

## THE INFLUENCE OF DISCOVERY LEARNING MODEL ON STUDENTS 4C THINKING SKILLS: META-ANALYSIS

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### **Abstract**

*In 21st century learning, students must have Critical Thinking, Creative Thinking, Collaborative and Communicative, better known as 4C skills. 4C skills help students provide solutions in solving a problem. However, teachers have not been able to stimulate students to have 4C thinking skills. The discovery model is one model that is effective in encouraging students to think 4C. The aim of this research is to determine the effect of the discovery learning model on students' 4c thinking abilities. This type of research is meta-analysis research. Data sources come from 10 national and international journals. Search for data sources via Google Scholar, ERIC, ScienceDirect, DOAJ, and Wiley databases. The data collection technique is direct observation through databases and documentation. The data analysis technique calculates the effect size value with the help of the JASP application. The research results concluded that the average score for critical thinking was 82.17, creative thinking 80.52, communication 85.16, and collaboration 80.57. Furthermore, the average effect size value is 1.017 with high criteria. These findings explain that the discovery learning model has a significant effect on students' 4c thinking abilities.*

**Keywords:** Discovery Learning; 4C Thinking, Effect Size, Meta-analysis

## Introduction

21st century learning leads students to have the ability to think systematically and logically in solving a problem (Xu & Zhou, 2019; Zulkifli et al., 2022; Zulyusri et al., 2023). 21st century learning students must have critical thinking, *creative thinking*, *Calaborative* and *Communicative* known as 4c skills (Ozen, 2022; Rais et al., 2021; Suharyat et al., 2023). 4c thinking skills help students be more active and innovative in learning (Onur & Kozikoğlu, 2020; Nurtamam et al., 2023; Putra et al., 2023; Ok & Rich, 2021). In addition, students who have 4C thinking skills will encourage students to improve soft skills and *hard skills* in the learning process (Ekawati et al., 2019). 4C thinking skills help students be more innovative in facing the industrial revolution 4.0 (Anwar et al., 2020)

Students' 4C thinking skills in facing the 21st century are still relatively low (Kristanto & Santoso, 2020; Utomo et al., 2023; Suryono et al., 2023). This can be seen from the results of PISA 2018 conducted by the OECD the level of science literacy of Indonesian students in the learning process obtained a score of 396 ranked 71 out of 78 countries (Razak et al., 2021; Rahman et al., 2023; Sofianora et al., 2023; Rahman, et al., 2023). Furthermore, the results of TIMSS research in 2015 showed that the critical thinking ability of Indonesian students in the fields of science and mathematics obtained a score of 397, ranked 45 out of 50 countries (Fitriyah & Ramadani, 2021); Septian & Riskiandi, 2017). This result is also supported by *The Global Creativity index* Survey in 2015 Indonesia ranked (Fitriyah & Ramadani, 2021). The low ability to think 4C is caused by many factors. Apart from that, students' low motivation in learning (Yasin et al., 2021). (Orak, 2021) Improper selection of learning models to improve students' 4C thinking skills.

The *discovery learning* model is one model that can encourage students' 4 C thinking skills in learning (Noviyanti & Ristanto, 2019; Yusnita & Prastika, 2021 ; Hariyanto et al., 2022; Rahmadhani et al., 2021). The *discovery learning* model is a learning model that encourages students to be more active in finding a concept independently (Widiadnyana et al., 2014; Ristanto et al., 2022; Usman et al., 2022). *Discovery learning* teachers only act as mentors so that students are more active in learning (Putri et al., 2011). Furthermore, *the discovery learning* model of students learns directly in learning activities (Zahara et al., 2020; Hariyanto et al., 2023).

Research Hariyanto et al., (2023) *discovery learning* model can improve students' communication skills in learning. Research (Putri et al., 2020; Suardana & Redhana, 2020; Wafa & Jatmiko, 2022) *the discovery learning* model has a positive influence on improving students' critical thinking skills. Furthermore, research (Syolendra & Laksono, 2018; Ridlo, 2018) *The discovery learning* model can improve students' creative thinking skills and interest in learning. Many studies related to the *discovery learning* model have not been found research on the effect of the size of the *discovery learning* model on students' 4c skills. Based on these problems, this study aims to determine the effect of the *discovery learning* model on students' 4c thinking skills.

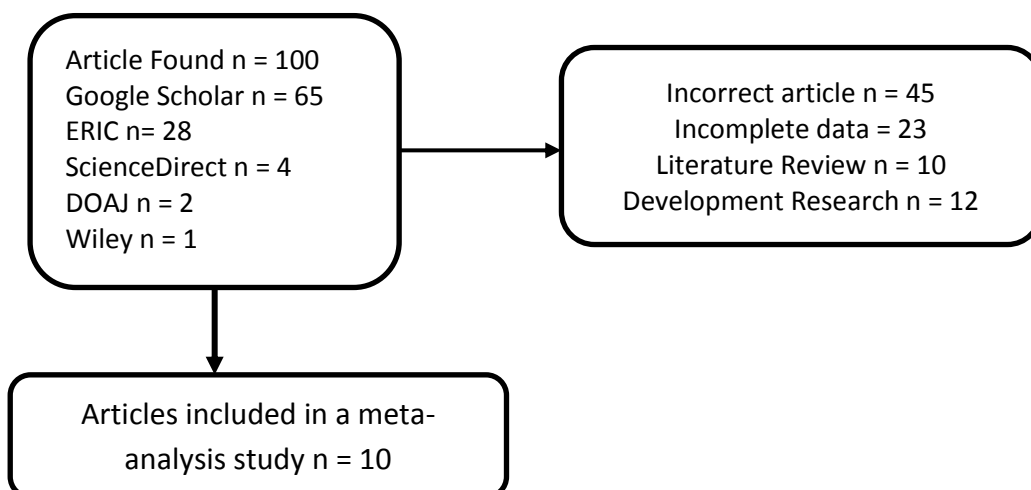
## Research Method

This study is a type of meta-analysis research. Meta-analysis research is a type of research that collects and analyzes primary studies quantitatively (Oktarina et al., 2021 ; Ichsan et al., 2022; Santosa et al., 2021; Chamdani et al., 2022; Joseph, 2023). This study aims to determine the effect of the discovery learning model on students' 4C thinking skills. Data sources come from 10 national and international journals. Search data sources through google scholar, ERIC, ScienceDirect, DOAJ, and Wiley databases. Data collection techniques are direct observation through databases and documentation. The inclusion criteria are research published from 2020-2023, related to the discovery learning model on students' 4c thinking skills, research must be indexed by SINTA, DOAJ, EBSCO, WOS, Microsof Academic and Scopus, research comes from international journals or proceedings and has a mean, Standard Deviation and sample size (N).

Furthermore, According to Cooper in (Nastiti et al. , 2021) The steps to perform meta-analysis are 1) formulating problems, 2) collecting data, 4) coding data and data analysis and interpretation. Data analysis techniques calculate the effect size value with the help of JASP application. The criteria for the value of effect size are guided by the criteria (Cohen et al., 2007) namely  $0.00 < d < 0.20$  small criteria;  $0.20 \leq d \leq 0.80$  medium criteria and  $d \geq 0.80$  high criteria.

## Result and Discussion

In this study, 10 relevant studies were obtained related to the effect of *discovery learning* models on students' 4c thinking skills. Research that has met this inclusion criterion comes from elementary, middle and high school students. The process of selecting data sources can be seen in figure 1.



Furthermore, an analysis of the effect size of 10 studies on the effect of *discovery learning* models on students' 4c thinking skills can be seen in Table 1.

Table 1. *Effect Size Analysis* Based on Data Source

Journal Code	Year of Publication	Sample Size (N)	Research Design	Effect Size
PL 1	2020	60	Experiment	0.63
PL2	2021	87	Experiment	0.8 8
PL3	2021	50	Experiment	1.52
PL4	2022	38	Experiment	0.91
PL5	2020	110	Experiment	2.23
PL6	2023	200	Experiment	1.07
PL7	2023	40	Experiment	0.70
PL8	2023	52	Experiment	0.84
PL9	2020	80	Experiment	0.69
PL10	2021	94	Experiment	0.80
<b>Average value of effect Size</b>				<b>1.017</b>

Based on Table 1, showing the results of effect size analysis from 10 studies analyzed sample size ranging from 38 – 200 students. According to Cohen et al., 2007, four articles had an effect size value (0.63 – 0.69) medium criterion and six articles had a high effect size value (0.80 – 2.23). These results concluded that the *discovery learning* model had a positive effect on students' 4c thinking skills with an average effect size score of 1,017 high criteria. This research is in line (Maubana & Sakbana, 2020) the *discovery learning* model has a positive influence on students' critical thinking skills in learning. The results of the study (Ekaputra, 2023) the application of the *discovery learning* model have an influence on improving students' collaborative and creative skills in learning. The *discovery learning* model trains students in finding concepts or learning materials directly (Sawah & Kusaka, 2023; Ilhan et al., 2019). Furthermore, the *discovery learning* model is effectively applied in 21st century learning (Winangun et al., 2021), thus encouraging students to improve 4C skills.

4C thinking skills consisting of critical, creative, collaborative and commonitive thinking skills are very important for students in solving a problem in life. The 4C's thinking skills help students understand the subject matter faster and easier. So, the application of *discovery learning* models in schools helps teachers stimulate students' 4C thinking skills. According to (Nofiana et al., 2020) the *discovery learning* model can foster students' higher-order thinking skills in learning activities. Furthermore, the results of the study (Juniarso, 2020; Kholili et al., 2021; . Ekawati & Sunarno, 2017) *discovery learning* model can improve students' creative and critical thinking skills in learning. The *discovery learning* model grows students' interpersonal intelligence

(Permatasari et al., 2018). Furthermore, knowing the mean effect size average and the average value of the influence of the discovery learning model in schools can be seen in Table 2.

**Table 2.** Effect size and Average Score of *Discovery Learning Model* on 4C Thinking Skills of Students in School

4C thinking skills	Education Level	Average Effect Size	Mean
Critical Thinking	SD	0.81	82.17
	SMP		
	SMA		
Creative Thinking	SD	0.86	80.52
	SMP		
	SMA		
Collaborative	SD	0.93	85.16
	SMP		
	SMA		
Communicative	SD	0.75	80.57
	SMP		
	SMA		

Based on Table 2, explaining the results of the effect size analysis and the average value of the discovery learning model in schools at the education level from elementary to high school obtained critical thinking skills effect size value of 0.81 high criteria and average value of 82.17, creative thinking skills effect size value of 0.86 and average value of 80.52, collaboration effect size value 0.93 height criteria and average value of 85.16 and communicative effect size value of 0.75 and average value of 80.57. These results conclude that the discovery learning model is effectively applied to improve students' 4C thinking skills. The results of the study (Simamora & Saragih, 2019) discovery learning model effectively improve students' problem-solving abilities and self-confidence so that it can encourage students' 4C skills. Research (Gunawan et al., 2020; Ristanto et al., 2022) The implementation of the discovery learning model can effectively develop students' cognitive thinking skills in learning. So, the *discovery learning* model makes a positive contribution to teachers in encouraging students' 4C thinking skills.

### Conclusion

From this meta-analysis research it can be concluded that the average score for critical thinking was 82.17, creative thinking 80.52, communication 85.16 and collaboration 80.57. Furthermore, the average effect size value is 1.017 with high criteria. These findings explain that the discovery learning model has a significant effect on

students' 4c thinking abilities. The discovery learning model helps students learn independently in discovering a learning concept directly.

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