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Meta-analysis of the Inquiry Based Teaching Model on Students' Critical Thinking Skills in Language Learning

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Abstract

This study aims to determine the effect of inquiry-based teaching model on students' critical thinking skills in language learning. The criteria for inclusion in research are that research must be experimental methods or quasi-experiments, research comes from journals or proceedings indexed by SINTA, research data is accessed through google scholar, ScienceDirect, Wiley and ERIC Journal, research must be relevant, research published in 2022-2024, learning subjects Indonesian and English, and have complete data to calculate effect size values. Data analysis with the help of JASP 0.8.5 application. The results concluded that the effect size data were heterogeneously distributed and normally distributed and the inquiry-based teaching model had a moderate effect on students' critical thinking skills in language learning with scores ($p < 0.005$; rRE = 0.74). These findings have a positive impact on educators to implement this learning model to improve students' critical thinking skills in Indonesian and English learning.

Keywords: *Model Inquiry Based Teaching, Critical Thinking, Effect Size, Meta-analysis*

Introduction

Critical thinking skills are one of the very important competencies in language learning. In the era of globalization and information, students must have the ability to process information, analyze, and make effective decisions (Alhowail & Albaqami, 2024; Harefa, 2024). In language learning, critical thinking skills help students to understand the meaning and context of texts, as well as to develop effective communication skills. Therefore, critical thinking skills are indispensable in language learning to improve students' ability to think critically and make the right decisions. In language learning, critical thinking skills also help students to develop analytical and synthesis skills (Ouhiba, 2022). By having the ability to think critically, students can understand the meaning and context of texts, as well as to develop effective communication skills. In addition, critical thinking skills also help students to develop the ability to solve problems and make informed decisions (Priyambodo et al., 2023). Therefore, critical thinking skills are indispensable in language learning to improve students' ability to think critically and make the right decisions.

Critical thinking skills also assist students in developing the ability to evaluate information and make informed decisions (Nashori et al., 2023). In language learning, students must have the ability to evaluate the information received and make informed decisions based on that information. By having critical thinking skills, students can make informed decisions and develop the ability to solve problems. Therefore, critical thinking skills are indispensable in language learning to improve students' ability to think critically and make the right decisions (Cosgun & Atay, 2021; Poštić et al., 2023). In language learning, critical thinking skills also help students in developing the ability to think independently and make informed decisions. By having critical thinking skills, students can think independently and make the right decisions without having to depend on others (Sutoyo et al., 2023; Eslit, 2023).

The existing literature on the impact of inquiry-based teaching on critical thinking skills in language learning is limited in its scope and depth. Specifically, there is a lack of comprehensive meta-analyses that systematically review and synthesize the findings from various studies on this topic (Antonio & Prudente, 2023). This gap is particularly significant in the context of Indonesian education, where the emphasis on critical thinking skills in language learning is increasingly recognized as crucial for students' success in the globalized world. Therefore, a meta-analysis that examines the overall effect of inquiry-based teaching on critical thinking skills in language learning is necessary to provide a more comprehensive understanding of the relationship between these variables (Syahrial et al., 2021).

In addition, existing research on inquiry-based teaching and critical thinking skills in language learning often focuses on specific aspects such as the role of teacher training or the impact of technology integration(Boonsathirakul & Kerdsomboon, 2023); . However, there is a need for a deeper understanding of the complex interactions between these factors and their combined effect on critical thinking skills (Shalihah et al., 2023). A meta-analysis that combines a wider range of studies and variables can help identify the most effective strategies for improving critical thinking skills in language learning and provide insight into the potential limitations and challenges of these approaches (Adnan et al., 2021). This knowledge can inform the development of more effective language learning curricula and instructional practices that prioritize critical thinking skills.

The inquiry-based teaching model has been widely recognized as a promising approach to enhance critical thinking skills in language learning (Raajitha, 2021; Raj et al., 2022; Arfae, 2019). Research has consistently shown that this model fosters active learning, promotes student autonomy, and encourages critical thinking and problem-solving skills. Studies have also highlighted the positive impact of inquiry-based teaching on students' motivation, engagement, and overall academic performance (Shamboul, 2022; Wale & Bishaw, 2020). However, despite these findings, there remains a need for a comprehensive and systematic review of the existing research on the effectiveness of inquiry-based teaching in improving critical thinking skills in language learning. This meta-analysis aims to fill this gap by synthesizing the results of multiple studies and providing a more nuanced understanding of the relationship between inquiry-based teaching and critical thinking skills in language learning.

Methods

This study This research is a type of meta-analysis research. The meta-analysis is a systematic review to synthesize the results of various studies examining the impact of the Inquiry-Based Teaching (IBT) model on students' critical thinking skills in language learning (Balemen & Keskin, 2018). The criteria for inclusion in research are that research must be experimental methods or quasi-experiments, research comes from journals or proceedings indexed by SINTA, research data is accessed through google scholar, ScienceDirect, Wiley and ERIC Journal, research must be relevant, research published in 2022-2024, learning subjects Indonesian and English, and have complete data to calculate effect size values. Data analysis with the help of JASP 0.8.5 application.

The research included a comprehensive search of relevant electronic databases and journals, resulting in a total of 16 articles that met the inclusion criteria. The articles are then evaluated for their methodological quality and data extraction is performed to obtain relevant information regarding the research design, sample size, and outcome size. The extracted data were then analyzed using a random effects model to estimate the overall effect size of the IBT model on critical thinking skills. The result is presented in the form of a forest plot, which provides a visual representation of the size of the effect and the corresponding confidence interval. This systematic approach ensures that this meta-analysis is comprehensive, unbiased, and reliable providing a robust estimate of the effect of the IBT model on students' critical thinking skills in language learning. Selanjutnya, kriteria effect size dalam penelitian ini dapat dilihat pada Tabel 1.

Table1. Value Categories Effect Size

Effect Size	**Kriteria Effect Size**
0.20≤ES≤ 0.50	Small
0.50≤ES≤ 0.80	Medium
ES ≥ 0.80	Large

Sumber:(Balemen & Keskin, 2018);

Results and Discussion

Result

Based on the results of searching data sources through the Google Scholar database, Sciendirect, Wiley and ERIC obtained 117 journals. Furthermore, the data was selected based on predetermined inclusion criteria, so 16 journals were included in the meta-analysis data. Next, test the heterogeneity of effect size data that can be seen in Table 2.

Tabel 2. Heterogeneity Test Results

Model	**N**	**Effect Size**	**95% Confidence Interval**		**Qb**	**p**
			Lower	Upper	167.219	0.001
Fixed Effect Model	16	0.52	0.35	0.71		
Random Effect Model	16	0.74	0.59	0.89		

Based on Table 2, Qb < p values (167.219 < 0.001), the effect size data of 16 journals are heterogeneously distributed. Furthermore, the effective model used in this meta-analysis is the random effect model. Based on the random effect model, the value of 95% Confidence interval lower is 0.25 and upper is 1.09 and the average value of effect size is 0.82. This finding shows that the inquiry-based teaching model has a positive effect on students' critical thinking skills in language learning compared to conventional models with large effect size categories. Next, analyze the effect size with the forest plot which can be seen in figure 1.

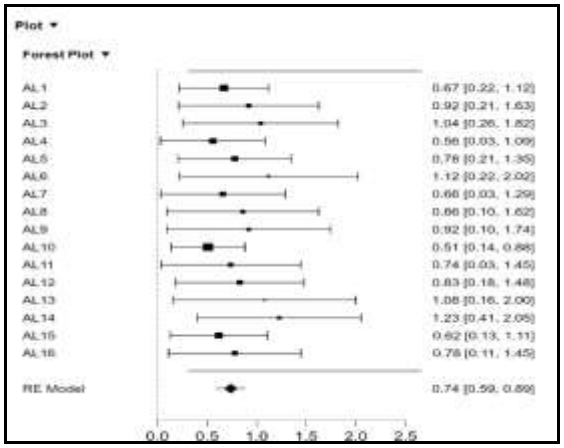

Figure 1. Forest Plot

Figure 1, explains that the value of the distribution of effect size values with the random effect model is 0.74. The next step is to analyze the publication bias value through Safe N Files which can be seen in Table 3.

Tabel 3. Nilai Fail Safe N

The Resistance of the Meta-Analysis versus Publication Bias	
z-value	9.493
p-value	< 0.001
Alpha Value	0.05
Alpha Value for the Z-value	1.07
N	16
p>the number of missing studies for the alpha result	1052

Berdasarkan Tabel 3, Nilai $p < 0.05$ maka 16 effect size yang dianalisis dalam meta-analisis valid dan tahan terhadap bias publikasi. Selanjutnya, melakukan pengecekan bias publikasi denan funnel plot yang dapat dilihat pada Gambar 2.

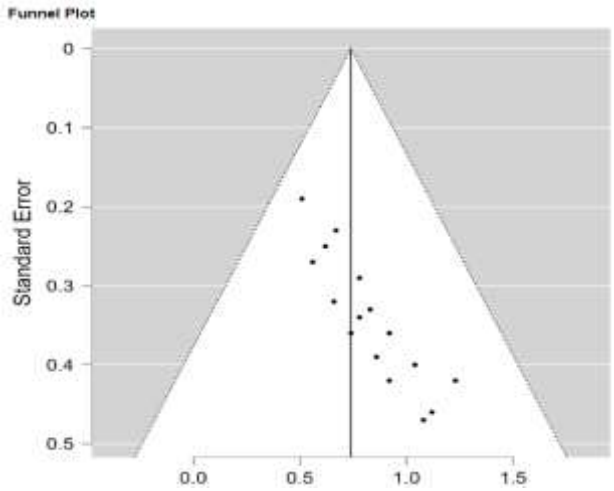

Figure 2. Funnel Plot Standard Error

Figure 2. Shows that the effect size in the meta-analysis is shaped in a symmetrical curve that illustrates there is no publication bias in the study of inquiry-based teaching models. In addition, it is also necessary to conduct the Begg and Mazumdar test which aims to find out that the samples used in the

meta-analysis are not statistically biased for publication. The results of Begg and Mazumdar's analysis can be seen in Table 4.

Table 4. Publication bias status of sampled studies

Publication Bias	
Kendall's (P-Q)	115.25
Kendal's tau	0.15
Tau for z-value	1.07
p	0.00

Based on Table 4, the results of this analysis show that the sample used has no publication bias in the meta-analysis (tau = 0.15; $p < 0.05$).

Discussion

The results of the analysis showed that the average effect size value of 16 studies using the random effect model was (ES = 0.74; k = 16). This effect size is classified as a moderate influence. These findings conclude that inquiry-based teaching models have a significant influence on students' critical thinking skills in language learning compared to conventional learning models. That the inquiry-based teaching model is effective for improving students' critical thinking skills in learning (Arsal, 2017; Ghaemi & Mirsaeed, 2017). The Inquiry-Based Teaching model has been widely adopted in language learning settings due to its potential to enhance students' critical thinking skills. This meta-analysis aims to synthesize the findings from various studies that have investigated the impact of the Inquiry-Based Teaching model on students' critical thinking skills in language learning. The analysis will focus on the effects of this model on the development of critical thinking skills, including the ability to analyze, evaluate, and create arguments, as well as to identify and challenge assumptions (Qing et al., 2010; Affilia et al., 2023).

Previous studies have shown that the Inquiry-Based Teaching model can significantly improve students' critical thinking skills in various subjects, including science, mathematics, and language arts. For instance, a study by Sampson et al. (2011) found that students who used the Inquiry-Based Teaching model in science classes demonstrated higher levels of critical thinking skills compared to those who did not. Similarly, a study by McNiff and Whitehead (2006) found that the model enhanced critical thinking skills in students learning English as a foreign language. The Inquiry-Based Teaching model is characterized by its emphasis on inquiry, problem-solving, and critical thinking (Kamaruddin et al., 2023). It encourages students to engage actively in the learning process by asking questions, seeking answers, and evaluating evidence. This approach fosters a deeper understanding of the subject matter and develops students' ability to think critically about complex issues. In the context of language learning, the model can help students develop their critical thinking skills by encouraging them to analyze and evaluate the language they use, as well as to identify and challenge assumptions in the language they encounter (Nazila et al., 2019).

Inquiry-Based Teaching model has been shown to be an effective approach for enhancing students' critical thinking skills in various subjects, including language learning. This meta-analysis aims to synthesize the findings from previous studies and to provide a comprehensive understanding of the model's impact on students' critical thinking skills in language learning (Thaiposri & Wannapiroon, 2015). The effectiveness of the Inquiry-Based Teaching model in enhancing critical thinking skills in language learners is supported by various studies. For example, a study by Putri et al. (2019) found that the model significantly improved students' critical thinking skills in physics learning, which can be applied to language learning as well. Another study by Nur'aini (2006) highlighted the importance of planning in the Inquiry-Based Teaching model, emphasizing the need for teachers to carefully design the learning activities to ensure students engage actively in the process.

Summary and Conclusion

From the results of this meta-analysis, it can be concluded that the effect size data is heterogeneously distributed and normally distributed and the inquiry-based teaching model has a moderate effect on students' critical thinking skills in language learning with a value ($p < 0.005$; rRE = 0.74). These findings have a positive impact on educators to implement this learning model to improve students' critical thinking skills in Indonesian and English learning. These findings have a positive impact on educators to implement this learning model to improve students' critical thinking skills in Indonesian and English learning. The model's emphasis on inquiry, problem-solving, and critical thinking enables students to develop their ability to analyze, evaluate, and create arguments, as well as to identify and challenge assumptions in the language they encounter.

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