Discovery Learning Model in Improving Critical Thinking in Elementary School Students: A Meta-Analysis

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Abstract

This paper analyses the relationship between the discovery learning model and students' critical thinking skills over the past decade. The study uses JASP 0.14.1.0 software for data analysis, employing a meta-analysis and systematic review methodology. A total of 90 papers were initially identified through a comprehensive search, and five were selected based on specific inclusion criteria. The data extracted from these selected articles included sample sizes (N) and correlation values (r), which were then used to calculate the effect size. The results indicate that the effect size for the relationship between the discovery learning model and students' critical thinking skills is 0.57, classified as medium, with a 95% confidence interval ranging from 0.26 to 0.88. These findings are consistent with previous research, thereby reinforcing existing theories. Consequently, there is a significant relationship between the discovery learning model and the enhancement of critical thinking skills among elementary school students.

Keywords: *Model; Discovery Learning; Critical thinking; Elementary school*

INTRODUCTION

Critical thinking skills have become one of the main competencies that students must have in the modern era, especially in facing increasingly complex global challenges (Zhurbenko et al., 2023). In the 21st century, education aims to transfer knowledge and develop analytical, evaluative and creative thinking abilities in students (Zhou, 2023). Developing these skills must be considered in basic education because childhood is a critical period in forming the foundations of thinking that will influence lifelong learning (Ibragimova & Eshbekova, 2022). One pedagogical approach that has received significant attention in this effort is the discovery learning model (Hermawan & Juandi, 2023). With its foundational ideas emphasizing inquiry, autonomous discovery, and exploration, discovery learning has much potential to develop kids' critical thinking abilities in elementary education (Sunarso et al., 2023). However, although many studies have explored the effectiveness of this model, there is an urgent need for a comprehensive literature review to understand the extent to which discovery learning can improve critical thinking skills in basic education contexts (Wafiqni et al., 2023).

Education has recently experienced a significant paradigm shift from a traditional teacher-centred approach to a more student-centred learning model (Deever, 2023). Discovery learning is one of the innovative approaches that has emerged from this change, where students are encouraged to be actively involved in the learning process through independent exploration and discovery (Suparni, 2023). This model is rooted in the constructivist theory put forward by Jean Piaget and Jerome Bruner, which emphasizes the importance of students' active involvement in building their understanding (Supriatno & Purwianingsih, 2023). In this context, discovery learning has great potential to improve critical thinking skills, which include the ability to analyze, evaluate and create new ideas. The importance of developing critical thinking skills in elementary school students lies in their current academic abilities and readiness to face future challenges (Soekamto & Astina, 2022). However, in reality, students must actively participate in learning (Kaltsas & Gkaintartzi, 2023).

With its active and constructive approach, the discovery learning model offers various advantages in basic education (Arlina et al., 2023). This method involves students in a more interactive learning process and encourages them to develop critical thinking skills through problem-solving and independent investigation (Tulandi et al., 2022). Various studies have shown that students who engage in discovery learning tend to have a deeper understanding and can apply their knowledge in different situations (Başbuğ, 2022). However, although there is evidence showing the potential benefits of discovery learning, existing research is often limited to certain contexts or lacks depth in exploring the direct relationship between this method and improving critical thinking skills in elementary school students (Saputri & Rusnilawati, 2023).

This research attempts to fill this gap by providing an in-depth and comprehensive analysis of how the discovery learning model can effectively improve critical thinking skills in elementary school students. Although several studies have explored specific aspects of discovery learning, this research offers a new perspective by combining various findings from the existing literature and evaluating its impact holistically. The novelty aspect of this research lies in the systematic approach to examining various strategies for implementing discovery learning and how these strategies can be adapted to meet the specific needs of students at the basic education level. In addition, this research also highlights the importance of critical thinking skills in current and future educational contexts, making this research relevant not only for academics but also for educational practitioners who wish to implement innovative learning methods in their classrooms. This research aims to evaluate and review existing literature regarding the impact of the discovery learning model on primary school students' critical thinking skills.

METHOD

This research uses quantitative research, which examines a phenomenon by

changing data into statistically analyzed numbers. In this case, the discovery learning model and critical thinking skills are the phenomena in question.

Research Approach

This research used meta-analysis as an approach. The techniques used include summarizing research data and reviewing and analyzing data from several relevant research results that have been published. In addition, a meta-analysis approach was carried out to combine and evaluate quantitative statistical data based on research findings, namely the relationship between discovery learning models and critical thinking skills.

Data collection

Research data was collected via the page https://typeset.io/ with the verbs "discovery learning" and "critical thinking". The search for research data was limited to the last ten years, namely between 2013 and 2023. Based on the search, 90 articles were obtained, and five articles were chosen according to predetermined characteristics.

Data analysis

Five of the 90 journals were determined based on predetermined characteristics. These characteristics include discovery learning analysis, critical thinking, sample size, r-count, madrasa level, Madrasah Ibtidaiyah (MI/SD), research location, standard error, and effect size. Effect size is a standard measure used by meta-analyses to determine the strength and direction of correlation (Borenstein et al., 2021). Data analysis in this study used JASP 0.18.3 software.

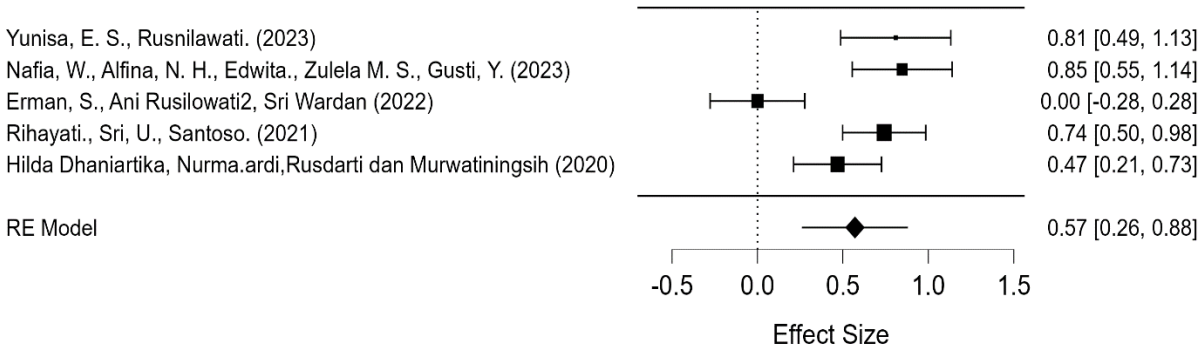
RESULTS AND DISCUSSION

As shown in the above table, five educational levels are utilized in elementary schools. Research samples are from Central Java, Banten, Southeast Sulawesi, and Central Java. Meanwhile, the sample research at the elementary school education level in Central Java province consisted of three samples. Meanwhile, at the elementary school education level in Banten province, there is one sample, and in Southeast Sulawesi province, there is one sample. The highest sample size was found in research conducted in Kudus district, Central Java (N = 68), while the lowest was in Bekonang district, Central Java (N = 40). The largest r value (0.85) was shown by the results of Nafia et al (2023), while the lowest r value (0.00) was shown by the results of Erman et al (2022).

Table 1
Research Results

Authors	Level	Regency/city	Province	N	r
Yunisa, ES, Rusnilawati. (2023)	elementary school	Bekonang	Central Java	40	0.81
Nafia, W., Alfina, NH, Edwita., Zulela MS, Gusti, Y. (2023)	elementary school	South Tangerang	Banten	48	0.85
Erman, S., Ani Rusilowati2, Sri Wardan (2022)	elementary school	Buton	Southeast Sulawesi	54	0.00
Rihayati., Sri, U., Santoso. (2021)	elementary school	Holy	Central Java	68	0.74
Hilda Dhaniartika, Nurma'ardi, Rusdarti and Murwatiningsih (2020)	elementary school	Semarang	Central Java	61	0.47

Then, an analysis of the effect size value was carried out. Based on the analysis results, the effect size value is 0.57, with a standard error of 0.157. The average confidence interval (M) is 95 per cent in the range of 0.26 to 0.88. In summary, the results of the effect size analysis of the discovery learning model and critical thinking skills can be seen in Figures 1 and 2, forest and funnel plots.



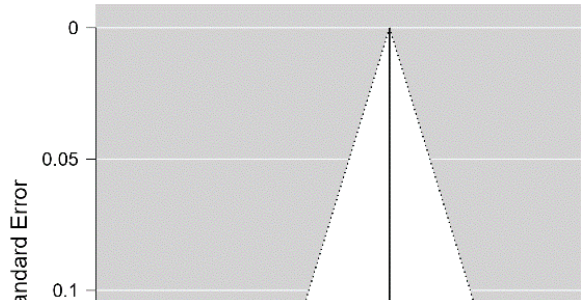


Figure 1
Effect Size

Next, determine whether the hypothesis is rejected or accepted. Based on calculations, Z-Value (3.628) and P-Value (0.708) < 0.01) were at the 95 per cent significance level. So, the hypothesis is accepted, meaning the discovery learning model significantly correlates with elementary school students' critical thinking skills.

Based on the effect size value obtained, which is 0.57 in the interval 0.26 to 0.88, which is in the medium category with a confidence level of 95 per cent, it can be concluded that there is a significant relationship between the discovery learning model and critical thinking skills. The discovery learning model impacts students' critical thinking skills. Discovery learning or based learning model discovery is a student-centred approach that emphasizes active learning, critical thinking, and motivation in the educational process. The discovery learning model has been proven to significantly improve elementary school students' thinking skills, especially critical thinking skills (Sunarso et al., 2023). In line with this, the use of discovery learning models shows an important effect on elementary school students' critical thinking skills, with the highest impact observed in education (Yuliati & Susianna, 2023). By engaging students in active learning, encouraging exploration, and fostering a deeper understanding of concepts, the discovery learning model has proven effective in improving elementary school students' thinking skills and preparing them for future challenges. From the discussion of the results of this research, it can be concluded that there is a relationship between the discovery learning model that is satisfactory during learning and critical thinking skills (Sunarso et al., 2023).

In using the discovery learning learning model, some factors support the application of the discovery learning learning model in improving critical thinking skills, namely learning environmental factors. Learning environmental factors also play an important role in developing students' critical thinking skills in the discovery learning model. An environment facilitating collaboration, discussion, and exploration of new ideas will encourage students to think critically and creatively. With positive

interactions between students and teachers and technology that supports interactive learning, the discovery learning model can improve students' critical thinking abilities (Agung et al., 2023).

Sunarso (2023) stated that leadership in the discovery learning model context motivates students to think critically. The principal or teacher, as a leader, must be able to provide inspiration, provide challenges, and provide the support needed so that students feel motivated to be actively involved in the learning process. With supportive and motivating leadership, students will feel more motivated to develop their critical thinking skills in the discovery learning model. Critical thinking factors are also the key to ensuring that students can apply the knowledge they have acquired in real-world situations, strengthening the relevance and effectiveness of discovery learning. Apart from that, factors such as analytical skills, courage to ask questions, and the desire to try new things also influence students' ability to think critically in discovery learning. By paying attention to and optimizing these factors, discovery learning can be more effective in developing students' critical thinking skills.

CONCLUSION

The discovery learning model has a significant relationship with critical thinking skills. Based on the research results conducted using the meta-analysis method, the discovery learning model positively impacts elementary school students' critical thinking skills. Various studies that have been conducted show that the discovery learning model encourages the active involvement of students in the learning process, promotes the development of critical and analytical thinking skills, and provides a more meaningful and relevant learning experience for students. Thus, this research provides an important contribution to understanding how the discovery learning model can effectively improve elementary school students' critical thinking skills. This research also highlights the importance of developing critical thinking skills in the current and future educational context, making it relevant for academics and educational practitioners who want to implement innovative learning methods in their classes.

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