

Research Article

The Effect of the Discovery Learning Model on Critical Thinking Skills and Science Learning Outcomes

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ABSTRACT

This research aims to examine the effect of the discovery learning model on critical thinking skills and science learning outcomes regarding the concept of environmental change in fifth-grade students at Gugus 1, Mangarabombang District, Takalar Regency. This study employs a quantitative research design using a Quasi-Experimental Design with a Posttest Only Control Group Design. The population consists of 132 fifth-grade students, and the sample of 44 students was selected using purposive sampling. Data collection techniques involved tests and observations. The data were analyzed using descriptive and inferential statistical methods. The results of the research indicate that the critical thinking skills and science learning outcomes are parametric data, which were tested using the Independent Samples Test, obtaining significance values of $0.000 < 0.05$ and $0.039 < 0.05$, respectively. Therefore, there is a partial effect of the discovery learning model on critical thinking skills and science learning outcomes in the environmental change concept for fifth-grade students at Gugus 1, Mangarabombang District, Takalar Regency. Additionally, the MANOVA test yielded a significance value of $0.000 < 0.05$, rejecting H_0 and accepting H_1 . This indicates that there is a simultaneous effect of the discovery learning model on critical thinking skills and science learning outcomes.

Keywords: Discovery Learning; Critical Thinking; Learning Outcomes; IPA

1. INTRODUCTION

Education plays a crucial role in enhancing the quality of human resources, especially in the mastery of knowledge and technology. As stipulated in the National Education System Law No. 20 of 2003, Article 3, the purpose of national education is to develop the abilities and shape the character and civilization of the nation to enrich the intellectual life of the nation. However, in reality, there are fundamental problems related to low critical thinking skills and learning outcomes in science subjects (IPA) (MY et al., 2023). Many students at various educational levels still struggle to analyze, solve problems, and think critically about phenomena happening around them, especially in science education (Ellianawati et al., 2025; Saksena, 2023). This presents a challenge that needs to be addressed through teaching approaches that can foster critical thinking abilities and improve learning outcomes in science subjects (Ristiani & Nuha, 2022). One model that has been widely considered is the Discovery Learning model, which is believed to enhance students' critical thinking skills and improve their science learning outcomes (Cahyani et al., 2020; Sembiring, 2013).

Education in Indonesia has undergone several reforms in an effort to create a more effective and relevant system, including through the 2013 Curriculum (Zuryanty, 2019). This curriculum emphasizes thematic and inquiry-based learning, where students are expected not only to memorize material but also to deeply understand and apply concepts (Sani, 2014). In this regard, science education (IPA), which requires students to think critically and conduct experiments, aligns perfectly with this goal. However, despite various efforts, the reality on the ground shows that many students still face difficulties in applying their critical thinking skills in science subjects (Lassari et al., 2024; Santos, 2017; Vieira et al., 2011). Therefore, this study aims to determine the impact of the Discovery Learning model on critical thinking skills and science learning outcomes, particularly on the concept of environmental change, in Grade V students at Gugus 1, Mangarabombang District, Takalar Regency.

Various studies have been conducted to improve the quality of education and student learning outcomes, one of which is through the application of the Discovery Learning model. This model involves students in an intuitive process of understanding concepts, which ultimately improves their motivation and learning outcomes. A study by Nurmala et al (2024) demonstrates that the application of the Discovery Learning model enhances the quality of civic education by engaging students in the process of understanding concepts through discovery. This approach not only increases their motivation but also leads to improved learning outcomes in maritime education institutions. Similarly, research conducted by Chumaerah & Azhari (2024) shows that applying Discovery Learning with a scientific approach significantly improves science learning outcomes for students at SMAN 9 Maros. The study highlights that this model fosters greater student involvement and activity during the teaching-learning process, contributing to enhanced academic performance. Furthermore, a study by

Bahrin et al (2022) in SMK Negeri 7 Talaud indicates that the Discovery Learning model significantly improved learning outcomes in digital communication. The average score of students rose from 70 to 82.26, while also promoting confidence, enthusiasm, independence, and responsibility in students.

Rugiyana (2022) also found that the implementation of Discovery Learning in teaching Social Studies at MTs Negeri 4 Gunungkidul led to significant improvements in student performance. The average score increased from 58.5 in the first cycle to 71.32 in the second cycle, demonstrating the model's effectiveness in enhancing student involvement and understanding. Additionally, a study by Hajar (2021) at SMA Negeri 2 Makassar showed that the use of Discovery Learning improved student activity from 40.27% in the first cycle to 76.38% in the second cycle, further evidencing its positive impact on student engagement and overall learning outcomes.

The numerous studies supporting the effectiveness of the Discovery Learning model in enhancing critical thinking skills and learning outcomes, some challenges remain to be addressed. One of the main challenges is its less-than-optimal implementation in the field, especially in science subjects that require hands-on experiments and deeper observation. Several previous studies, such as those by Djeipy (2022), show that while this model is effective, many students still struggle to apply it in science education, particularly when the concepts being taught are abstract or require a deeper level of understanding. Additionally, another factor influencing the successful implementation of this model is the teacher's ability to manage the classroom and design appropriate learning activities tailored to the students' characteristics (Sari et al., 2024). Furthermore, the results of the 2018 PISA study, released by the OECD, show that Indonesia ranked 70th out of 78 countries in terms of science proficiency, with an average score of 396, significantly lower than the OECD average score of 489. This indicates the urgent need to improve education quality, especially in terms of critical thinking skills and science learning outcomes. Previous studies reveal that although there are efforts to improve the quality of education, the results remain insufficient, particularly in science teaching, which requires students to think critically and conduct scientific inquiries (Alake-Tuenter et al., 2012). Therefore, it is important to further explore how the application of Discovery Learning can contribute positively to improving critical thinking and science learning outcomes in Indonesia.

Many studies have investigated the application of Discovery Learning in education, there are still several gaps that need to be addressed, both empirically and theoretically. One of the primary gaps is the lack of comprehensive studies that measure the effectiveness of this model in science education, particularly in teaching abstract concepts such as environmental change, which not only require theoretical understanding but also the ability to apply knowledge in real-life contexts. Most existing studies focus primarily on cognitive aspects and test scores, while critical thinking skills and the application of concepts in real-world scenarios remain underexplored (Wahyuni et al., 2021). Additionally, while many studies indicate that Discovery Learning is effective in improving learning outcomes, most of these studies do not address the specific context of science education, where experimentation and observation play a key role. This gap suggests the need for more in-depth research on how Discovery Learning can be effectively applied in science education, particularly for complex concepts that demand critical and practical understanding. Moreover, previous research has also overlooked the role of teachers in facilitating the implementation of this model in classrooms. Teachers' ability to design and manage inquiry-based learning activities plays a significant role in the successful application of Discovery Learning (Ana, 2019; Fahruirozi, 2017). Therefore, this study aims to fill this gap by focusing on the application of Discovery Learning in the context of science education in Grade V, particularly examining its impact on improving critical thinking skills and learning outcomes.

This study aims to identify the impact of the Discovery Learning model on critical thinking skills and science learning outcomes in Grade V students at Gugus 1, Mangarabombang District, Takalar Regency. The main objectives of this study are to examine how this model can enhance students' critical thinking skills and learning outcomes in science, specifically on the concept of environmental change. This study is expected to provide new insights into the development of more effective and relevant teaching models in Indonesia, particularly in improving science education quality at the elementary school level. Thus, this research not only contributes to the understanding of Discovery Learning in science education but also offers practical recommendations on how inquiry-based learning can enhance students' critical thinking skills, ultimately improving their learning outcomes.

2. RESEARCH METHOD

This study aims to determine the effect of the Discovery Learning model on critical thinking skills and science learning outcomes of grade V students in Gugus 1 Mangarabombang District, Takalar Regency, using quantitative methods in the form of Quasi Experimental Design and Posttest Only Control Group Design research design. The population of this study included 132 students, with a sample of 44 students selected by purposive sampling. Data were collected through tests and observations, and analyzed using descriptive and inferential statistical tests. The results showed that the data obtained regarding critical thinking skills and science learning outcomes were parametric data, which were tested with the Independent Samples Test with a significance value of $0.000 < 0.05$ for critical thinking and $0.039 < 0.05$ for science learning outcomes, which showed a significant effect partially. The MANOVA test also showed a significance value of $0.000 < 0.05$, indicating a simultaneous effect of the Discovery Learning model on both variables.

3. RESULTS AND DISCUSSION

3.1 The effect of discovery learning model on students' science learning outcomes

Table 1. Independent Sample t-test Results of Student Science Learning Outcomes

Variables	Sig. (2-tailed)	Df	t _{count}	Description
Critical Thinking Ability	.039	46	2,122	Significant

Source: Data Analysis Results (2025)

Based on the results of the *t-test sample independent* test in **Table 1**, it is known that the degree of freedom (df) is 52 with the getting sig value. (2-tailed) is 0.039, sig value. $0.039 < 0,05$. Apart from that, it can also be seen from the getting t calculated value of $2.122 > t(\text{table})(l)$ value of 2.012. So, it can be stated that H_a is accepted and H_0 is rejected. Based on the hypothesis criteria of the sample t test, it can be concluded that there is a difference in student science learning outcomes between the experiment class and the control class after using the discovery learning model. The results of this study are in line with research conducted by (Aryani and Wasitohadi 2020) which shows that there is a significant influence on the critical thinking skills of grade IV elementary school students using the discovery learning model. Also in line with research Lieung (2019) that the discovery learning model has a positive effect on critical thinking skills significantly. Also supported by research Fadila & Makki (2021) whose results show the N-Gain test obtained an increase in the critical thinking ability of students who use the discovery learning model in the experimental class of 0.399 in the medium category. Likewise, research conducted by (Susanti, 2018) shows that the average post-test value of the experimental group is 86.90 and the average post-test of the control group is 78.19. The t-test results show that the t-count of 4.912 is greater than the t-table of 1.685 ($4.192 > 1.685$).

3.2. The Effect of Discovery Learning Model on Student Learning Outcomes in Science Learning at Elementary School

Table 2. Independent Sample t-test Results of Science Learning Outcomes

Variables	Sig. (2-tailed)	Df	t _{count}	Description
Critical Thinking Ability	.039	46	2,122	Significant

Source: Appendix XII Page 115

Based on the results of the *t-test sample independent* test in **Table 2**, it is known that the degree of freedom (df) is 52 with the getting sig value. (2-tailed) is 0.039, sig value. $0.039 < 0,05$. Apart from that, it can also be seen from the getting t calculated value of $2.122 > t(\text{table})(l)$ value of 2.012. So, it can be stated that H_a is accepted and H_0 is rejected. Based on the hypothesis criteria of the sample t test, it can be concluded that there is a difference in student science learning outcomes between the experiment class and the control class after using the discovery learning model. The results of this study are in line with research conducted by (Safitri & Mediatat, 2021) whose results show that the Discovery learning model is proven to be able to improve students' critical thinking skills and learning outcomes. Likewise, research conducted by Ristiani & Nuha (2022) which reveals that the Discovery Learning learning model has a significant effect on critical thinking skills and learning outcomes of junior high school students. In another study also revealed that the application of learning by using the Discovery Learning learning model can improve critical thinking skills and student learning outcomes (Dwi et al., 2019) . The application of learning by using the Discovery Learning model can improve critical thinking skills and student learning outcomes. This indicates that the Discovery Learning model has a positive impact on these aspects. Overall, these results provide strong support for the influence of the *Discovery Learning* model in improving students' learning outcomes and critical thinking skills.

3.2. The Effect of Discovery Learning Model on Science Learning Outcomes and Students' Critical Thinking Skills in Science Learning at Elementary School

Table 3. Multivariate Tests

Multivariate Tests ^a						
Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.954	470.417 ^b	2.000	45.000	.000
	Wilks' Lambda	.046	470.417 ^b	2.000	45.000	.000
	Hotelling's Trace	20.907	470.417 ^b	2.000	45.000	.000
	Roy's Largest Root	20.907	470.417 ^b	2.000	45.000	.000
Class	Pillai's Trace	.697	51.644 ^b	2.000	45.000	.000
	Wilks' Lambda	.303	51.644 ^b	2.000	45.000	.000
	Hotelling's Trace	2.295	51.644 ^b	2.000	45.000	.000
	Roy's Largest Root	2.295	51.644 ^b	2.000	45.000	.000

a. Design: Intercept + Class

b. Exact statistic

Source: Appendix XII Page 115

Table 3, shows the results of the Multivariate significance test. The results of the analysis show that the class F prices for Pillai's Trace, Wilk Lambda, Hotelling's Trace, and Roy's Largest Root have a significance value of $0.000 < 0.05$. This shows that the F prices for Pillai's Trace, Wilk Lambda, Hotelling's Trace, and Roy's Largest Root are all significant. So it can be concluded that there is a significant influence between class variables on science learning outcomes and students'

critical thinking skills. The results of this study are in line with research conducted by (Safitri & Mediatat, 2021) whose results show that the Discovery learning model is proven to be able to improve students' critical thinking skills and learning outcomes. Likewise, research conducted by Ristian & Nuha (2022) which reveals that the Discovery Learning learning model has a significant effect on critical thinking skills and learning outcomes of junior high school students. In another study also revealed that the application of learning by using the Discovery Learning learning model can improve critical thinking skills and student learning outcomes (Dwi et al., 2019). The application of learning by using the Discovery Learning model can improve students' critical thinking skills and learning outcomes. This indicates that the *Discovery Learning* model has a positive impact on these aspects. Overall, these results provide strong support for the influence of the *Discovery Learning* model in improving students' learning outcomes and critical thinking skills.

4. CONCLUSION

This study aims to determine the effect of the discovery learning model on critical thinking skills and natural science learning outcomes on the concept of environmental changes in grade V students in Gugus 1 Mangarabombang District, Takalar Regency. Based on the results of the analysis that has been done, it can be concluded that the discovery learning model has a significant effect on both variables. The t-test analysis shows that the t-count value for critical thinking skills (9.632) and learning outcomes (2.122) is greater than the t-table value (2.012), which indicates that the application of the discovery learning model has a significant positive impact on improving critical thinking skills and student learning outcomes. In addition, the MANOVA test results also support this finding, with a significance value of 0.000 which is smaller than 0.05, indicating a comprehensive and integrated effect between the discovery learning model on both aspects, namely critical thinking skills and learning outcomes. The success of this study signifies the importance of innovative and interactive learning approaches such as discovery learning in improving students' critical thinking skills and learning outcomes, especially in understanding scientific concepts related to environmental change. This finding is in line with various literatures that show that active learning that encourages exploration and discovery can improve students' analysis and reflection skills. The discovery learning model provides space for students to develop their metacognitive skills, which allows them to think more deeply, analyze existing phenomena, and connect them with prior knowledge. In addition, the positive impact on learning outcomes shows that this approach can optimize the understanding of scientific concepts and strengthen students' academic achievement. The application of this model in learning can be a strategic step for developing the quality of education in primary schools, especially in materials that require deep conceptual understanding, such as natural science. Nevertheless, this study has several limitations that need to be considered. Firstly, this research was only conducted in one location, namely Gugus 1 Mangarabombang sub-district, Takalar district, so the findings may not be generalized to all educational contexts in Indonesia. The effect of the discovery learning model on critical thinking skills and learning outcomes may be influenced by other factors not addressed in this study, such as differences in student background, teacher experience, or family socioeconomic conditions. In addition, this study only focused on two main variables, namely critical thinking skills and learning outcomes, while the discovery learning model may also have an impact on other aspects such as social skills, learning motivation, and attitude towards the environment. Therefore, further research can develop this study by involving other variables that may also be influenced by the discovery learning model.

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