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The Effect of The Blended Learning Model on Student Critical Thinking Skill: Meta-analysis

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Abstrak

Penelitian ini bertujuan untuk menyelidiki pengaruh model pembelajaran blended learning terhadap kemampuan berpikir kritis siswa: Meta-analisis. Penelitian ini adalah penelitian meta-analisis. Sumber data dalam penelitian ini berasal dari analisis 10 jurnal nasional dan internasion yang terbit dari tahun 2015-2023. Penelusuran sumber data melalui Google Scholar, ScienceDirect, Wiley, ProQuest dan Sage. Kriteria inklusi dalam penelitian yakni 1) artikel terbit harus terindeks SINTA dan Scopus; 2) Penelitian harus eksperimen atau quasi eksperimen; 3) artikel mempunyai data yang dapat dihitung nilai effect size (ES). Analisis data dalam penelitian adalah analisis kuantiatif dengan menghitung nilai effect size masing-masing artikel dengan bantuan aplikasi JSAP. Hasil penelitian menunjukan bahwa nilai rata-rata effect size sebesar 0.79 denga kriteria sedang. Temuan ini menunjukan bahwa model pembelajaran blended learning mempunyai pengaruh yang signifikan terhadap ketrampilan berpikir kritis siswa. Model blended learning memabantu siswa dalam menumbuhkan ketrampilan berpikir kritis siswa ketika belajar.

Kata Kunci: Pendidikan, Blended Learning, Berpikir Kritis, Meta-analisis

The Effect of The Blended Learning Model on Student Critical Thinking Skill: Meta-analysis

Abstract

This study aims to investigate the effect of blended learning learning models on students' critical thinking skills: meta-analysis. This research is a meta-analysis research. The source of the data in this study came from an analysis of 10 national and international journals published from 2015-2023. Data source tracking through Google Scholar, ScienceDirect, Wiley, ProQuest and Sage. The inclusion criteria in the study are 1) published articles must be indexed by SINTA and Scopus; 2) Research must be experimental or quasi-experimental; 3) the article has data that can be calculated by the value of the effect size (ES). Data analysis in this research is a quantitative analysis by calculating the effect size value of each article with

the help of the JSAP application. The results showed that the average effect size was 0.79 with moderate criteria. These findings indicate that the blended learning learning model has a significant influence on students' critical thinking skills. The blended learning model helps students grow their critical thinking skills when studying.

***Keywords**: Education, Blended Learning, Critical Thinking, Meta-analysis*

Introduction

Critical thinking is an ability that students must have in facing the 21st century (Amin et al., 2020; Yustiana el al., 2022; Rijal et al., 2021). Critical thinking skills have a very important role for students in solving a problem in learning activities (Lestari et al., 2017; Zulyusri et al., 2023; Oktarina et al., 2021; Elfira et al., 2023; Jasmi et al., 2023). Critical thinking in students needs to be trained because this skill is important for students in providing solutions to creative ideas in learning (Amalia & Susilaningsih, 2014; Sudirman et al., 2021; Rahman & Ristiana, 2020); Rahman et al., 2023); . Maryam *et al.,* (2020) stated that critical thinking encourages students to improve higher-order skills.

Critical thinking of Indonesian students is still low (Wahyuni, 2020; Navies et al., 2012). This can be seen from the results of the Human Development Index (HDI) survey Indonesia obtained an index of 0.689 ranked 110 out of 183 countries (Munawwarah et al., 2020). In addition, the results of the Program for International Studenst Assesment (PISA) in 2018 the critical thinking skills of Indonesian students obtained a score of 396 ranked 71 out of 78 countries (Sofianora et al., 2023; Ichsan et al., 2023; Rahman et al., 2023). The low level of students' critical thinking skills is influenced by the teacher-centered learning process, the learning methods and models used (Firdaus & Wilujeng, 2018; Fitriani, 2020; Suharyat et al., 2022). In addition, the learning process lacks student involvement so that thinking skills are not trained (Husein et al., 2015). Research results Qurniati et al.,(2015) stated that 64.71% of students were not directed in finding learning concepts so that the teaching and learning process of students was not directed at critical thinking skills. Therefore, it is necessary to have a learning model that stimulates students' critical thinking skills (Ichsan et al., 2022; Suharyat et al., 2022).

Blended learning is one of the learning models that can be done online and face-to-face. Blended learning model can encourage students' critical thinking skills in learning (Habibah et al., 2022; Nur & Amal, 2022; Wiwik et al., 2018). The blended learning model also helps teachers to improve student learning outcomes (Santosa et al., 2021). The blended learning model combines synchronous and asynchronous, making it easier for teachers and students to achieve learning objectives (Ardika et al., 2021; Ernawati & Maniarta, 2022; Rahman et al., 2023; Mursid et al., 2022). Handayani (2023) The researcher stated that blended learning helps students' learning process more easily in accessing learning materials and concepts without time limit. Research result Khairiatin et al., (2020) stated that blended learning encourages students to learn more creatively and independently.

Previous research by Gede et al., (2019) stated that the blended learning model has a significant effect on students' concept understanding in learning. Research by Khoiroh et al., (2017) stated that the blended learning model has an effect on student motivation. The blended learning model helps students' learning process more effectively and efficiently (Kusaeri et al., 2022; Hbullah & Hassan, 2022). Research by Haka et al., (2020) stated that blended learning model has a great impact on students' learning independence and creativity. However, in reality, many studies on the effect of blended learning in the learning process of students are still minimal to explain how much influence blended learning has on students' critical thinking skills. Furthermore, this study aims to determine the effect of blended learning model on students' critical thinking skills.

Methods

This research is a type of meta-analysis research. Meta-analysis is a type of research that analyzes previous studies that can be statistically analyzed (Zulkifli et al., 2022; Karim et al., 2023; Razak et al., 2021; Putra et al., 2023; Suparman et al., 2021). The sources in this study came from 10 national and international journals. Source searches through Google scholar, ScienceDirect, ProQuest, Eric and Sage Journal. The process of selecting data sources is carried out systematically (Figure.1).

The inclusion criteria in this study are 1) data sources come from national and international journals indexed by SINTA and Scopus' 2) Journals or proceedings published from 2018-2023; 3) The type of research is experimental or quasi-experimental; 4) Data has a relationship with blended learning and critical thinking; 5) Journals have data sources that can be analyzed for effeck size. Data collection technique is direct observation from online databse. Data analysis is quantitative statistical analysis by calculating the Effect Size (ES) value, Standard Error (SE) and Standard Deviation (SD) with the help of JSAP application. The effect size value criteria can be seen in Table 1.

Table 1. Effect Size Value Criteria

Effect Size	Criteria
0 ≤ ES ≤ 0.2	Low
0.2 ≤ ES ≤ 0.8	Medium
ES ≥ 0.8	Hight

Source:(Luvia et la., 2020; Supriyadi et al., 2023)

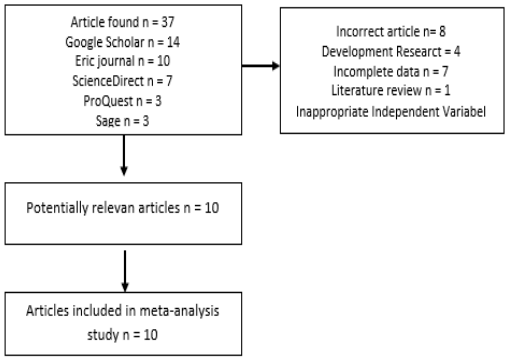

Figure 1. Flow chart of the process of selecting data sources for meta-analysis

Result and Discussion

From the analysis of 37 national and international journals related to the effect of blended learning on critical thinking skills, 10 journals met the inclusion criteria. Journals that have met the inclusion criteria are used as data sources in the meta-analysis. Furthermore, the data sources from the journals were calculated the effect size (ES), Standard Error and Effect size Criteria of each journal. Complete data sources from each journal can be seen in Table 2.

Table. 2 Effect Size of Each Data Source

No	Author	ES	SE	Criteria
1	Anggraeni et al., (2019)	0.92	0.43	Hight
2	Ernawati & Maniarta (2022)	1.10	0.51	Hight
3	Susilowati et al., (2021)	0.82	0.39	Hight
4	Hasanah et al., (2020)	1.30	0.77	Hight
5	Jou et al., (2018)	0.81	0.36	Hight
6	Suana et al., (2020)	0.72	0.31	Medium
7	Hasna & Saputra (2021)	0.87	0.43	Hight
8	Yustina et al., (2020)	1.30	0.79	Hight
9	Ardianti et al., (2020)	0.75	0.32	Medium

10	Hadisaputra et al., (2020)	0.52	0.28	Small
Average *effect size*		**0.790**		**Medium**

Based on Table 2. Shows the average value of effect size (ES = 0.790) with high criteria. This result explains that the blended learning model has a significant effect on students' critical thinking skills. The next step is to determine the meta-analysis model used in this study by conducting a heterogeneity test. The results of the heterogeneity test can be seen in Table 3.

Table 3. Heterogeneity Test Results in Determining the Meta-analysis Model

Model	n	Hedge's g	SE	95% CI	Q	P	Decision
Fixed	10	0.702	0.085	[0.672;0.890]	31.15	0.00	Reject H_0
Random	10	0.790	0.124	[0.572; 1.280]			

Based on Table 3. Heterogeneity test results (Q = 31.15; P = 0.000 <0.05). These results indicate that the effect size is heterogeneously distributed and uses a random effect model in conducting the analysis. The average effect size value is 0.790 with medium criteria. So, the application of blended learning model has a high impact on students' critical thinking skills compared to conventional learning models. Furthermore, determining the publication bias of each journal aims to determine whether all journals are resistant to publication bias. To calculate publication bias in this meta-analysis using Funnel Plot which can be seen in Figure 2.

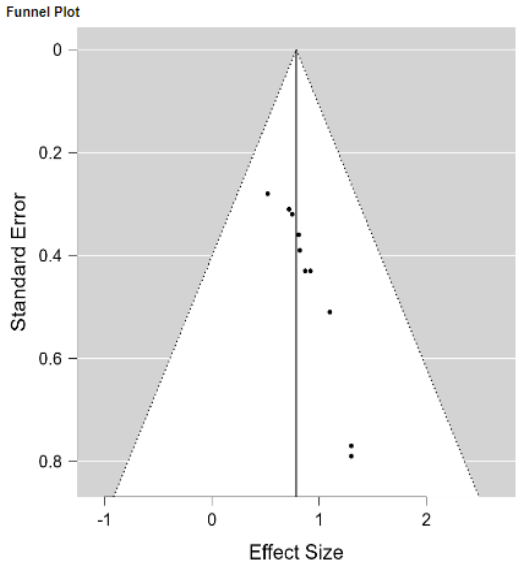

Figure 2. Funnel Flot of Hedge's Standar Error

Based on Figure 2. Shows the funnel plot effect size value is on the vertical line, it is necessary to do the Roshental Fail Save-N (FSN) test to determine whether each study is resistant to publication bias. The results of the Roshental Fail Save-N (FSN) test can be seen in table 4.

Table 4. Results of the Roshental Fail Save-N (FSN) Test

Classical Fail Safe- N	
Z-value for observed studies	10.178
The P-value for observed	0.000
studies	0.050
α	2.000
Tail	1.920
Z for Alpha	10
Number of observed studies	146.000
Number of missing studies that would bring p-value to > α	

Based on Table 4. Shows that the value of the Roshental Fail Save-N (FSN) test is 146,000 then 146/(5.10+10) = 2.43> 1 meaning that all studies used are resistant to publication bias. Next, we conducted hypothesis testing to determine the effectiveness of the blended learning model on students' critical thinking skills. The results of hypothesis testing with

random effect model can be seen in Table 5.

Table 5. Hypothesis Test Results with Random Effect Model

Estimation Model	n	Z	P	ES	SE
Random Effect Model	10	6.35	0.00	0.79	0.12

Based on Table 5. It shows that the p value <0.05 or 0.001 <0.05 then the blended learning model is effective in encouraging students' critical thinking skills in learning. In addition, the blended learning model makes students more creative and innovative in learning.

Discussion

The application of blended learning model in the learning process has a high impact on students' critical thinking skills. This can be seen from the average effect size value (ES = 0.790) with moderate criteria. Research results Made & Putra (2020) stated that the blended learning model has a significant effect on students' critical and creative thinking skills in learning. The blended learning model helps students understand learning technology more easily (Mulyanto et al., 2020; Roqobih & Rahayu, 2020; Rahmatan et al., 2022). Furthermore, the blended learning model makes students more active in learning so that it stimulates students to think critically (Doyan et al., 2022; Ichsan et al., 2022; Saekawati & Nasrudin, 2021). Critical thinking skills are very important for students in solving various phenomena in their lives (Razak et al., 2021; Zulyusri et al., 2022; Fradila et al., 2021).

Payadnya & Atmaja (2019) The blended learning model trains students to access information and teaching materials more quickly, thus stimulating them to think critically. The blended learning model is very effective in encouraging students' critical thinking skills. It can be seen from the results of hypothesis testing with a p value <0.05. The blended learning model has the advantage that students are more practical in learning, faster in accessing information about learning materials and learning without time limits (Wiktorowicz et al., 2018; Fadhilatunnisa et al., 2020). Research results Sari (2021) stated that blended learning is very effective in promoting students' 21st century thinking skills. Therefore, blended learning is one of the most suitable learning models to be implemented through the learning platform (Kade et al., 2019; Rohmawati et al., 2021).

In the learning process conducted by teachers in schools that apply the blended learning model, it creates a more interesting learning atmosphere. Research results Widyasari & Rafsanjani (2021) stated that the use of blended learning model has a positive impact on the distance learning process. The blended learning model can be done online through learning platforms and face-to-face in class (Mamahit, 2021; Yusuf et al., 2020; Munzadi, 2018; Sirait et al., 2020). Therefore, the blended learning model helps teachers to improve the quality and learning potential of students in schools.

Conclusion

From this study, it can be concluded that the average effect size value is 0.79 with moderate criteria. This finding shows that the blended learning model has a significant influence on students' critical thinking skills. The blended learning model helps students in developing students' critical thinking skills when learning. This learning model has a positive impact on students and teachers in achieving learning objectives. Furthermore, the blended learning model can be done online and face-to-face so as to create a more interesting learning atmosphere for students

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