IJOELA: International Journal of Education and Learning Assessment
Vol. 01, No. 02, Year 2025, pp. 82-89

Application of Discovery Learning Model to Improve Students' Creative Thinking Skills on Reaction Rates Topic at SMAN 5 Palu

Sy.Zulkifli Sy.Alwi[1], Ni ketut Ketis[2]
[1.2]*Tadulako University*
Email: zulkiflisayidalwi@gmail.com

Article Info

Article history:

Retrieved June 10, 2025
Revised June 17, 2025
Accepted June 20, 2025

Keywords:

Discovery Learning, Reaction Rate, Creative Thinking, Classroom Action Research

ABSTRACT

This study aims to enhance students' creative thinking skills on the topic of reaction rates through the implementation of the Discovery Learning model in class XI A5 of SMAN 3 Palu. The research employed a Classroom Action Research (CAR) design conducted in two cycles, each consisting of four stages: planning, action, observation, and reflection. Data were collected using a creative thinking test based on four key indicators: fluency, flexibility, originality, and elaboration. The results indicated a significant improvement in students' creative thinking abilities. The average score increased from 48.16 in the pre-cycle, to 67.44 in the first cycle, and further to 80.20 in the second cycle. The mode value rose from 28 to 100, while the standard deviation decreased from 20.14 to 17.18, showing more consistent progress among students. The implementation of the Discovery Learning model combined with chemistry practicum activities proved effective in fostering an active, reflective, and collaborative learning atmosphere. Through this approach, students not only gained a deeper understanding of the abstract concept of reaction rates but also improved their creative thinking skills, including fluency, flexibility, originality, and elaboration.

Corresponding Author:

Zulkifli Sayid Alwi
Tadulako University
Email: zulkiflisayidalwi@gmail.com

INTRODUCTION

Education has a role that is not only limited to the delivery of knowledge, but also as a means of character formation and the development of students' potential as a whole. Teachers are expected to be able to create a learning atmosphere that fosters students' activeness, reflection, and creativity. The ability to think creatively is a crucial aspect in facing the challenges of the 21st century, where students are required not only to master concepts, but also to be able to produce innovative ideas and solutions in various contexts. In line with this, Suhartiningsih and Sahono (2021) stated that when students are given the opportunity to discover concepts independently, they become more active, think creatively, and experience an increase in learning outcomes.

The importance of creativity in learning requires chemistry teachers to design a learning process that not only focuses on delivering material, but also provides space for students to explore and build understanding independently. This is especially important because many chemical concepts are abstract and difficult to observe directly. One example is reaction rate material, which requires students to understand processes at the microscopic level, such as the mechanism of collision between particles. Without the right learning strategy, these conditions can reduce student participation and creativity. Research by Izza Muizzah and Kiki Fatkhiyani shows that the low creativity and learning outcomes of students are due to the dominance of the use of conventional methods, such as lectures, questions and answers, and assignments, which lack opportunities for students to explore and develop ideas independently.

As a solution to these problems, the application of the discovery learning model can be an effective alternative. This model allows students to discover concepts independently through observation, experimentation, and problem-solving activities, so that learning becomes more meaningful. The results of the research of Luthfiyah Nurlaela et al. (2019) show that the application of *the discovery learning* model is proven to be able to develop students' creative thinking skills, which include aspects of fluency, flexibility, originality, and idea development. In addition, this model also contributes to increasing students' motivation to learn and confidence, as they play an active role in the process of concept discovery and knowledge development.

A similar study was conducted by Desi Riski, Rahmi Wahyuni, and Novianti (2023) which examined the effectiveness of *the discovery learning* model in science learning at the high school level. The results of their study showed that students who learned using this model experienced a significant improvement in creative thinking skills compared to the control group who used conventional learning. These findings are in line with the research results of Paulina Hendrajanti and Siti Rochmiyati (2021), who stated that the application of *discovery learning* assisted by virtual chemistry laboratories on acid-base titration materials provides wider opportunities for students to develop high-level thinking skills, such as analyzing, inferring, and making predictions based on exploration results. Both studies strengthen the evidence that *discovery learning* is effective in fostering creativity as well as students' analytical abilities in understanding science concepts in depth.

The conditions at SMA Negeri 3 Palu, especially in class XI A5, show that most students still have a low level of creativity in chemistry learning. Students tend to be passive, rely only on examples from teachers, and lack the initiative to explore ideas independently. This indicates that indicators of creative thinking such as fluency, flexibility of thinking, and uniqueness of solutions have not been optimally developed. This condition is very likely caused by a learning approach that has not provided adequate exploration space, especially in abstract and conceptual chemical materials. For example, Seliwati (2017) explained that high school students in Palangka Raya have difficulty understanding the conceptual and procedural nature of chemical materials due to their microscopic nature and lack of opportunities to build conceptual understanding independently.

In this context, the *discovery learning* model can be a suitable alternative to create an active, collaborative learning environment and encourage the development of students' creativity. Research by Zulfatul Khoiriyah and Siti Fatonah (2022) shows that *the discovery*

learning model is able to increase students' active participation and encourage creative thinking skills through exploratory and reflective activities. In line with that, Dede Jakiyah Darojat and Zakirman (2024) emphasized that students who are accustomed to discovering their own concepts through teacher guidance, especially with the help of props on dynamic fluid materials, tend to have more meaningful understanding and more flexible thinking skills. Therefore, the use of learning models that provide space for exploration is very important to be applied in the context of complex and challenging chemistry learning.

Based on these various problems, it can be concluded that the low ability of students' creative thinking skills in chemistry learning, especially in abstract materials such as reaction rates, is a challenge that needs to be overcome immediately. The lack of exploration space in learning makes it difficult for learners to develop new ideas, think flexibly, and come up with original solutions. Therefore, this classroom action research is designed by applying *the discovery learning* model as a strategy to improve students' creative thinking skills. This model was chosen because it is oriented towards independent knowledge search and allows students to be actively involved in the learning process. Through this research, it is hoped that students of grade XI A5 SMAN 3 Palu will not only understand the concept of reaction rate in depth, but also be able to develop creative thinking skills that are important for their academic success and future lives.

RESEARCH METHODS

The design of this research uses Classroom Action Research (PTK) which is carried out in two cycles. Each cycle consists of four stages, namely planning, action, observation, and reflection. This design was chosen because it is in accordance with the research objectives, which are to improve the quality of the chemistry learning process while improving students' creative thinking skills on reaction rate materials.

The research approach used in this study is descriptive quantitative. The selection of this approach was carried out because this study aims to provide a real picture of students' creative thinking abilities systematically based on the data obtained. The research data was collected through a creative thinking ability test which was compiled with reference to four indicators, namely *fluency*, *flexibility*, *originality*, and *elaboration*. Through this test, researchers can map the development of students' creative thinking skills from pre-cycle, cycle I, to cycle II.

This research was carried out at SMAN 3 Palu with the research subject of students in class XI A5 for the 2024/2025 school year. The number of students involved was 36 people, consisting of 16 males and 20 females. The selection of class XI A5 was carried out because at this level students already have sufficient basic knowledge to take part in chemistry learning which emphasizes exploration and creativity development. In addition, a large number of students is expected to provide representative data so that the results of the research are more meaningful.

The main instrument used in this study is the test of creative thinking ability. This test is given at each stage of the research, namely pre-cycle, cycle I, and cycle II. The test result data is then analyzed using descriptive statistical techniques, because this technique is able to provide a clear picture of the performance of students before and after the intervention (Kasmudin Mustapa, Rahmita, and Putriwanti. 2025). Through descriptive analysis, researchers can determine the development trend of learning outcomes and compare the changes in scores that occur in each cycle in a measurable manner.

In analyzing the data, three main statistical measures were used, namely mean, mode, and standard deviation. Mean is used to determine the general trend of student scores in each cycle, so that the average increase can be clearly seen. The mode is used to identify the most frequently appearing scores, which represent the most achievements achieved by the learners. This is important to know the dominant position of students in achieving learning outcomes. Meanwhile, standard deviation is used to see the variation or spread of values against the mean. If the standard deviation value is low, then the learning outcomes of students are relatively even, while if the standard deviation is high, it means that there is a considerable difference between individuals in the achievement of creative thinking skills.

Thus, the use of these three statistical measures—mean, mode, and standard deviation—provides a more comprehensive picture of the development of students' creative thinking skills. Not only the average increase can be observed, but also the distribution of scores as well as the tendency of the scores to be achieved the most. This makes data analysis more comprehensive in assessing the effectiveness of interventions carried out in chemistry learning.

RESULTS AND DISCUSSION

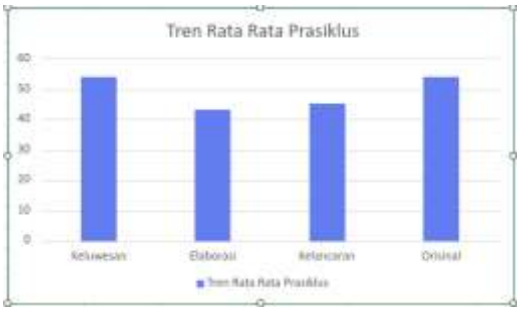
In this study, the instrument used was a creative thinking ability test consisting of 10 questions. The questions are compiled based on four main indicators, namely flexibility, elaboration, fluency, and originality. Each question is assessed with a score range of 1 to 5 according to the quality of students' answers. Overall, the maximum score a student can get is 50 points. The details of the maximum score for each indicator are as follows: the flexibility indicator consists of 2 questions with a maximum score of 10 points, the elaboration indicator consists of 3 questions with a maximum score of 15 points, the fluency indicator consists of 3 questions with a maximum score of 15 points, and the originality indicator consists of 2 questions with a maximum score of 10 points. With this division, researchers can get a more specific picture of student achievement in each aspect of creative thinking measured.

To obtain a more standardized result, the scores obtained by students are then converted into percentage form using the formula:

Final score = $\frac{skor\ yang\ diperoleh}{skor\ maksimal}\ X\ 100$

In this way, the grades obtained by each student will have a range of 0–100, making it easier to analyze and compare between pre-cycle, cycle I, and cycle II.

Based on the results of data analysis at the pre-cycle stage, the average creative thinking ability score of 36 students reached 48.16. This figure shows that students' creative thinking skills before being given actions are still relatively low. The average that has not reached 50 indicates that most students have not been able to display their creative skills optimally, both in flexibility, elaboration, fluency, and originality.



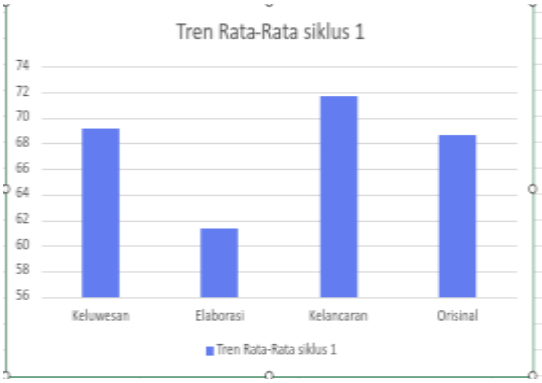
In addition to the average, pre-cycle data analysis also showed that the value of students' creative thinking ability mode was 28. This number means that most students get a score around that score, so it can illustrate the achievement trends that appear most often in the group. Meanwhile, the standard deviation value in the pre-cycle stage was 20.14. This fairly high standard deviation value indicates that there is a large variation between students in achieving scores. In other words, students' creative thinking abilities in the early stages of research are still very diverse.

After going through the pre-cycle stage, the research then continued to cycle I by applying the discovery learning model. In the first cycle stage, the application of the discovery learning model began to show a positive impact on students' creative thinking skills. Based on the results of descriptive statistical analysis, a mode value of 44 was obtained. This means that the score that students get the most is 44, so this achievement can be considered as an overview of the dominant level of creative ability in cycle I.

In addition, the standard deviation value of 19.61 shows that the variation in scores between students is still relatively high. This means that there is a considerable difference between students with high achievement and students with low achievement. However, the standard value of this deviation is smaller than that of pre-cycle (20,138), so it can be concluded that the distribution of students' abilities begins to lead to more even conditions.

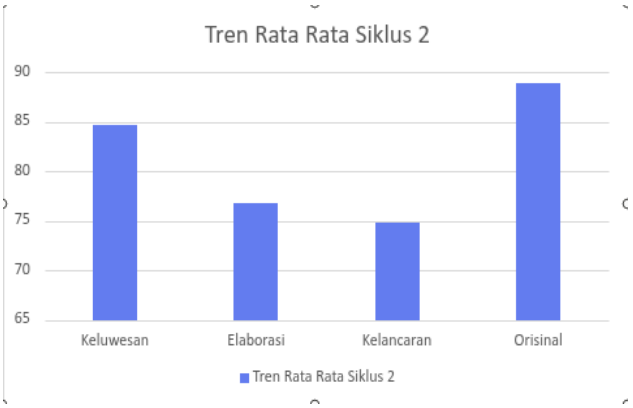
When compared to the pre-cycle, there was an increase in the average score (mean) from 48.16 to 67.44. This increase indicates that most students have been able to show an increase in creativity in the indicators of fluency, flexibility, originality, and elaboration. In other words, discovery learning-based learning successfully facilitates students to be more active, independent, and reflective in discovering concepts.

In cycle II, learning is carried out by improving through practicum on reaction rate material. The application of practicum provides students with the opportunity to make direct observations so that they can understand concepts more concretely. Through this activity, students are also encouraged to be more active in cooperating, discussing, and conveying ideas.



The results of the analysis showed that the average creative thinking ability of students reached 80.20. This figure is higher than the first cycle (67.44) and pre-cycle (48.16), which means that there is a significant increase after the improvement. A mode value of 100 indicates that most students manage to obtain the highest score, indicating that learning outcomes not only improve, but also being able to achieve excellent categories.

In addition, the standard deviation value of 17.18 was lower than the previous cycle. This shows that the variation in scores between students is getting smaller so that the improvement in learning outcomes occurs more evenly. Thus, the practicum applied in cycle II has been proven to be able to improve the reaction rate learning process, as well as increase student creativity in terms of smoothness, flexibility, authenticity, and elaboration of ideas.



Overall, the graph shows a consistent upward trend from pre-cycle to cycle II. The increase is not only seen in one indicator, but evenly distributed in all aspects of creative thinking ability. Thus, it can be concluded that the application of *the discovery learning* model combined with practicum on reaction rate materials has proven to be effective in improving students' overall creative thinking skills.

CONCLUSION

Based on the results of class action research carried out in class XI A5 SMAN 3 Palu, it can be concluded that the application of the discovery learning model combined with practicum activities on reaction rate materials has proven to be effective in improving students' creative thinking skills. This is reflected in the increase in the average score (mean) of students' creative thinking ability, which is from 48.16 in the pre-cycle, increased to 67.44 in the first cycle, and reached 80.20 in the second cycle.

In addition, an increase was also seen in the mode value, from 28 in the pre-cycle to 44 in the first cycle, to 100 in the second cycle. This change shows that the achievement of the highest score is increasingly obtained by students in the final stage of the research. Meanwhile, the standard deviation decreased from 20.14 in the pre-cycle to 19.61 in the first cycle, and finally 17.18 in the second cycle, which meant that the distribution of values became more even and the gap between individuals decreased.

Qualitatively, this increase is evenly distributed across all indicators of creative thinking, namely fluency, flexibility, originality, and elaboration. This proves that discovery learning is able to create a more active, reflective, and collaborative learning atmosphere, so that students not only understand abstract concepts of reaction rates better, but also are encouraged to develop new ideas, think flexibly, and come up with original solutions.

Thus, it can be concluded that learning strategies that provide space for exploration and active student involvement, such as discovery learning with practicums, are very relevant to be applied in chemistry learning. Not only does it improve cognitive learning outcomes, but it also contributes significantly to the development of creative thinking skills that are the main demands of the 21st century.

BIBLIOGRAPHY

Darojat, D. J., & Zakirman. (2024). Dynamic fluid learning innovation with discovery learning and teaching aids: Impact on student creativity and understanding. Academic Discourse: Scientific Magazine of Education, 8(1), 33–41.

Hendrajanti, P., & Rochmiyati, S. (2021). Improving critical thinking skills with discovery learning assisted by virtual chemistry laboratory. Indonesian Journal of Science Education and Learning (JPPSI), 4(2), 78–86.

Khoiriyah, Z., & Fatonah, S. (2022). The use of the discovery learning model in fostering understanding of science concepts in elementary schools. Didactic Journal: Scientific Journal of Basic Education, 6(1), 45–54.

Luthfiyah, N., Suparji, S., Buditjahjanto, I. G. P. A., Sutiadiningsih, A., & Lukitasari, F. (2019). Improving creative thinking skills through discovery learning model in vocational high schools. Journal of Technology and Vocational Education, 25(1), 62–67.

Muizzah, I., & Fatkhiyani, K. (2020). The application of innovative learning models to improve the creativity and learning outcomes of chemistry students in high school. Indonesian Journal of Chemistry Education, 4(2), 115–123.

Mustapa, K., Rahmita, & Putriwanti (2025). Strategic and Implication Class Action Research, Malang. A thousand stars

Riski, D., Wahyuni, R., & Novianti, N. (2023). Improving creative thinking skills through HOTS type questions with a discovery learning model. Journal of Science and Science Learning, 7(2), 156–164.

Squirrel. (2017). Difficulties in understanding the conceptual and procedural nature of chemical equilibrium in high school students in Palangka Raya City. Kanderang Tingang Scientific Journal, 8(1), 45–55.

Suhartiningsih, T., & Sahono, S. (2021). The application of the discovery learning model to increase the creativity and learning achievement of students. Diadik: Scientific Journal of Educational Technology, 11(1), 1–10.