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THE INFLUENCE OF A GUIDED INQUIRY LEARNING MODEL IN IMPROVING STUDENTS' CREATIVE THINKING ABILITIES: A META-ANALYSIS STUDY

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Abstract. Critical thinking skills are necessary in everyday life and are the main competencies that students must have in the 21st century which is full of competition. The guided inquiry learning model improves students' creative thinking skills and is able to bridge the theory obtained at school with the real world in society. This research is a meta-analysis research aimed at analysing the influence of the guided inquiry learning model in improving students' creative thinking abilities. Data was obtained from searching scientific articles published in accredited journals Science and Technology Index (SINTA). Articles published from 2016 to 2022. The research sample that met the inclusion and exclusion criteria was 7 articles. Data were analysed using the JASP V. 0.11 software application. Heterogeneity test results showed Q value = 63.426 and p value < 0.001. Model combining effect size used random effect model. The research results showed a combined effect size value of 1.10 with a very high effect category and Fail-safe test results N> 5k + 10, indicating there was no publication bias. The results of this meta-analysis research contributed to strengthening the findings of previous research.

INTRODUCTION

The inquiry learning model is a learning approach that encourages students to actively seek information and solve problems through independent exploration and problem solving (Narta, 2022). In contrast to conventional learning methods which tend to be teacher-centred, the inquiry model focuses on student involvement in discovering concepts and developing their own understanding. This is based on constructivism theory, which suggests that students learn by constructing new knowledge based on their experiences (Piaget, 1970).

Many studies support that the inquiry approach improves students' critical thinking abilities, problem solving skills, and learning motivation. Alfieri et al. (2011); Evi Yupani & Widana (2023) found that students who were involved in inquiry learning showed increased understanding of concepts and better analytical skills compared to those who learned

through direct instruction. Ramadhani (2021) in his meta-analysis found that the inquiry learning model had a moderate effect on students' mathematical problem solving abilities. Analysis carried out on various studies between 2012 and 2020 showed that this model was effective in improving mathematical problem solving abilities. Similar results were also found by Minner et al. (2010) who in their meta-analysis concluded that the inquiry learning model had a significant positive effect on student learning outcomes in science subjects at various levels of education. Furtak et al. (2012) highlighted that the positive effects of the inquiry learning model became increasingly clear when teachers provided targeted support (scaffolding) during the learning process. This study showed that students who were given guidance in the early stages of exploration showed better learning outcomes and higher interest in the subject being studied. In other words, students' active involvement in the inquiry model, when supported by appropriate assistance from the teacher, provided an ideal environment for students' cognitive development (Widana, 2022; Widodo et al., 2021).

Furthermore, Lazonder & Harmsen (2016); Susmariani et al (2022) found that the effectiveness of the inquiry learning model was also influenced by the subject context. In the study, the inquiry model showed a very strong impact in science and technology learning, where students were involved in experiments and direct observations. However, for some other subjects, the inquiry model required further adjustments to suit the desired learning characteristics. Vibrianti et al. (2023) also supported this, where through a meta-analysis of 20 articles published between 2015 and 2021, the inquiry learning model was found to have a significant positive impact on students' scientific literacy in learning. physics. This increasing scientific literacy occured at various levels of education, especially in subjects that involved exploration and direct observation (Vibrianti et al., 2023).

Parwati et al. (2024) highlighted the impact of the guided inquiry model on students' critical thinking skills and scientific attitudes in science learning. This study showed that students taught using the guided inquiry model showed better critical thinking skills and scientific attitudes compared to students taught using conventional methods. These results indicated that students' active involvement in the inquiry model could encourage deeper thinking and positive attitudes towards science. In addition, Rahmawati (2023) showed that inquiry learning could also increase students' interest in learning, especially when applied in a project-based learning context. In this study, students who took part in project-based inquiry learning showed higher interest in taking science lessons, because they felt more involved and challenged in learning activities.

Based on the background above, the researcher considered it necessary to conduct meta-analysis research on the effect of the guided inquiry learning model in improving students' creative thinking abilities. The research aimed to summarized the results of previous research which still had varying results and to find out how big the combined effect size value was (summary effect). As a basis for drawing stronger and more accurate conclusions. So the results of this meta-analysis research can provide the same views and conclusions regarding the findings regarding the Effect of the Guided Inquiry Learning Model on Increasing Students' Creative Thinking Abilities.

METHOD

This research was conducted using meta-analysis research methods. This research was carried out from November to December 2023 in Badung. The articles sampled in this research were articles published in Indonesia which were accessed online via the Google

Scholar database. The research population wass Inquiry Learning Model articles. The research sample was a published research article on the Effect of the Guided Inquiry Learning Model on Increasing Students' Creative Thinking Abilities. The inclusion and exclusion criteria were experimental research articles with a pre test-post test control group design. The keywords used in searching for this article were "Inquiry Learning Model" and "Creative Thinking Ability". The flow of the article selection process can be described as follows.

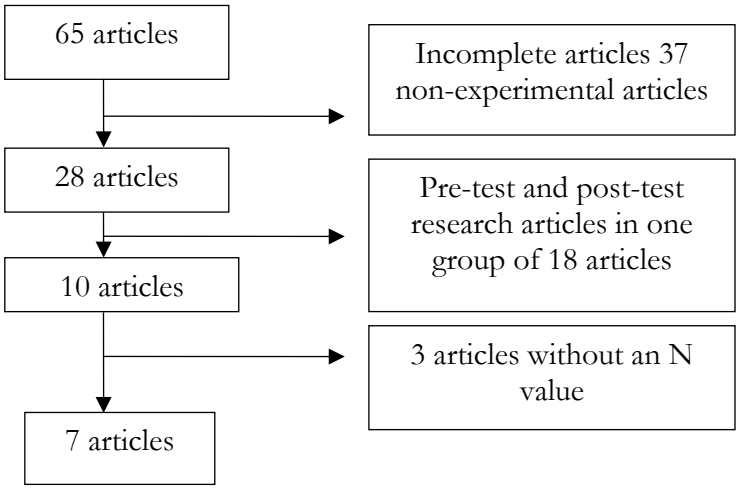

Image 1. Article Selection Process Flow

The independent variable of this research was the Guided Inquiry Learning Model, the dependent variable was Improving Students' Creative Thinking Abilities, with restrictions on articles published in Indonesian and articles published from 2016 to 2022.

This research data processing was carried out with the help of JASP V. 0.11 software (Goss Samspson, 2019) to calculate the effect size value of the studies that was the research sample. The effect size value is the difference in value between the control group and the experimental group. To determine the merging model, the researcher used the heterogeneity test. If the p value > 0.05 or I2 is small, then the merging model is with fixed effects. If the p value < 0.05 or the I2 value is large, then the merging model is based on the random effect model (Renawati et al., 2018).

RESULTS AND DISCUSSION

The results of searching for articles on the Google Scholar database resulted in 65 articles with the keywords "Inquiry Learning Model" and "Creative Thinking Ability." Articles that met the criteria were used as research samples, totaling 7 articles that met the criteria set by the researcher. Data from 7 articles were taken for the N value (number of samples), mean value and SD value from the control group and experimental group to calculate the effect size value and the heterogeneity test to determine the combined model. Data from 7 articles is presented in table 1 below.

Table 1. Articles and sources

No	Author(s)	Journal Name
1	(Asriani et al., 2021)	Jurnal Literasi Pendidikan Fisika, Vol. 2 No. 1, pp. 34-43. April 2021

2	(Susanti et al., 2017)	BioEduin Jurnal Program Studi Pendidikan Biologi Februari ISSN: 2338-7173, Vol. 7, No. 2017
3	(Antoni et al., 2021)	JPPF, Vol. 9 No. 1 year 2019 p-ISSN: 2599-2554 (Print), e-ISSN: 2599-2562 (online)
4	(Masitoh & Ariyanto, 2017)	BIOEDUKASI Volume 10, Number 1 Halaman 71-79. p-ISSN: 1693-265Xe-ISSN: 2549-0605 February 2017
5	(Dewi Muliani & Citra Wibawa, 2019)	Jurnal Ilmiah Sekolah Dasar Volume 3, Number 1, Tahun 2019, pp. 107-114. P-ISSN: 2579-3276 E-ISSN: 2549-6174
6	(Istakarini, 2018)	Jurnal Pendidikan Guru Sekolah Dasar Edition 14 year 7 2018
7	(Harjilah et al., 2019)	Jurnal Kumparan Fisika, Vol. 2 No. 2, August 2019, pp. 79-84 https://ejournal.unib.ac.id/index.php/kumparan_fisika ISSN: 2685-1806 e-ISSN: 2655-1403

From table 1 above, 7 articles were selected in accordance with the specified inclusion and exclusion requirements. Data from the article are presented in table 2.

Table 2. Research Article Data

No	Experimental Group 1			Control Group 2		
	N 1	MEAN 1	SD1	N2	MEAN 2	SD2
1	36	64.51	0.845	36	56.94	0.530
2	35	80.00	8.300	35	74.93	10.850
3	30	57.55	7.740	29	49.46	7.570
4	32	81.44	7.247	32	75.97	9.654
5	17	22.82	4.990	21	17.00	4.620
6	16	74.62	9.700	11	65.28	11.686
7	34	81.40	70.600	34	57.50	40.600

Table 2. above presents data for each article which includes data on sample size, mean value, and SD in the experimental group and control group.

Table 3. Heterogeneity Test Results

Fixed and Random Effects

	Q	**df**	**p**
Omnibus test of Model Coefficients	96.137	1	< .001
Test of Residual Heterogeneity	63.426	6	< .001

Note. *p* -values are approximate.

Table 3. presents the results of the heterogeneity test where the Q value = 63.426 and the p value <0.001. So that the research sample is not varied (homogeneous). The model combines with the random effect model. The forest plot is presented in Figure 2.

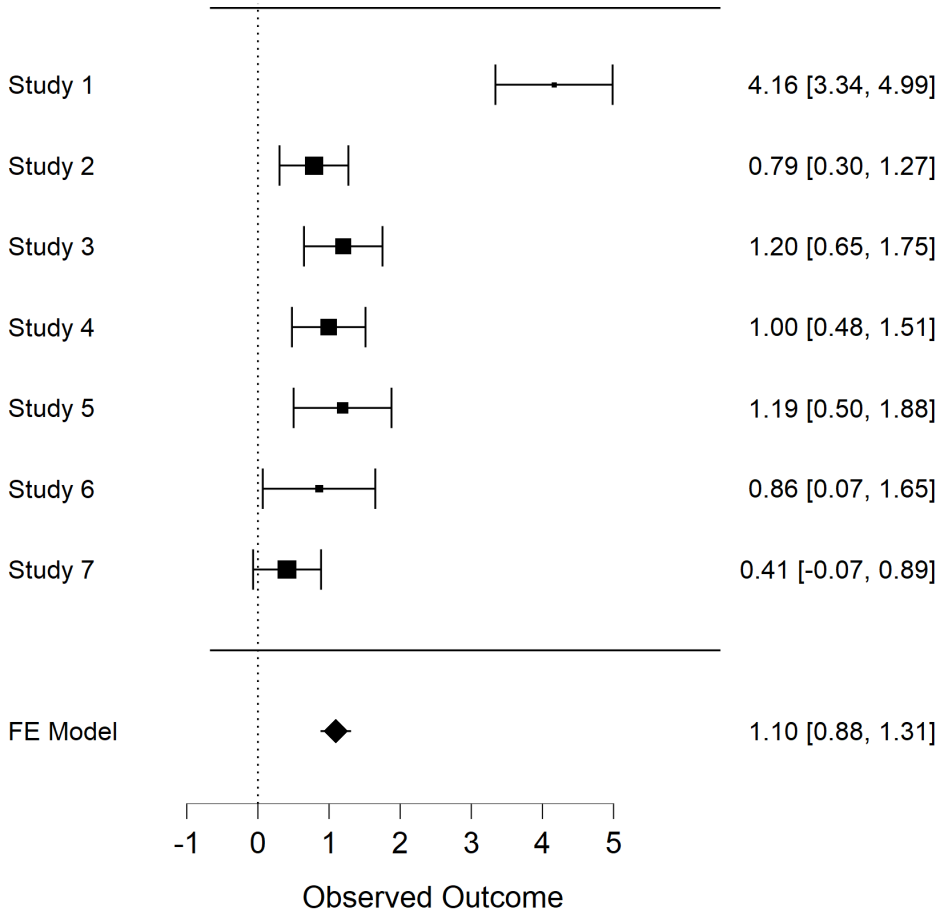

Image 2. Forest Plot

From the forest plot image above, the rectangular image shows the effect size value of each study and the horizontal line shows the width of the confidence interval value, the vertical line shows the value 0, meaning there is a difference and the diamond image at the bottom is a combined value of 1.10 (summary effect). And the effect size values of the studies analysed varied between 0.41 and 4.16.

Table 4. Mean effect size value

Coefficients						
					95% Confidence Interval	
	Estimate	Standard Error	z	p	Lower	Upper
intercept	1.095	0.112	9.805	< .001	0.876	1.314

Note. Wald test.

The results of analysis using the random effect model showed that there was a difference between the control group and the experimental group regarding students' creative thinking

abilities with a value of Z = 9.805; p < 0.001; 95% CI (0.876;1.314) and the mean effect size value is 1.095.

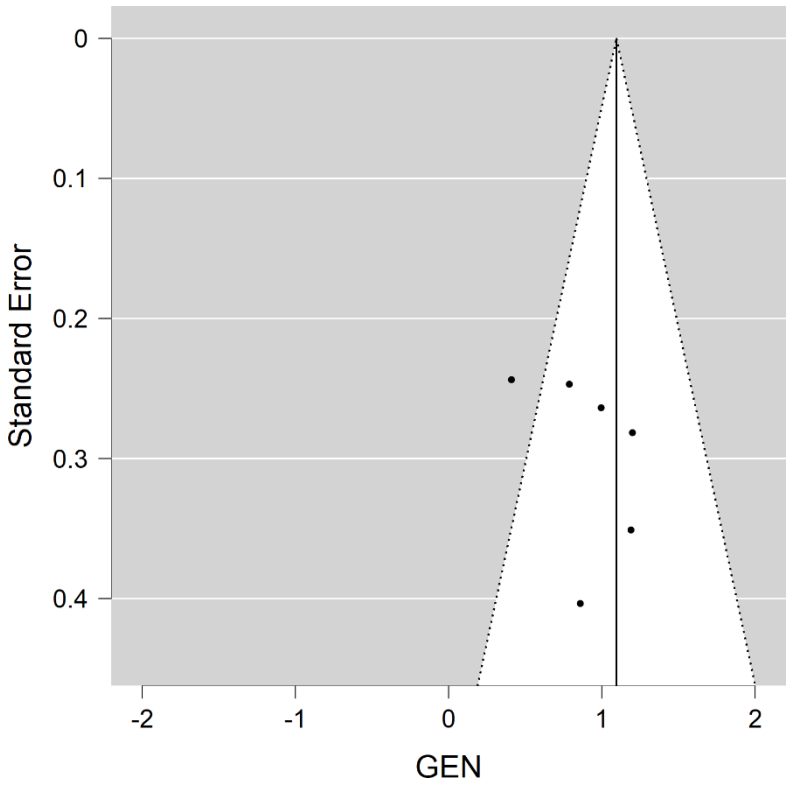

Image 3. *Funnel plot*

From the funnel plot image above, it is difficult to conclude whether the funnel plot is symmetrical or not, so the Egger test is needed.

Table 4. Eggers test

Regression test for Funnel plot asymmetry ("Egger's test")		
	z	**p**
sei	5.495	< .001

The results of the Egger's test p < 0.001 confirm that the funnel plot is not symmetrical.

Table 5. Fail-safe N Test

File Drawer Analysis			
	Fail-safe N	**Target Significance**	**Observed Significance**
Rosenthal	290.000	0.050	< .001

File Drawer Analysis			
	Fail-safe N	Target Significance	Observed Significance

From the file-safe N test of K= 7, so 5K + 10 = 45. The Fail-safe N value obtained is 290,000 with a significant target of 0.05 and $p < 0.001$. Because the Fail-safe N value> 5k + 10, it can be concluded that there is no publication bias in this meta-analysis study.

The results of this meta-analysis research show that there is an influence from the model. The Influence of the Guided Inquiry Learning Model on Improving Students' Creative Thinking Abilities is indicated by the total effect size value of 1.10, including the very high influence category at the interval $1.10 <$ effect size ≤ 1.145 and there is no element of publication bias, this can be proven from the file-safe test. Because the Fail-safe N value> 5k + 10, it can be said that the Guided Inquiry Learning Model Improves Students' Creative Thinking Abilities.

Research conducted by Asriani, et al. (2021) on Forest Plot shows an effect size value of 4.16 with the interval [3.34 – 4.99] being the widest interval and the effect size is very high. Research by Hajrin, et al. (2019) showed effect size value 1.20. In the research of Dwi, et al., (2017) the effect size value was 1.00., also in the research of Muliani dan Wibawa (2019), the effect size value was 1.19. Likewise in the research of Susan, et al. (2017), the value the effect size is 0.79 high and in Istakarini's research (2019), the effect size value is 0.86 high. And one study with a moderate effect size value of 0.41 was in the research of Harjilah, et al., (2019).

From the analysis of the effect size and interval values in each of the articles above, the effect size values can be grouped into four articles with effect size values in the very high category, two articles with high effect size values and one article with an effect size value in the medium category. With large variations in the effect size values of each article. This is caused by several factors, one of which is the small number of research samples. By combining several articles into a sample, the number of research samples becomes larger, namely a group of 198 and an experimental group of 200 people. so the combined effect size value is 1.10 with the interval [0.88 – 1.31], so the combined effect size value is in the very high category.

This proves that a larger number of research samples can further increase the precision of the results of a study. So the results of this meta analysis can strengthen the findings from research that has been produced previously.

CONCLUSION

The results of the analysis showed that there was a significant difference between the learning outcomes of the experimental group. The Guided Inquiry Learning Model Improved students' critical thinking abilities compared to the conventional group. Data from the forest plot showed that the summary effect value was 1.10, so it could be interpreted that the results of the experimental group using the Guided Inquiry Learning Model Improved students' critical thinking abilities were higher than students who used the conventional model. With a 95% confidence interval with confidence interval values

ranging from 0.876 to 1.314. This showed a significant difference between the experimental group and the conventional group. It could be concluded that the Guided Inquiry Learning Model increased students' critical thinking abilities, which was more effective than conventional models.

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