a fundamental subject that helps develop students' logical and systematic thinking skills. However, many students still face difficulties in learning mathematics, which leads to low academic achievement. One contributing factor is the lack of instructional strategies that actively engage students in the learning process. This study aims to determine the effectiveness of the Discovery Learning method in improving students' mathematics learning outcomes. The research employed a Classroom Action Research (CAR) approach conducted in two cycles, each consisting of planning, action, observation, and reflection stages. The results show that the implementation of the Discovery Learning method in the first cycle was not optimal, with teacher and student activities categorised as "good" (77%) and "fair" (55%), respectively, and the students' learning outcomes did not meet the minimum mastery criteria. After reflection and improvements, the second cycle showed significant progress: teacher activity reached 95% ("very good"), student activity increased to 92% ("very good"), and learning mastery reached 100% with an average score of 83.85. Therefore, the Discovery Learning method is proven effective in enhancing student engagement and learning outcomes in the topic of systems of linear equations in two variables.

Keywords: Learning Outcomes; Discovery Learning Method

Abstrak

Matematika merupakan mata pelajaran penting dalam membentuk kemampuan berpikir logis dan sistematis peserta didik. Namun, masih banyak siswa mengalami kesulitan dalam pembelajaran matematika yang berdampak pada rendahnya hasil belajar. Salah satu penyebabnya adalah kurangnya strategi pembelajaran yang melibatkan siswa secara aktif. Penelitian ini bertujuan untuk mengetahui efektivitas metode *Discovery Learning* dalam meningkatkan hasil belajar matematika siswa. Penelitian menggunakan pendekatan Penelitian Tindakan Kelas (PTK) yang dilaksanakan dalam dua siklus dengan tahapan perencanaan, tindakan, observasi, dan refleksi. Hasil penelitian menunjukkan bahwa penerapan metode *Discovery Learning* pada siklus pertama belum optimal, dengan aktivitas guru dan siswa masing-masing hanya mencapai kategori "baik" (77%) dan "cukup" (55%), serta hasil belajar siswa yang belum tuntas secara klasikal. Setelah dilakukan refleksi dan perbaikan, siklus kedua menunjukkan peningkatan signifikan: aktivitas guru mencapai 95% (kategori "sangat baik"), aktivitas siswa mencapai 92% (kategori "sangat baik"), dan ketuntasan belajar mencapai 100% dengan rata-rata nilai 83,85. Dengan demikian, metode *Discovery Learning* efektif dalam meningkatkan keaktifan dan hasil belajar siswa pada materi sistem persamaan linear dua variabel.

Kata kunci: Hasil Belajar; Metode Discovery Learning.

INTRODUCTION

Mathematics is a fundamental science that helps students develop logical and structured thinking to solve various practical problems. As a discipline, mathematics supports and serves other fields of knowledge. In other words, mathematics thrives as an independent discipline, yet it also contributes significantly to the advancement and operation of other sciences. Therefore, mathematics is always included in the curriculum at every level of schooling. However, a common complaint from

students is that mathematics is a difficult subject. Difficulties in learning mathematics contribute to low student achievement. Students' difficulties in understanding and solving mathematical problems are often caused by a lack of teaching strategies that optimise student participation, resulting in passive learning.

According to recent research by Aqila et al. (2025), the lack of implementation of learning models that provide space for students to think critically and exploratively is correlated with low student engagement in mathematics learning. Therefore, to foster student engagement in learning, a strategy is needed in the learning system to improve mathematics learning outcomes. Discovery Learning is one method used in learning that involves students actively and collaboratively in mathematics learning in class to achieve optimal learning. According to Wibowo (2020:25), the Discovery Learning model is a teaching model that has cognitive theories, such as Piaget's theory, that support teachers and students to engage with each other in the learning process in the classroom.

In 1961, Bruner, a psychologist, discovered a learning concept frequently used in mathematics instruction: discovery learning. Bruner's research demonstrated that this learning model aims to enable students to independently acquire new knowledge during the learning process. Although the goal of discovery learning is to improve independent learning, the learning environment and conditions of the students still depend on the assistance of instructors/teachers.

Students will experience many benefits from using the discovery learning method. It encourages them to investigate independently, build on past experiences and knowledge, utilise intuition, imagination, and creativity, and seek out new information to discover new facts and truths. This allows students to solve problems independently by actively seeking answers and solutions. This is because understanding through storytelling differs from learning methods that allow students to explore independently.

Discovery learning is the support of an individual or group to discover their knowledge based on their experiences (Rusman in Nuryakin, 2025). According to the Minister of Education and Culture Regulation Number 22 of 2016, discovery learning is a problem-based learning method aimed at developing project assessment instruments as an innovative operational assessment development.

Research by UBM et al. (2024) shows that implementing the discovery learning model in mathematics learning increases student engagement, encourages higher-order thinking skills, and significantly impacts learning outcomes. Related research using a similar method was also proposed by Septiani (2025), who found that discovery learning is an effective learning method for developing students' mathematical problem-solving skills through exploratory and collaborative activities.

The discovery learning model is designed for students to actively learn through hands-on activities. Here, teachers encourage students to develop their knowledge, skills, values, and attitudes through practical experiences (Fauzi & Atok, 2017). This model uses a variety of techniques such as group discussions, collaborative projects, and experiments. While the methods differ, the main goal is the same: students understand the material through active engagement. When students explore and conduct experiments, they tend to retain newly learned concepts and knowledge more easily.

METHOD

The type of research used in this study is classroom action research. Classroom action research is a type of research conducted by teachers in their classes through self-reflection to improve their teaching performance, thereby enhancing the learning process and increasing student learning outcomes. The subjects in this study were 21 students of class VIII at Adyaksa Ende Private Middle School. The data collection procedure went through several stages, including (1) Planning. Planning is the preparation of actions and understanding of the possibilities of actions carried out based on

previous observations and experiences. Planning must be general and changeable. (2) Implementation of Action: Implementation is a process or action carried out to achieve certain goals or objectives. Actions are guided by planning in the sense that they refer to. Planning is the basis for thinking. Just like plans, actions must always have a temporary level. (3) Observation has a function to document the impact of actions critically. Careful observation needs to be done because of the impact of subsequent actions. Observation activities must be planned so that they become the basis in the form of documents in conducting reflection. As with actions and plans, observations must be flexible and open to unexpected facts. Researchers need to provide observation sheets when carrying out observations. (4) Reflection means remembering actions that have been recorded through observation. Reflection reviews and considers the processes, problems, issues, and shortcomings that exist in the action strategy. This is done by paying attention to the variety of possible perspectives of situations and understanding the circumstances and issues where they arise. Reflection becomes the basis for reviewing the action plan. Reflection has an evaluation aspect for researchers to assess whether the impact of the actions that arise is as desired and to make re-planning.

To determine the effectiveness of learning activities, researchers analyzed data using qualitative data analysis techniques, namely a research method that describes reality or facts that correspond to the data obtained. The aim is to determine the use of the Discovery Learning method in observing teacher and student activities. In addition, researchers also used test techniques to determine learning outcomes after students used the Discovery Learning method.

RESULTS AND DISCUSSION

Based on the observation results, the teaching and learning process in mathematics subjects using the discovery learning method directly shows that the learning process is dominated by subject teachers, not in accordance with the basic principles and syntax of the discovery learning method. This is reinforced by the learning outcome test which is still far from expectations, almost 50% are not complete, this happens because students do not understand the teacher's explanation of the material being taught and students themselves do not have a guidebook that can help students understand the concepts being taught, so students become passive in the learning process.

The next step is for the researcher and the subject teacher to reflect on the learning that has taken place. The results of the reflection are used to update several weaknesses in the first cycle so that they do not become weaknesses again in the second cycle. Based on the results of observations and the results of the second cycle test, the implementation of learning is based on the basic principles and syntax of the discovery learning method.

Table 1. Teacher Activity Observation Results

Cycle	Maximum Score	Score is Obtained	Percentage (%)	Category
Cycle I	70	54	77%	Good
Cycle II	70	67	95%	Very Good

Teacher activity, based on the results of observations of teacher activity during the observation in two meetings, showed an increase. This can be seen in the first cycle, with a total score of 54, with a percentage of 77% included in the good category, while in the second cycle, with a total score of 67, a percentage of 95% included in the very good category. This shows that the teacher delivered the material with an emphasis on the Discovery Learning method and has implemented the learning process well.

Table 2. Results of Student Activity Observations

Cycle	Maximum Score	Score is Obtained	Percentage (%)	Category
Cycle I	70	39	55%	Quite Good
Cycle II	70	65	92%	Very Good

Student activities, based on the results of observations of student activities observed by researchers by applying the Discovery Learning model in mathematics learning on the material of two-variable linear equation systems in cycle I with a total score of 39 with a percentage of 55% included in the sufficient category, while in cycle II with a total score of 65 with a percentage of 92% included in the very good category.

Table 3. Student Learning Outcomes (Classical Mastery)

Stages	Classical Completion Percentage
Before	Nearly 50% incomplete
Cycle I	Not yet reached 100%
Cycle II	100%

Learning completion, student learning outcomes before and after implementing the Discovery Learning model in mathematics learning, increased in cycle II, with an average of 83.85 points, with a classical completion percentage of 100%. This indicates that the discovery learning method can improve mathematics learning outcomes. The overall results of the study are shown in the graph below.

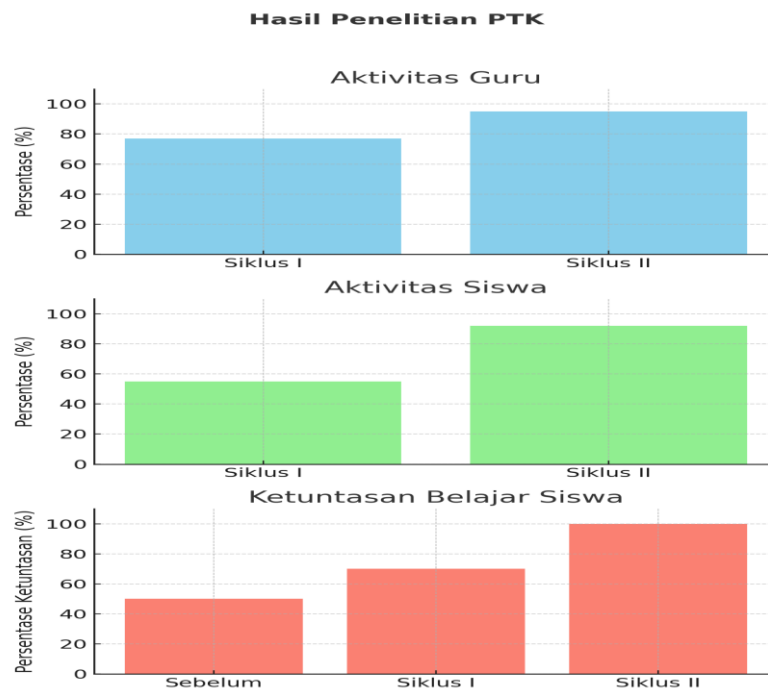


Figure 1. Results of Classroom Action Research

The results of the study show that the application of the Discovery Learning method in mathematics learning has a positive impact on teacher activities, student activities, and student learning outcomes. Based on observations, teacher activity in implementing learning increased from 77% (good category) in Cycle I to 95% (very good category) in Cycle II. This improvement indicates that teachers are beginning to understand and are able to implement Discovery Learning syntax more

effectively, such as providing stimuli, guiding students in data collection, and facilitating conclusions. This finding aligns with research by Jufri et al. (2023), which shows that teacher skills in implementing discovery-based learning play a crucial role in creating an active and productive learning environment. Teachers who are able to guide students in discovering concepts on their own can increase the effectiveness of the learning process.

Student activity also increased significantly, from 55% (sufficient) in Cycle I to 92% (very good) in Cycle II. In the first cycle, students appeared passive due to teacher dominance and the lack of student manuals. However, after reflection and improvements in the second cycle—such as dividing the class into exploratory groups and using adequate learning media—student activity improved significantly. These results support research by Indah (2024), which found that student engagement increases when they are given the space to explore, discuss, and draw their conclusions through Discovery Learning. When students are active, learning becomes meaningful and positively impacts conceptual understanding.

In terms of learning outcomes, there was an increase from the initial level (almost 50% of students failed) to 100% completion in Cycle II, with an average score of 83.85. This demonstrates the effectiveness of the Discovery Learning method in improving students' understanding of mathematical concepts, particularly in the Two-Variable System of Linear Equations (SPLDV) topic. This improvement aligns with research by Dari & Ahmad (2020), which found that Discovery Learning can improve students' critical thinking and mathematical problem-solving skills. When students construct their knowledge, they more easily understand and remember the material. Overall, the results of this study indicate that the implementation of the Discovery Learning model has a positive effect on the quality of mathematics learning in the classroom. Teachers become more active facilitators, students become more engaged, and learning outcomes improve significantly. These findings support Bruner's (1961) assertion that Discovery Learning enables students to assimilate new knowledge more deeply through direct experience and exploration. Discovery Learning is an appropriate approach for developing higher-order thinking skills in students.

CONCLUSION

The Discovery Learning method effectively increases teacher activity in the learning process. Teachers become more active as facilitators, providing stimuli, guiding students to discover their concepts, and creating an interactive and meaningful learning atmosphere. Student activity increased significantly. In cycle I, student activity was still considered adequate (55%), but after improvements in cycle II, student activity reached the very good category (92%). This indicates that students are more engaged in the learning process when allowed to explore and discover concepts on their own. Students' mathematics learning outcomes experienced significant improvement. Classical mastery increased from less than 50% in the initial stage to 100% in cycle II, with an average score of 83.85. This proves that Discovery Learning can improve students' conceptual understanding and learning achievement. The learning process becomes more meaningful because students not only receive information but also actively construct knowledge through direct experience, group discussions, and collective conclusions.

REFERENCE

Aqila, M. N., Roslita, I., Anisa, R., & Farhurohman, O. (2025). Analisis Model Discovery Learning Terhadap Kemampuan Berpikir Kritis Siswa Di Sekolah Dasar. *Jurnal Pengajaran Sekolah Dasar*, 4(2), 454-465. <https://doi.org/10.56855/jpsd.v4i2.1466>.

- Bruner, J. S (1961). *The Act of Discovery*. Harvard Educational Review, 31, 21-32. Cambridge, MA: Harvard Education Publishing Group
- Dari, F. W., & Ahmad, S. (2020). Model discovery learning sebagai upaya meningkatkan kemampuan berpikir kritis siswa SD. *Jurnal Pendidikan Tambusai*, 4(2), 1469-1479.
- Fauzi, A., & Atok, R. (2017). Penguatan karakter rasa ingin tahu dan peduli sosial melalui discovery learning. *Jurnal Teori Dan Praksis Pembelajaran IPS*, 2(2), 83-93. <https://doi.org/10.17977/um022v2i22017p079>.
- INDAH, N. L. (2024). Model Pembelajaran Discovery Learning pada Operasi Bilangan Kelas 4 SD. *SCIENCE: Jurnal Inovasi Pendidikan Matematika dan IPA*, 4(4), 382-399. <https://doi.org/10.51878/science.v4i4.3497>.
- Jufri, A. P., Asri, W. K., Mannahali, M., & Vidya, A. (2023). *Strategi pembelajaran: Menggali potensi belajar melalui model, pendekatan, dan metode yang efektif*. Bantul, Yogyakarta: Ananta Vidya.
- Nuryakin, M. P. (2025). *Model Pembelajaran Discovery Learning dan Penerapannya*. Yogyakarta: Deepublish
- Permendikbud No. 22 Tahun 2016 tentang Standar Proses Pendidikan Dasar dan Menengah. Jakarta: Kementerian Pendidikan dan Kebudayaan
- SEPTIANI, A. (2025). *PROSES KOLABORASI SISWA DALAM MEMECAHKAN MASALAH MATEMATIKA MATERI FUNGSI KUADRAT KELAS X MELALUI PEMBELAJARAN DISCOVERY BERBANTUAN GEOGEBRA* (Doctoral dissertation, Universitas Islam Sultan Agung). Semarang: Universitas Islam Sultan Agung
- UBM, M. A. A., Syah, N. I., & Maharani, W. F. (2024). Pengaruh Discovery Learning Terhadap Peningkatan Hasil Belajar Matematika Dan Keterampilan Berpikir Kritis Siswa Sekolah Dasar. *Pedagogia: Jurnal Pendidikan Dasar*, 4(3), 132-140. <https://jurnal.educ3.org/index.php/pedagogia/article/view/191>.
- Wibowo, H. (2020). *Pengantar Teori-teori belajar dan Model-model pembelajaran*. Depok: Puri Cipta Media.