

**IMPROVING MATHEMATICS LEARNING OUTCOMES USING  
DISCOVERY LEARNING IN CLASS XI SOFTWARE ENGINEERING 1  
INFOKOM BOGOR VOCATIONAL HIGH SCHOOL**

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**Abstract**

This study aims to determine how to improve mathematics learning outcomes by using the Discovery Learning model. This research is Classroom Action Research (CAR). This research was conducted in 2 cycles, namely, cycle 1 and cycle 2. The research was carried out at Vocational High School INFOKOM Bogor class XI Software Engineering (RPL) 1 with a total of 25 students, consisting of 17 male and 8 female students. In pre-cycle activities, the average score obtained by students was 59.4, with the number of students who completed 9 people (36%). In cycle 1 activities, the average value of students obtained increased to 70.6 with the number of students who completed increased to 14 people or by 56%. In cycle 2, the average score of students increased to 90.6, with the number of completed students increasing to 22 (88%). Referring to the results obtained in cycles 1 and 2, it can be concluded that the Discovery Learning model can improve mathematics learning outcomes in class XI Software Engineering 1 Vocational High School INFOKOM Bogor.

**Keywords:** discovery learning; mathematics; learning outcomes

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**INTRODUCTION**

Mathematics is a compulsory subject that is taught from elementary to the college level as stated in the Regulation of the Minister of National Education of the Republic of Indonesia number 22 of 2006 (Depdiknas, 2006). Mathematical comprehension is the mental foundation for solving math and daily situations (Sari, Gistituati, & Syarifuddin, 2019). Mathematics subjects need to be given to all students starting from elementary school to equip students with logical, analytical, systematic, critical, and creative thinking skills as well as the ability to cooperate. These competencies are needed so that students can have the ability to

obtain, manage, and utilize information to survive in conditions that are constantly changing, uncertain, and competitive.

There are several competencies or abilities that students must learn and master during the mathematics learning process in the classroom, including thinking and reasoning mathematically, arguing and communicating mathematically, modelling, compiling and solving problems, representations, symbols, and using and utilizing tools and technology (Shadiq, 2007). Moreover, Numerical knowledge is essential for other mathematical learnings, and the necessity of mathematical processes for achieving greater performance in daily life is

underlined (Coronata & Alsina, 2014). Therefore, learning mathematics is necessary to support learning success at a higher level or in the face of increasingly developing technology.

Although several competencies or abilities must be mastered by students, in reality, students still experience difficulties learning mathematics at school. Many students still have difficulty solving problems to solve given math problems. Moreover, in Africa many children struggle with numbers and the four fundamental operations (Maruyama & Kurosaki, 2021). This has an impact on student learning outcomes are low.

Pre-cycle student learning outcomes data shows the average value of students is 59.4. This can be seen from the data on student learning outcomes carried out in class XI RPL 1 in Mathematics with three-dimensional material. From these data, it can be seen that there are still many low student scores, which are still below the *KKM* (Minimum Completeness Criteria). The *KKM* score that should be obtained is 75. However, from the number of students, as many as 25 people, only 9 students or about 36%, have the correct score and are above the *KKM*. The remaining 16 students, about 64%, are still below the *KKM*.

Several factors affect learning outcomes. Factors that influence learning outcomes include internal factors consisting of physiological aspects (physical, eye, ear) and psychological aspects (intellective factors: talent, intelligence and non-intellectual factors: attitudes, interests, needs, motivation), external factors consisting of the social environment (family, teachers, community, and friends), and non-social environment (conditions of the home, school, equipment around, and nature), and learning approach factors (Syah, 2012). In addition, students' classroom learning will be more engaging and able to cultivate critical thinking abilities if they are taught how to conduct research beginning with simple ways to find a

conclusion or knowledge base (Fahmi, Setiadi, Elmawati, & Sunardi, 2019).

One factor that influences learning outcomes is a teacher's role. A teacher plays an essential role in improving student learning outcomes in the teaching and learning process. Therefore, a teacher must develop strategies when teaching so that students do not feel bored and bored, can play an active role in the learning process, and can create a pleasant classroom atmosphere. If students are happy with the class atmosphere, it can also impact the material being taught. Learning strategy is tactic teachers use to achieve learning objectives, including approaches, methods, and learning techniques (Kusrini, 2015).

In mathematics, each concept is related to another concept, and one concept is a prerequisite for another concept. Therefore, students should be given more opportunities to learn and explore their learning concepts independently. For this reason, a learning model is needed that can motivate students to explore the concept. One learning model that emphasizes this concept is Discovery Learning.

Discovery Learning is one of the models in teaching cognitive theory by prioritizing the teacher's role in creating learning situations that involve students learning actively and independently. Discovery Learning is learning to find and find yourself. In this teaching and learning system, the teacher presents lesson materials that are not final (Widodo, Surabaya, Kampus, & Surabaya, 2015). However, students can seek and find their own using a problem-solving approach. Discovery learning or discovery learning models is also defined as learning to understand concepts, meanings, and relationships, through an intuitive process to conclude (Mulyana, 2016). Discovery occurs when individuals are involved, especially in using their mental processes to find some concepts and principles. Discovery is made through

observation, classification, measurement, prediction, determination and inference.

Bruner stated that discovery learning is a teaching model that emphasizes the importance of helping students understand a discipline's structure and key ideas, the need for active student involvement in learning, and authentic learning comes through discovery (Nurdyansyah & Fahyuni, 2016). According to Bruner, the goal of Discovery Learning is that teachers should allow their students to become problem solvers, scientists, historians, or mathematicians (Ozdem-Yilmaz & Bilican, 2020). Moreover, through these activities, students will master it, apply it, and find things that are useful for themselves (Kemendikbud, 2014). Based on the opinions of the experts above, it can be concluded that Discovery Learning is a learning model that emphasizes students to be actively involved in finding a concept independently, where the teacher is only a facilitator, motivator and mentor.

The research was conducted to improve student learning outcomes based on the problems in learning mathematics in class XI RPL 1 INFOKOM Bogor Vocational School. Therefore, the researcher compiled a study entitled "Improving Mathematics Learning Outcomes by Using Discovery Learning in class XI RPL 1 INFOKOM Bogor Vocational School.

## METHOD

The type of research carried out is Classroom Action Research (CAR) (Sugiyono, 2013). Classroom Action Research (CAR) is research conducted by teachers in their classrooms through self-reflection to improve their performance so that student learning outcomes increase (Wardani & Wihardit, 2018).

The research was conducted at INFOKOM Bogor Vocational School, Sindang Barang Loji Village, West Bogor. The subjects of the Classroom Action Research that the researcher conducted were students of class

XI RPL 1 with a total of 25 students, consisting of 17 male and 8 female students.

The research was carried out in two cycles, namely, cycle 1 and cycle 2. However, before that, pre-cycle activities were carried out. Each cycle has 4 stages, namely 1) Planning Phase; 2) Implementation Phase; 3). Observation Phase, and 4) Reflection Stage. In this study, researchers used a written test as a post-test to collect data on student learning outcomes in class XI learning mathematics. In observing the learning process, researchers used observation sheets.

Student learning outcomes were obtained from each lesson's final test (post-test). The data obtained were analyzed by using the percentage of the number of students divided by the data of children who were completed and not yet completed. The percentage calculation uses the formula:

$$\text{Students' completeness} = \frac{\sum \text{complete/uncomplete}}{\text{number of students}} \times 100\%$$

## RESULTS AND DISCUSSION

### A. Results

Pre-cycle activities are carried out at the beginning of learning with Three Dimensional material. A score of 75 is the *KKM* value (Minimum Completeness Criteria) determined by the Mathematics subject teacher at school. So if the value is above 75, it is considered complete, and if it is below 75, it is considered incomplete.

**Table 1**  
**Mathematics Post Test Values in Pre-Cycle**

No	Indicators	Pre-Cycle
1	Lowest Score	20
2	Highest Score	100
3	Average Score	59.4
4	Students who completed	9 people (36%)
5	Students who did not complete	16 people (64%)

The data in Table 1 shows that from a total of 25 students, only 9 scored above the KKM or around 36%. Therefore, improvement is needed. The results of the improvement in learning mathematics obtained using Discovery Learning include:

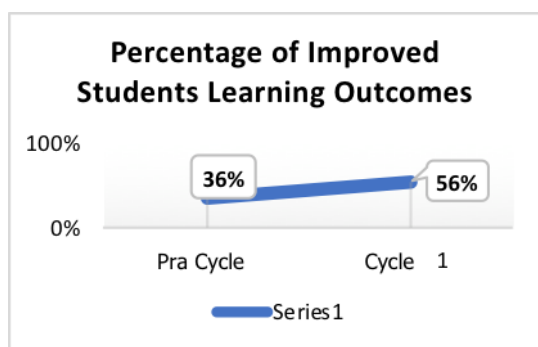
### 1. Results of Learning Improvements in Cycle 1

The results of improving learning in cycle 1 using Discovery Learning have increased. This can be seen in the table of post-test values for cycle 1 in table 2.

**Table 2**  
**Mathematics Post Test Scores in Cycle 1**

No	Indicator	Cycle 1
1	Lowest score	30
2	Highest score	100
3	Average score	70.6
4	Students who completed	14 people (56%)
5	Students who did not finish	11 people (44%)

The data in table 2 shows that the number of students who completed was 14 people, or a percentage was 56%. Students who had not finished were 11 people or 44%. Compared to the pre-cycle activities that have been carried out, the actions of cycle 1 have increased, although only slightly.



**Figure 1. Student Learning Outcomes of Pre-Cycle - Cycle 1**

To improve the results of pre-cycle activities, improvements were made in cycle 1 activities, namely by using Discovery Learning. Moreover, it can be seen that after the first cycle of activities,

the number of students who scored above the KKM increased to 14 people or 56%. This means that there is an increase in the number of students who complete as many as 5 people or an increase of 20% from pre-cycle activities to cycle 1 activities. There are several successes and failures contained in the first cycle of action, including:

- Some students have started to discuss in their respective groups actively.
- There are still students who do not want to be involved in the discussion and rely on their group mates. This is because the student still does not understand the concept of three-dimensional material.

To follow up on the shortcomings in cycle 1, improvements are made, including:

- They were using learning media, namely teaching aids in the form of a cube frame, so that students get an idea about determining the distance between points and the distance from the point to the line from the frame. The cube.
- Stimulate students' thinking power by involving them in making cube frames and determining the distance between points and the distance from points to lines in three-dimensional material, and processing them.

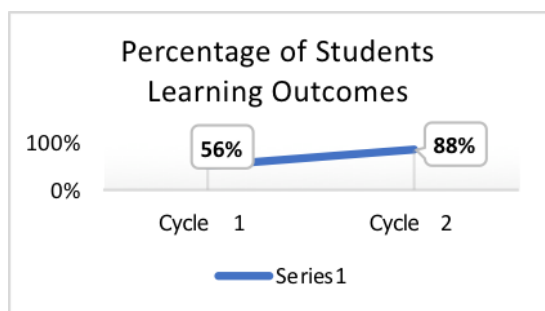
### 2. Results of Learning Improvements in Cycle 2

Cycle 2 was carried out to follow up on student learning outcomes in cycle 1 actions that were less than optimal. Based on the results of the test in the second cycle of action carried out, it was found that the number of students who completed was 22 people or the percentage was 88%, and students who had not completed as many as 3 people or (12%) of the total number of students. The data are listed in Table 3.

**Table 3**  
**Mathematics Post Test Scores in Cycle 2**

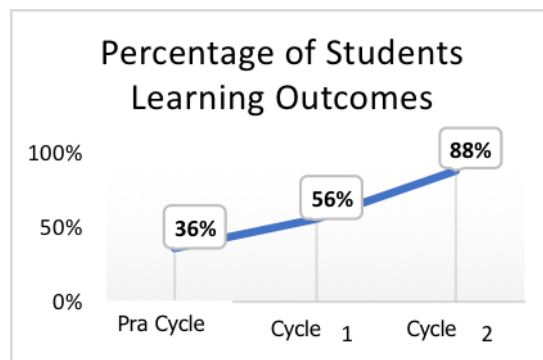
No	Indicators	Cycle 2
1	Lowest Score	50
2	Highest Score	100
3	Average Score	90.6
4	Students who completed	22 people (88%)
5	Students who did not complete	3 people (12%)

The results of improving learning in cycle 2 using the Discovery Learning and learning media, namely teaching aids in the form of a cube frame, have increased from the action of cycle 1.



**Figure 2. Student Learning Outcomes Cycle 1 – Cycle 2**

The graph above shows that the number of students who completed cycle 2 increased. From the beginning of cycle 1, the number of students who completed as many as 14 people, or 56%, increased to 22 people, or the percentage was 88%. The number of students who completed from cycle 1 to cycle 2 increased by 8 people or 32% of the number of students in the class. So from the pre-cycle activities to the improvement of cycle 2, there was an increase in the number of students who completed, namely 13 students or 52%. This shows that learning mathematics with Three Dimensional material using Discovery Learning and coupled with teaching aids in the form of a cube frame can be successful or effective. As seen in graph 4.3 below.



**Figure 3. Student Learning Outcomes Pre-Cycle - Cycle 1 - Cycle 2**

The success in the action of cycle 2, among others:

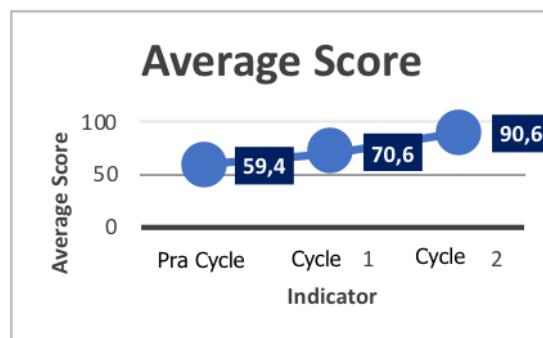
1. Increased student learning outcomes. Students take an active role in their group discussions. This is due to Discovery Learning, which allows students to communicate and be invited to discuss when they cannot do the given questions.
2. Student motivation also increases, supported by the use of teaching aids that make students understand more about the concept of building space because students independently apply the problems they get into the framework of the cube they make.

## B. DISCUSSION

The average value obtained by class XI RPL 1 shows that the improvement results from cycle 1 using the Discovery Learning increased from 59.4 in pre-cycle activities to 70.6. This is because, during the learning process in pre-cycle activities, students have not shown any motivation and learning activities. This is because the researcher's method is still unable to make students active in learning. The absence of group discussions caused students to be confused with working on the problems given by the teacher because there were no friends to discuss. Students are busy working on their respective questions, which impacts student learning outcomes and shows a low average score.

The increase in the average value that occurs from pre-cycle activities to cycle 1 is 11.2. In the learning process in cycle 1, student activities have begun to be seen. Students are involved in the group discussion process. The learning model used by researchers is one of the reasons for increasing student activity and motivation. By using Discovery Learning, students become more active in solving a problem in the discussion process. However, the results obtained are still not optimal because the average value of cycle 1 is still below the KKM. Therefore, the researcher continued the action of cycle 2 activities.

The learning process in cycle 2 had shown a significant increase in results by obtaining an average student score of 90.6. There was an increase in the average value of 20% from the activity of cycle 1 to cycle 2. If it was calculated from the activity of pre-cycle to the action of cycle 2, it was obtained that the increase in the average value was 31.2. The average value obtained in the improvement of cycle 2 has exceeded the KKM value, so it can be said that the indicators of success in the action of cycle 2 have been achieved. This is due to the Discovery Learning model and the use of learning media as teaching aids that make students more active in discussion, independent, and critical thinking in the learning process and also understand concepts in spatial or three-dimensional structures. The following average values of pre-cycle, cycle 1 and cycle 2 are depicted in the graph below:



**Figure 4. The average score of pre-cycle students - cycle 1 - cycle 2**

However, from 100% of the number of students who are expected to complete all of them, there are 12 % or three students whose grades have not been completed or whose grades are still below the KKM. After the researchers paid attention, several factors caused the three students not to be able to work on the questions given. Some of these factors include: being lazy to read, often staying up late so that when they are at school, they are sleepy and cannot concentrate on receiving subject matter, and also rarely going to school, so they often miss lessons, which confuses when given questions. Therefore, there need to be further improvements.

## CONCLUSION

(1) Discovery Learning, applied to Mathematics with Three Dimensional material, can improve students' mathematics learning outcomes, (2) By using Discovery Learning, students become more active and critical by arguing with each other and being active in learning (3) Student learning outcomes in learning Mathematics increase. Judging from the results of the tests carried out by students after the learning activities were completed, the average score in cycle 1 was 70.6, increasing to 90.6 in cycle 2, with the percentage of students' completeness from 56% in cycle 1 to 88% in cycle 2 activities, and (4) The use of teaching aids helps students to be more active, creative,

and independent in solving problems in the learning process. Students become better at understanding the concept of the third dimension because they prove themselves solving the problems given.

## REFERENCES

- Coronata, C., & Alsina, Á. (2014). Evaluation of the mathematical processes in the practices of teaching and learning in childhood education. *Procedia-Social and Behavioral Sciences*, *141*, 1320–1323. [Scopus](#)
- Depdiknas. (2006). *Peraturan Menteri Pendidikan Nasional Republik Indonesia nomor 22 tahun 2006*. [Google Scholar](#)
- Fahmi, F., Setiadi, I., Elmawati, D., & Sunardi, S. (2019). Discovery learning method for training critical thinking skills of students. *European Journal of Education Studies*. [Google Scholar](#)
- Kemendikbud. (2014). *Kementerian Pendidikan dan Kebudayaan. 2014. Modul Materi Pelatihan Implementasi Kurikulum 2013 Mata Pelajaran Matematika SMP/MTs. Jakarta: Kemendikbud.*
- Kusrini, et al. (2015). *Strategi Pembelajaran Matematika*. Tangerang Selatan: Universitas Terbuka.
- Maruyama, T., & Kurosaki, T. (2021). Do remedial activities using math workbooks improve student learning? Empirical evidence from scaled-up interventions in Niger. *World Development*, *148*, 105659. [Scopus](#)
- Mulyana, A. (2016). Model pembelajaran Discovery Learning. Retrieved from <https://ainamulyana.blogspot.com/2016/06/model-pembelajaran-discovery-learning.html>
- Nurdyansyah, N., & Fahyuni, E. F. (2016). *Inovasi model pembelajaran sesuai kurikulum 2013*. Nizamia Learning Center. [Google Scholar](#)
- Ozdem-Yilmaz, Y., & Bilican, K. (2020). Discovery Learning—Jerome Bruner. In *Science Education in Theory and Practice* (pp. 177–190). Springer. [Google Scholar](#)
- Sari, G., Gistituati, N., & Syarifuddin, H. (2019). The effect of guided discovery learning method toward students' ability in understanding math concept. *International Journal of Educational Dynamics*, *1*(2), 54–60. [Google Scholar](#)
- Shadiq, F. (2007). Apa dan mengapa matematika begitu penting. *Departemen Pendidikan Nasional Direktorat Jenderal Peningkatan Mutu Pendidik Dan Tenaga Kependidikan Pusat Pengembangan Dan Pemberdayaan Pendidik Dan Tenaga Kependidikan (PPPPTK) Matematika*, 1–10. [Google Scholar](#)
- Sugiyono, D. (2013). *Metode penelitian pendidikan pendekatan kuantitatif, kualitatif dan R&D*. [Google Scholar](#)
- Syah, M. (2012). *Psikologi Belajar*. Jakarta: Raja Grafindo Persada.
- Wardani, I., & Wihardit, K. (2018). *Materi penelitian tindakan kelas*. Jakarta: Universitas Terbuka. [Google Scholar](#)
- Widodo, G., Surabaya, U. N., Kampus, J., & Surabaya, K. (2015). Pengembangan Dan Implementasi Perangkat Pembelajaran Berbasis Proyek. *Innovation of Vocational Technology Education*, *11*(1), 41–56. <https://doi.org/10.17509/invotec.v11i1.4837>. [Google Scholar](#)



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