



Effect Size Discovery Learning Model on Students Critical Thinking Skills

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Abstrak

Penelitian ini bertujuan untuk mengetahui efek size model discovery terhadap keterampilan berpikir kritis siswa. Jenis penelitian ini adalah penelitian meta-analisis. Sampel penelitian berasal dari analisis 10 jurnal nasional dan Internasional yang terindeks SINTA, Scopus dan Web of Science. Proses pencarian sumber data berasal dari Google Scholar, ScienceDirect, Eric dan Wiley. Kata kunci penelusuran sumber data yakni model discovery learning dan keterampilan berpikir kritis. Teknik pengumpulan data adalah observasi langsung dan dokumentasi. Analisis data adalah analisis statistik dengan menghitung effect size masing-masing penelitian dengan bantuan JSAP. Hasil penelitian menunjukkan bahwa rata-rata effect size sebesar 0.90 dengan kriteria sangat tinggi, nilai rata-rata kelas eksperimen sebesar 85. 90 dan kelas kontrol 72.10 dan nilai N-gain sebesar 0.52 . Temuan ini menunjukkan adanya pengaruh yang positif model discovery learning terhadap keterampilan berpikir kritis siswa. Model discovery membantu siswa lebih aktif serta memiliki kemampuan berpikir tingkat tinggi dalam belajar.

Kata Kunci: Pendidikan, Model Discovery Learning, Berpikir Kritis

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Abstract

This study aims to determine the effect size of the discovery model on students' critical thinking skills. This type of research is meta-analysis research. The research sample comes from the analysis of 10 national and international journals indexed by SINTA, Scopus and Web of Science. The data source search process comes from Google Scholar, ScienceDirect, Eric and Wiley. The keywords for searching data sources are discovery learning model and critical thinking skills. Data collection techniques were direct observation and documentation. Data analysis is statistical analysis by calculating the effect size of each study with the help of JSAP. The results showed that the average effect size was 0.90 with very high criteria, the average value of the experimental class was 85. 90 and the control class was 72.10 and the N-gain value was 0.52. These findings indicate a positive effect of the discovery learning model on students' critical thinking skills. The discovery model helps students be more active and have higher-level thinking skills in learning

Keywords: Education, Discovery Learning Model, Critical Thinking

Introduction

Critical thinking is the ability to solve a problem in life (Elfira et al., 2023; Fradila et al., 2022; Zulyusri et al., 2023; Suryono et al., 2023). Critical thinking skills are among the high-level skills that students must master in the 21st century (Zainil et al., 2023; Rahman et al., 2023; Ichsan et al., 2022; Jamaludin et al., 2022). Hariyanto et al., (2022) Critical thinking helps students more easily analyze a problem in learning activities. Furthermore, critical thinking skills have an important role for students in understanding learning materials and content (Arisoy & Aybek, 2021 ;Luciana et al., 2023; Nurtamam et al., 2023; Susilowati, 2020; Ristanto et al., 2022) Critical thinking skills train students to formulate and evaluate a phenomenon that occurs (Solihin et al., 2018; Oktarina et al., 2021; Sofianora et al., 2023; Palavan, 2020; Yaiche, 2021).

The level of critical thinking of Indonesian students is currently still relatively low (Putra et al., 2023; Zulkifli et al., 2022; Supriyadi et al., 2023; Chusni et al., 2022). It can be seen from TIMSS in 2015 that the level of thinking skills of Indonesian students scored 397 far from the average international score of 500 (Ilmi et al., 2019; Suharyat et al., 2022; Rahman et al., 2023; Supratman et al., 2021). Furthermore, the results of the 2018 Program for International Student Assessment (PISA) conducted by the OECD showed that the science literacy of Indonesian students in critical thinking skills only obtained a score of 396, ranked 71 out of 78 member countries (Ingkawang et al., 2018; Santosa et al., 2021; Suhaimi et al., 2022; Suharyat et al., 2022; Razak et al., 2021). The low level of students' critical thinking skills is caused by teacher-centered learning (Ayu et al., 2023; Nusantari et al., 2021; Zulyusri et al., 2022; Suharyat et al., 2022). In addition, research results (Hamengkubuwono et al.,

2016) The low critical thinking skills of students are influenced by teachers still using conventional learning models and the selection of learning models that are not appropriate.

Discovery learning is one of the learning models that can encourage students' thinking skills (Sutiani et al., 2021; Mardi et al., 2021). Discovery learning can make students more active in learning and discover concepts and principles for themselves (Hariyanto et al., 2023; Nurcahyo , 2018; Andayani, 2020; Batubara, 2019). The discovery learning model can make the learning process student-centered (Rahmayani et al., 2019). In addition, the discovery learning model trains students to learn independently and creatively (Septiana et al., 2021; Mulyanto et al., 2020; Suharyat et al., 2023). Research results (Syahmel & Jumadi, 2019) stated that the discovery learning model can foster students' interest and learning achievement.

Furthermore, previous research (Putra & Linuwih, 2020) explained that the discovery learning model can emphasize students' eternal thinking skills-21. Research results by (Ketut et al., 2018) The discovery learning model has a positive influence on student learning outcomes. But in reality, many studies on the discovery learning model are still few studies that describe the size effect of the discovery learning model on students' critical thinking skills. based on these problems, this study aims to determine the size effect of the discovery model on students' critical thinking skills.

Methods

This study is a type of meta-analysis research. Meta-analysis is a type of research that analyzes related studies that can be analyzed with statistics (Khairunnisa & Juandi, 2022; Razak et al., 2021; Rahman

et al., 2023; Ramadhani & Ratnawulan, 2022). Data sources came from analyzing 13 national and international journals. Search for data sources through google scholar, Eric, ScienceDirect and Wiley. The method of selecting data sources is the PRISMA method.

The keywords for data search are discovery learning model and critical thinking skills. The inclusion criteria in this study are 1) national and international journals indexed by SINTA, DOAJ, Scopus and IEEE. 2) Type of experimental or quasi-experimental research; 3) National and international journals published in 2010-2023; 4) research has a relationship with research variables and 5) has complete data (t value, F value and Standard Deviation). Source collection techniques through direct observation and documentation. Data analysis is quantitative analysis by calculating the effect size value of each study with the help of the JSAP application. The effect size value criteria can be seen in Table 1.

Table 1. Effect Size Value Criteria

Effect Size	Kriteria
-0.15 ≤ ES < 0.15	Ignored Effect
0.15 ≤ ES < 0.40	Low Effect
0.49 ≤ ES < 0.75	Moderate Effect
0.75 ≤ ES < 1.10	High Effect
1.10 ≤ ES < 1.45	Very High Effect
ES ≥ 1.45	Very good Effect

Source: (Khairunnisa & Juandi, 2022; Suharyat et al., 2022; Ichsan et al., 2022)

Result and Discussion

Result

From the analysis of national and international journals, only 143 journals that have a relationship with the effect of the discovery learning model on students' critical thinking skills, only 13 journals that have met the inclusion criteria are then used as data sources. Journals that have met the inclusion criteria are analyzed for

journal type and effect size which can be seen in Table 2.

Table 2. Journal Type Analysis and Effect Size of Each Study

NO	Author	Journal Type	Effect Size	Criteria Effect
1	Ristante <i>et al.</i> , (2022)	International	1.14	Very High Effect
2	Haris <i>et al.</i> , (2015)	National	0.68	Moderate Effect
3	Resty & Mufti (2019)	National	0.96	High Effect
4	Noviyanto & Wardani (2020)	National	1.20	Very High Effect
5	Qurniati <i>et al.</i> , (2015)	National	0.85	High Effect
6	Fikriyatii <i>et al.</i> , (2022)	International	0.42	Low Effect
7	Maulidar <i>et al.</i> , (2016)	National	0.74	Moderate Effect
8	Purwanto <i>et al.</i> , (2012)	National	1.30	Very High Effect
9	Simamora & Saragih (2019)	International	0.81	High Effect
10	Fadila & Makki (2021)	National	0.49	Low Effect
11	Rusminiati <i>et al.</i> , (2015)	National	1.80	Very good Effect
12	Maubana & Sakbana (2020)	National	0.62	Moderate Effect
13	Yaiche (2021)	International	0.77	Moderate Effect
Average Effect Size			0.90	High Effect

Table 2 shows that there are 4 international journals and 9 national journals that have met the inclusion criteria regarding the discovery learning model on students' critical thinking skills. Furthermore, the average effect size value (ES = 0.90) with very high criteria. This result explains that the discovery learning model has a positive influence on students' critical thinking skills. The next step is to analyze the level of education which can be seen in Table 3.

Table 3. Meta-analysis of Education Level

Kode Jurnal	Tingkatan Pendidikan	Effect Size	Nilai rata-	Kriteria
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			rata Effect Size	
B1	SD	1.14	0.995	High
B2	SD	0.68		
B3	SD	0.96		
B4	SD	1.20		
B5	SMP	0.85	0.67	Moderate
B6	SMP	0.42		
B7	SMP	0.74		
B8	SMA	1.30	0.965	High
B9	SMA	0.81		
B10	SMA	0.49		
B11	SMA	1.80		
B12	SMA	0.62		
B13	SMA	0.77		

Table 3. Explains that the average effect value at the elementary level is 0.995 with high criteria, the average effect size at the junior high school level is 0.67 and the average effect size at the high school level is 0.965 with high criteria. These results show that the level of education affects the application of the Discovery Learning model to students' critical thinking skills at school. Furthermore, calculating the average value of the application of the discovery learning model in the experimental class and the control class can be seen in Table 4.

Table 4. Mean scores of Experimental and Control Classes

Kelas	Nilai Rata-rata	Standard Deviasi
Ekeperimen	85.90	0.762
Kontrol	72.10	0.481

Table 5. It shows that the experimental class average score of 85.90 is higher than the control class average score of 72.10. This proves that the discovery learning model can increase the value of students' critical thinking skills in learning. Furthermore, conducting hypothesis testing to determine the effectiveness of the discovery learning model on students' critical thinking skills can be seen in Table 6.

Table 6. Hypothesis Test Results of the Effectiveness of Discovery Learning Model > Students' Critical Thinking Skills

Z	P	N-gain
6.620	0.000	0.52

Table 6. Explaining the results of hypothesis testing, it is known that the Z value is 6.620 or $p < 0.05$ with an N-gain value of 0.52. This result shows that the discovery learning model is effective in improving students' critical thinking skills.

Discussion

The results of this study show that the application of the discovery learning model has a significant effect on students' critical thinking skills. This can be seen from the average effect value (ES = 0.90) with very high criteria. The results of this study are in line with (Prasetyo & Kristin, 2020) stated that the application of the discovery learning model has a positive influence on students' critical thinking skills. The discovery learning model can improve students' understanding of concepts and scientific attitudes as well as students' motivation in learning (Putri et al., 2011; Widiadnyana et al., 2014). Research results by Rahman (2017) The discovery learning model trains students to think critically and creatively in learning. Furthermore, the discovery learning model helps students to be more active and independent in learning activities (Cintia et al., 2018; Wahyudi et al., 2019; Supratman et al., 2021). The discovery learning model directs students in finding concepts through an experiment so that it can foster students' critical thinking skills (Putri et al., 2020; Setiadi & Elmawati, 2019; Rudibyani & Perdana (2018).

The application of the discovery learning model can encourage student learning outcomes in critical thinking. The results can be seen in Table 4. from the average value of the experimental class using the discovery learning model of 85.90 is higher than the average value of the control class of 72.10 with the conventional model. This result is in line with research (Usman et al., 2022; Waziana

et al., 2020; Kharisma, 2022). The application of the discovery learning model is able to train students to work together and be able to connect the knowledge they have with the new knowledge found (Muhammad et al., 2023; Simamora & Saragih, 2019). Knowledge is all information obtained by students through certain literature (Ferry et al., 2019). Linggile & Payu (2022) Discovery learning trains students to acquire knowledge independently according to their interests, thus encouraging critical thinking skills in learning.

Critical thinking skills play an important role in solving problems in learning (Hacioglu, 2021); Zulyusri et al., 2022; Rahman et al., 2023; Suharyat et al., 2022). Critical thinking skills help students more easily understand the subject matter presented by the teacher (Sayg & Karaka, 2021; Atwa et al., 2022; Pala, 2022). So, the selection of the discovery learning model is one of the solutions in improving students' critical thinking skills in learning. The p value <0.05 with an N-gain value of 0.52. It shows that the discovery learning model is very effective in improving students' critical thinking skills in learning. The results of this study are in line with (Eskris, 2021) The discovery learning model is effective for developing critical thinking skills in learning.

Conclusion

From this study it can be concluded that the average effect size is 0.90 with very high criteria, the average value of the experimental class is 85.90 and the control class is 72.10 and the N-gain value is 0.52. This finding shows that there is a positive effect of the discovery learning model on students' critical thinking skills. The discovery model helps students be more active and have higher-level thinking skills in learning. In addition, the discovery

learning model helps teachers more easily engage students in learning.

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