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ORIGINAL PAPER

Meta–Analysis: The Effect of the Discovery Learning Model on Mathematics Learning Outcomes

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Abstract
The purpose of this study was to examine the effect of the Discovery Learning model on mathematics learning at all levels, using 27 articles. This study uses a quantitative meta-analysis approach, collecting as many articles as possible to determine which are suitable for use. The data collection technique involved searching for references to articles or electronic journals using Google Scholar and PoP (Publish or Perish). The search for this article was also conducted with certain criteria, such as the journal's period of no more than ten years, or in other words, it had to be published within the last ten years. Afterward, this research was also coded and analyzed statistically. The results of the research prove the link between Discovery Learning and the process of learning mathematics. This is evidenced by the results of the analysis under hypothesis 1 (H0), namely, "Does the average effect size present the intervention of each learning model in high school all significantly different and discover zero?" Based on the results described earlier, H0 is rejected. Then, it is obtained that there is an average effect size representing the intervention of each Discovery Learning model across all levels of education, with p-value = 0.561 > 0.05. According to the results of this calculation, H1 is accepted, indicating no difference in the magnitude of the influence of the discovery learning model on mathematics learning. In addition to education level, the impact of categories based on publication sources and the number of meetings in this study was not particularly influential: for publication sources, p-value = 0.214 > 0.05, and for the number of meetings, p-value = 1.000 > 0.05. In other words, these two categories do not have a major influence on learning mathematics. Whereas in this study, categories based on the year of research show major differences that affect the discovery learning model in learning mathematics, as p-value = 0.000 <0.05. This is why this research took various years to publish in previous articles.

Keywords:
Meta-Analysis
Mathematics
Discovery Learning

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INTRODUCTION

A learning model that trains students by having them solve problems is usually called Discovery Learning. Discovery Learning is student-centred, where students are given the freedom to try, use intuition, analyse, and collect information through group discussions to find solutions based on information and observation activities (Khasanah et al., 2018). Discovery learning, a method that requires students to be active in constructing new knowledge, can offer students a range of advantages. Previous research has shown that discovery learning positively impacts learning outcomes, for example, in mathematics, learning achievement, mathematical critical thinking skills, mathematical creative thinking skills, and mathematical reasoning and communication skills (Kamaluddin & Widjajanti, 2019). Some experts also note that the discovery learning model is often called inquiry learning, a

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learning approach that emphasises experience and prioritises the process over learning outcomes (Rochani, 2019). In this learning, the teacher is only a facilitator.

Discovery Learning also offers several advantages, including helping students improve their skills and cognitive processes. The knowledge gained through this method is highly individual and effective because students can experience various emotions, such as happiness. In addition, students can develop rapidly both rationally and emotionally, depending on their respective personalities. This study relates the Discovery Learning learning model to students' mathematics learning outcomes following the meta-analysis process. Research conducted by Ramadhani (2021) stated that the advantage of the Discovery Learning model is that students become faster at understanding the provided material and can learn more independently, or, in other words, with greater focus. The virtues of Discovery Learning have also been researched in an article written by Lestari (2017). This research leads to Guided Discovery Learning at the grade level of SMA XI IPS, stating that discovery learning is very influential on mathematics learning in the classroom, especially geometry. When the learning model is implemented, the level of critical thinking and problem analysis increases.

The meta-analysis conducted by Pangesti and Radia (2021), namely the meta-analysis of the influence of the discovery learning model on science learning outcomes at the elementary level, shows that the Discovery learning method can increase students' learning achievement in science subjects at the elementary level. In this study, there was an increase in learning outcomes of 17% to 48%, with an average increase of 28.33%. The results of the effect size calculation also showed a high score of 3.09%. So, the novelty of the research to be carried out here lies in a meta-analysis of the discovery learning model and its relation to mathematics learning. In addition, Labibah and Jauhariyah (2021) conducted a meta-analysis proposing physics lessons at the high school level. This study presented the results of the meta-analysis and obtained an average effect size of 0.852. It turns out that this study also found a significant influence on physics lessons at the high school level, increasing students' creativity. Also, the application of the Discovery Learning model significantly influences the teaching of gas kinetic theory through virtual lab teaching aids. So, in this study, a novelty was also obtained, namely, meta-analysis in the discovery learning model, which can also be carried out in physics lessons at the high school level. Students and their peers have conducted extensive research on meta-analyses of the Discovery Learning model. Therefore, the previous presentation is a tangible form of this research. Not only that, but a meta-analysis was also conducted by Juandi and Siagian (2022). Researchers conducted research at the elementary, junior high, and high school levels using the Discovery Learning learning model in mathematical reasoning skills. This research also centred on the Java island area, and the largest sample was obtained at the junior high school level. The results of this study yielded an average effect size of 0.815, placing it in the high-effect category; in other words, it has a strong influence on learning. It was also found that the novelty of the meta-analysis in this study can be used to measure students' level of mathematical reasoning.

This meta-analysis is needed to evaluate the implementation of the discovery learning model, see the whole picture clearly, and consider the implications. Thus, this research will directly contribute to the discovery of a learning model in the future, especially in the field of education. This study will answer two hypotheses: 1) Does the average size effect of the intervention of each discovery learning model in high school show a significant and zero effect? 2) Are there differences in the effects of discovery learning implementation based on categorical variables? Based on research in an article written by Eskris (2021), the meta-analysis process of the effect size affects the outcome of student learning development. This is reflected in the effect size of the discovery learning method, which is increasing as students' critical thinking skills improve. From this meta-analysis process, it can also be seen which stage is feasible.

METHOD

This study focuses on the influence of quantitative data and meta-analysis used in this study, taken from Google Scholar. Specifically, it investigates the effectiveness of the Discovery learning (DL) model applied across all levels. This study was conducted to determine the magnitude of the overall effect of Discovery Learning and to analyse the role of categorical variables in variation in the effect size across studies. To achieve this goal, this study uses a meta-analysis approach. Meta-analysis is research conducted by collecting several studies that have been carried out (Pangesti & Radia, 2021) with the keyword "Discovery Learning". From the journal search carried out, 342 articles were obtained, consisting of national and international journals, international procedures, and national procedures (plus for research methods), which span one decade or ten years. In general, meta-analysis research begins by formulating research problems and hypotheses, then proceeds with a search for variable-coding literature. Statistical analysis ends with the interpretation of the findings (Tamur et al., 2023).

Literature Search

The initial data search in this study began by using the Google Scholar software application, and PoP (Publish or Perish) was used as a place to search for journals to collect data in this study, with the keywords "Discovery Learning" or "The Effect of Discovery Learning", and then collected all journals with these keywords as initial data without looking at the criteria and so on. Initial data were collected from as many as 342 journals in POP that had not been screened or selected, and that met the criteria.

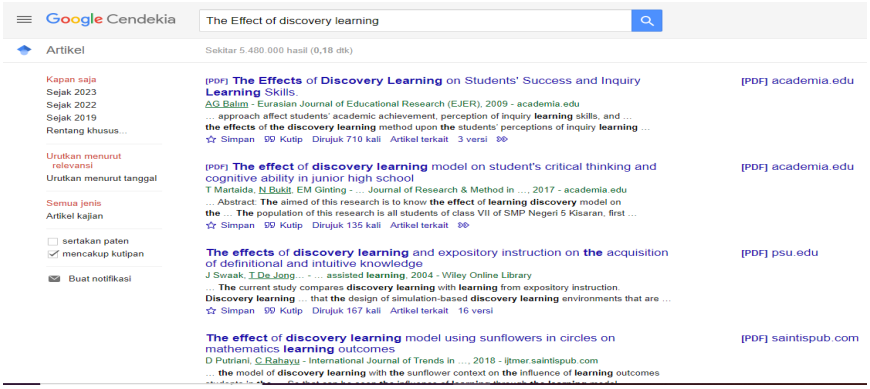

Figure 1. Journal Search on Google Scholar Page

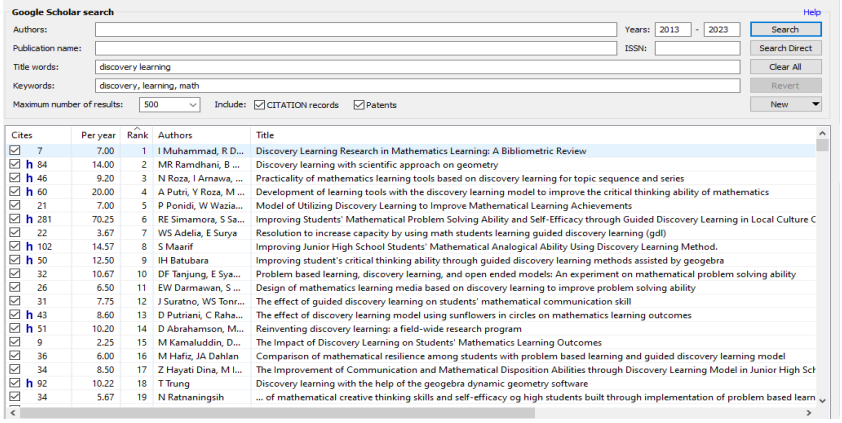

Figure 2. Journal Search of Discovery Learning Articles Using Publish or Perish

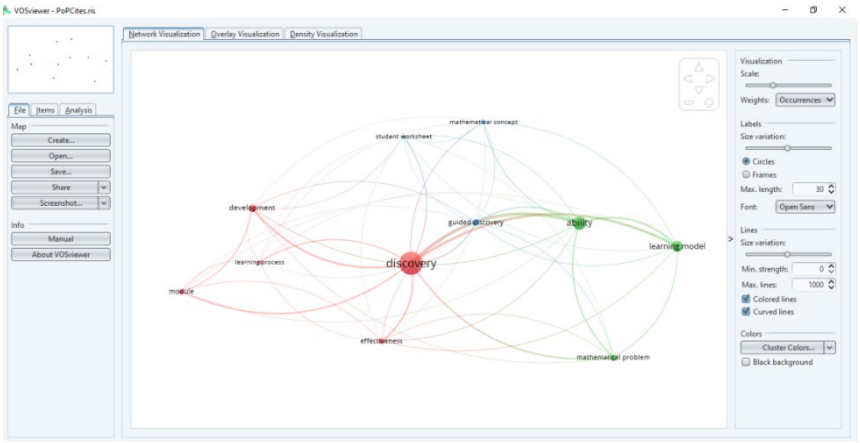

Figure 3. Journal Search of Discovery Learning Articles Using VOS Viewer

Literature Criteria

Criteria for journal articles in this study. The data that were successfully identified had the criteria used in this study, including the following:

a) Journal with international accreditation, with a span of the last ten years, namely 2013-2023.
b) Journals/researchers that contain statistical information to obtain influence or relationship values; journals that do not meet these criteria will be eliminated or not used.
c) The study article is the result of experimentation with the Discovery Learning model and other models as a control class.
d) Data skills are required to carry out the meta-analysis process.

Furthermore, the data filtering process is shown in the figure below.

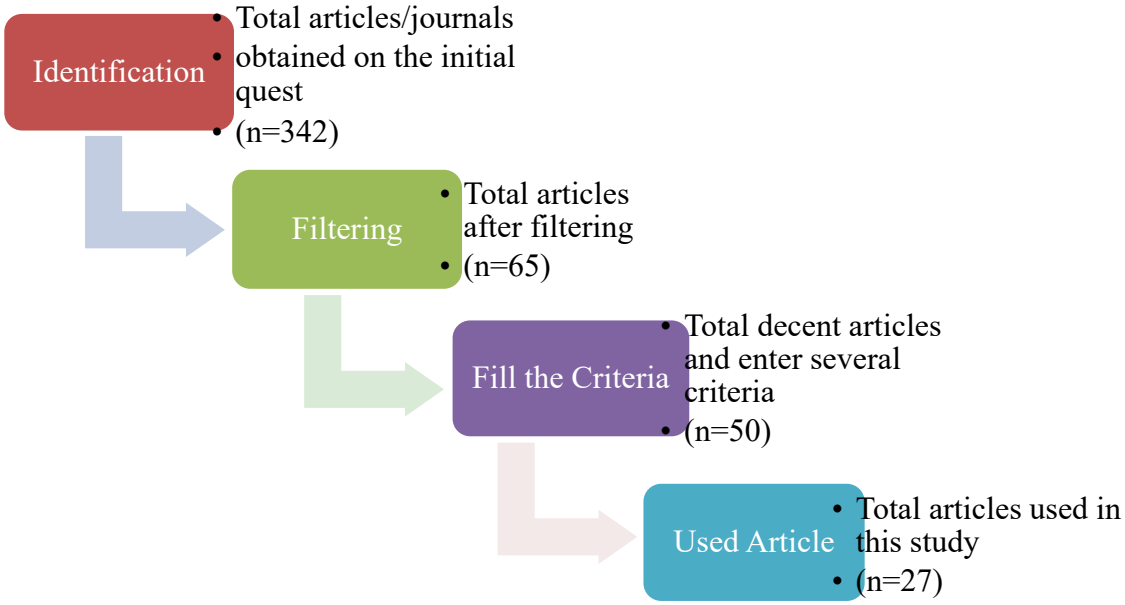

Figure 4. Journal Recapitulation

The figure above illustrates the data filtering process to be used in the study. Of the 342 articles obtained from the article pop results that met the screening process, 65 articles went through the eligibility stage, 50 met the article criteria, and the final result of the data or articles used was 27.

Coding

The instruments in this meta-analysis were administered using category coding sheets. The coding form is structured according to predetermined characteristics, namely the researcher's name, the research year, the research class, the sample size, and the type of mathematical software used. In addition, the coding form includes the sample sizes for the two groups, the average, and the standard deviation. This form of coding was developed to improve the reliability and suitability of the studies involved.

Statistic Analysis

The parameter used to estimate the population in the meta-analysis is the effect size. In this study, the effect of measure is defined as the magnitude of the influence of the discovery learning model on mathematics learning at all levels of education. The device used in this study was CMA (Comprehensive Meta-Analysis) software version 3.7 Zip, which was used to calculate the effect size for each study, including the overall effect size, P-value, Q statistic, and confidence intervals. The program also draws funnel plots and research forest plots. The g-hedged metric was applied in this study, and the interpretation of the effect size was based on the classification of less than 0.2 (negligible), 0.2 to 0.5 (small effect), 0.5 to 0.8 (moderate effect), 0.8 to 1.3 (large effect), and more than 1.3 (very large effect). In this study, the random effect of the model was determined after the heterogeneity test was met. This test is performed by observing p-values. The null hypothesis, which states that all studies are equal (homogeneous), is rejected if the p-value < 0.05. Rejecting the null hypothesis suggests that the effect measure across studies or study groups may not estimate the same population parameters. The condition showed that differences in learning categories affected the size of the study effect.

RESULTS AND DISCUSSION

Result

First, the results of the research aimed at answering the first question are presented. After filtering the main study, 27 articles from Google Scholar were analysed in this study. Figure 4 presents a research forest plot showing the study name, effect measure (ES), standard error, variance, confidence interval, z-value, and p-value. Based on Figure 5, the effect sizes of these studies are heterogeneous, indicating wide variation in confidence levels and an inconsistent response rates.

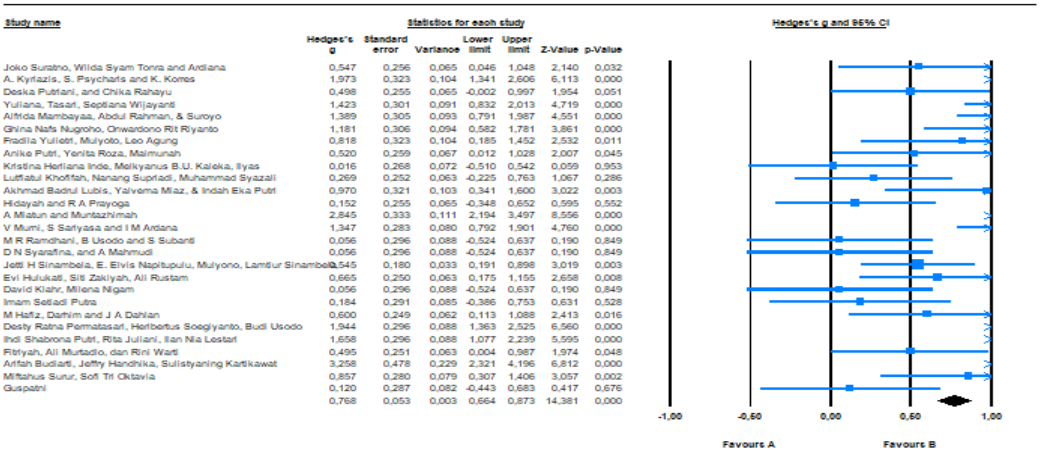

Figure 5. *Plot Forest Research*

In Figure 6, the results of the overall analysis in answering hypothesis 1 are presented to establish the estimation method.

Model	Effect size and 95% confidence interval					Test of null (2-Tail)	
Model	Number Studies	Point estimate	Standard error	Variance	Lower limit	Upper limit	Z-value	P-value
Fixed	27	0,768	0,053	0,003	0,664	0,873	14,381	0,000
Random	27	0,873	0,138	0,019	0,603	1,144	6,329	0,000

Figure 6. *The Meta-Analysis Result According To The Estimation Model*

Hypothesis 1 is tested using Z; based on the selected estimation model, the Z value is 0.873. This value was found to be significant with p=0.000. It is not significant if the p-value> 0.005. Alternatively, the calculated Z value is compared to the critical Z value. This result means rejecting H0. Therefore, there was an average size effect that presented the intervention of each discovery learning model in high school, which was different, all significant, and zero.

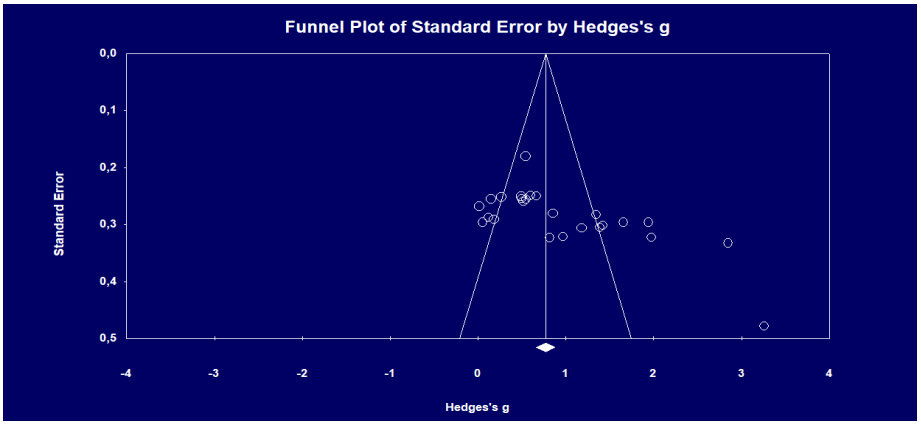

Figure 7. *Plot of Standard Error by Hedges' g*

When observed in Figure 7, ES (effect size) accumulates almost symmetrically at the end of the funnel plot, and the left and right sides of the vertical lines indicate the size of the combined effect. Since the distribution does not appear completely symmetrical, Rosenthal's FSN statistics help determine the likelihood of publication bias. Statistical information is given in Figure 5. Calculate the average effect size and test hypotheses using CMA software. The effect size used is Hedge's g. The interpretation of the magnitude of the effect, using the classification developed by Thalheimer & Cook (2002), is:

Duval and Tweedie's trim and fill

		Fixed Effects			Random Effects			Q Value
	Studies Trimmed	Point Estimate	Lower Limit	Upper Limit	Point Estimate	Lower Limit	Upper Limit	
Observed values		0,76847	0,66374	0,87321	0,87324	0,60281	1,14367	170,43844
Adjusted values	0	0,76847	0,66374	0,87321	0,87324	0,60281	1,14367	170,43844

Figure 8. *Trim and Fill test*

The results of the trim and fill test, as shown in Figure 8, indicate no difference between the observed effect size and the virtual effect size predicted by the effect model. Therefore, there is no tendency to publish this study unfairly or to make cuts or even additions to the research due to the tendency to publish. So, the overall effect measure is 0.873 and is not affected by publication bias.

Furthermore, the results of the study are presented to answer the second question. It has been shown earlier that the estimation method is consistent with the random effects model. This shows that the effect sizes of the studies are heterogeneous, indicating that categorical variables affect discovery learning in mathematics. A summary of the analysis related to the catalogue variables is illustrated in the following figure.

Groups		Effect size and 95% confidence interval					Test of null (2-Tail)		Heterogeneity				Tau-squared			
Group	Number Studies	Point estimate	Standard error	Variance	Lower limit	Upper limit	Z-value	P-value	Q-value	df (Q)	P-value	I-squared	Tau Squared	Standard Error	Variance	Tau
Fixed effect analysis																
30 atau krg	14	0,612	0,079	0,006	0,457	0,767	7,743	0,000	85,863	13	0,000	84,860	0,492	0,232	0,054	0,702
30 atau lbh	13	0,900	0,073	0,005	0,758	1,042	12,413	0,000	77,363	12	0,000	84,489	0,376	0,189	0,036	0,613
Total within									163,226	25	0,000					
Total between									7,212	1	0,007					
Overall	27	0,768	0,053	0,003	0,664	0,873	14,381	0,000	170,438	26	0,000	84,745	0,430	0,146	0,021	0,656

Figure 9. *Summary Of Category Variable Analysis*

Hypothesis test 2 uses the Qb test; from the decision criteria, it can be seen that p = 0.007 < 0.05. Therefore, from the results of this calculation, H1 is rejected, meaning that there is a difference in the magnitude of the influence of discovery learning on mathematics learning based on the following sample size. A. at most 30 b. more than 30. In this case, the implementation of Discovery Learning is effective if students are set with an average of 0.768 for a category of 30 or more students. Therefore, it is concluded that there are differences in the effects of Discovery Learning implementation based on category variables.

Based on the difference in the effect of the education level category

Groups		Effect size and 95% confidence interval					Test of null (2-Tail)		Heterogeneity				Tau-squared			
Group	Number Studies	Point estimate	Standard error	Variance	Lower limit	Upper limit	Z-value	P-value	Q-value	df (Q)	P-value	I-squared	Tau Squared	Standard Error	Variance	Tau
Fixed effect analysis																
College	2	0,682	0,195	0,038	0,301	1,064	3,504	0,000	10,350	1	0,001	90,338	0,729	1,142	1,303	0,854
ES	2	0,716	0,209	0,044	0,306	1,126	3,422	0,001	9,174	1	0,002	89,099	0,718	1,139	1,298	0,847
JHS	15	0,842	0,070	0,005	0,705	0,979	12,074	0,000	100,615	14	0,000	86,086	0,456	0,209	0,044	0,675
SHS	7	0,665	0,112	0,012	0,446	0,884	5,954	0,000	47,321	6	0,000	87,321	0,610	0,415	0,172	0,781
teacher	1	0,547	0,256	0,065	0,046	1,048	2,140	0,032	0,000	0	1,000	0,000	0,000	0,000	0,000	0,000
Total within									167,459	22	0,000					
Total between									2,980	4	0,561					
Overall	27	0,768	0,053	0,003	0,664	0,873	14,381	0,000	170,438	26	0,000	84,745	0,430	0,146	0,021	0,656

Figure 10. Analysis of Mediator Categories by Education Level

Based on the results that have been obtained, it can be seen in the figure above that the size of the effect in the study conducted on the p-value level = 0.561 > 0.05. According to the results of this calculation, H1 was accepted, indicating that there is no difference in the influence of the discovery learning model on mathematics learning across educational levels. This means that the application of the discovery learning model is more effective at the college, high school, junior high school, and elementary school levels, but the effect is small at the teacher level.

Based on the difference in the effect of the publication source category

Groups		Effect size and 95% confidence interval					Test of null (2-Tail)		Heterogeneity				Tau-squared			
Group	Number Studies	Point estimate	Standard error	Variance	Lower limit	Upper limit	Z-value	P-value	Q-value	df (Q)	P-value	I-squared	Tau Squared	Standard Error	Variance	Tau
Fixed effect analysis																
Journal	15	0,832	0,074	0,005	0,687	0,976	11,276	0,000	89,678	14	0,000	84,389	0,443	0,202	0,041	0,665
Proceeding	12	0,699	0,078	0,006	0,547	0,851	9,013	0,000	79,215	11	0,000	86,114	0,454	0,236	0,056	0,674
Total within									168,894	25	0,000					
Total between									1,545	1	0,214					
Overall	27	0,768	0,053	0,003	0,664	0,873	14,381	0,000	170,438	26	0,000	84,745	0,430	0,146	0,021	0,656

Figure 11. Analysis of Mediator Categories by Publication Source

Based on the results that have been obtained, the size of the effect in the study conducted on the publication source can be seen in the figure above, with the p-value = 0.214 > 0.05. So, the results of calculation H1 are accepted, meaning that there is no difference in the influence of the discovery learning model on mathematics learning based on publication sources.

Based on differences in the effects of the research year category

Groups		Effect size and 95% confidence interval					Test of null (2-Tail)		Heterogeneity				Tau-squared			
Group	Number Studies	Point estimate	Standard error	Variance	Lower limit	Upper limit	Z-value	P-value	Q-value	df (Q)	P-value	I-squared	Tau Squared	Standard Error	Variance	Tau
Fixed effect analysis																
2004,000	1	0,056	0,296	0,088	-0,524	0,637	0,190	0,849	0,000	0	1,000	0,000	0,000	0,000	0,000	0,000
2010,000	1	1,973	0,323	0,104	1,341	2,606	6,113	0,000	0,000	0	1,000	0,000	0,000	0,000	0,000	0,000
2017,000	6	1,114	0,123	0,015	0,873	1,354	9,084	0,000	44,040	5	0,000	88,647	0,718	0,530	0,281	0,847
2018,000	6	0,863	0,105	0,011	0,656	1,069	8,203	0,000	41,466	5	0,000	87,942	0,509	0,389	0,151	0,714
2019,000	6	0,817	0,114	0,013	0,593	1,041	7,142	0,000	24,929	5	0,000	79,943	0,314	0,250	0,062	0,561
2020,000	3	0,270	0,154	0,024	-0,032	0,571	1,751	0,080	2,934	2	0,231	31,825	0,033	0,105	0,011	0,183
2021,000	1	0,269	0,252	0,063	-0,225	0,763	1,067	0,286	0,000	0	1,000	0,000	0,000	0,000	0,000	0,000
2022,000	2	0,661	0,196	0,038	0,277	1,045	3,376	0,001	9,671	1	0,002	89,660	0,686	1,083	1,172	0,828
2023,000	1	0,184	0,291	0,085	-0,386	0,753	0,631	0,528	0,000	0	1,000	0,000	0,000	0,000	0,000	0,000
Total within									123,040	18	0,000					
Total between									47,399	8	0,000					
Overall	27	0,768	0,053	0,003	0,664	0,873	14,381	0,000	170,438	26	0,000	84,745	0,430	0,146	0,021	0,656

Figure 12. Mediator Category Analysis by Research Year

Based on the results that have been obtained, it can be seen in the figure above that the size of the effect in the study conducted during the research year, the p-value = 0.000 < 0.05. Therefore, the results of this calculation, H1, are rejected, indicating a difference in the influence of the discovery learning model in mathematics learning by year of study.

Based on differences in the effects of the category number of meetings

Groups		Effect size and 95% confidence interval					Test of null (2-Tail)		Heterogeneity				Tau-squared			
Group	Number Studies	Point estimate	Standard error	Variance	Lower limit	Upper limit	Z-value	P-value	Q-value	df (Q)	P-value	I-squared	Tau Squared	Standard Error	Variance	Tau
Fixed effect analysis																
5 atau lrg	27	0,768	0,053	0,003	0,664	0,873	14,381	0,000	170,438	26	0,000	84,745	0,430	0,146	0,021	0,656
Total within									170,438	26	0,000					
Total between									0,000	0	1,000					
Overall	27	0,768	0,053	0,003	0,664	0,873	14,381	0,000	170,438	26	0,000	84,745	0,430	0,146	0,021	0,656

Figure 13. Mediator Category Analysis by Number of Meetings

Based on the results that have been obtained, it can be seen in the figure above that the size of the effect in the study conducted on the number of p-value meetings = 1,000 > 0.05. So, the results of calculation H1 are accepted, meaning that there is no difference in the influence of the discovery learning model on mathematics learning based on the number of meetings.

Based on the difference in the effect of the analysis variable category.

Table 1. Analysis of Category Variables

No	Variable Mediator	Group	N	Combined Effect Size (Hedge's G)	Test Of Null (2-Tailed)		Heterogeneity		
					Z	P	Between-Classes Effect (Q_h)	Df (Q)	P
1	Number of Meetings	5 atau krng	27	0,768	14,381	0,000	170,438	1	1,000
2	Level of Education	Collage ES JHS SHS Teacher	2 2 15 7 1	0,682 0,716 0,842 0,665 0,547	3,504 3,422 12,074 5,954 2,140	0,000 0,001 0,000 0,000 0,032	10,350 9,174 100,615 47,321 0,000	5	0,561
3	Research Year	2023 2022 2021 2020 2019 2018 2017 2010	1 2 1 3 6 6 6 1	0,184 0,661 0,269 0,270 0,817 0,863 1,114 1,973	0,631 3,376 1,067 1,751 7,142 8,203 9,084 6,113	0,528 0,001 0,286 0,080 0,000 0,000 0,000 0,000	0,000 9,671 0,000 2,934 24,929 41,466 44,040 0,000	8	0,000
4	Sunber Publications	Journal Proceeding	15 12	0,832 0,699	11,276 9,013	0,000 0,000	89,678 79,215	2	0,214

Discussion

Level of Education

Based on the results obtained in this study, the effect on education level is not statistically significant, with p = 0.561 > 0.05. According to the results of the H1 test, the null hypothesis was accepted, indicating no difference in the influence of the discovery learning model on mathematics learning across educational levels. This means that the application of the discovery learning model is more effective at the college, high school, junior high school, and elementary school levels, but the effect is small at the teacher level. This study is in line with the findings (Mahmudah, 2020). In general, the average effect of the size of the learning method in ten experimental studies reached 1.65, which can be categorised as a significant effect. The overall average effect corroborates the finding that Discovery Learning and Problem-based Learning significantly impact mathematics learning at the elementary level, especially in developing critical thinking skills in mathematics. Analysed learning methods: this article has been tested on several different bound variables. In other words, this research has a significant influence on elementary schools.

Publication Source

Based on the results that have been obtained in this study, the size of the effect in the study conducted on the publication source, the p-value = 0.214 > 0.05. Therefore, the results of this calculation, H1, are accepted, indicating that there is no difference in the influence of the discovery learning model in

mathematics learning across publication sources. This finding is different from the research (Devita Anjarwati, 2022), which is based on published information that it is known that the level of influence in research published in journals is 0.872, which can be categorised as a major influence, while the level of influence in research published in proceedings is 0.057, which can be categorised as a small influence. The heterogeneity test results showed that the average effect across the two research groups differed ($Q = 4.571$, $p < 0.05$). Since the p-value < 0.05, it can be concluded that the distribution of effect sizes across the two categories in the study's characteristics differs significantly. Therefore, there is a significant difference in the effect of the Geogebra-assisted Discovery Learning Model on students' mathematical critical thinking skills across publication sources. Thus, the conclusion is that the application of the GeoGebra-assisted Discovery Learning Model in improve students' mathematical critical thinking skills is influenced by the publication sources. In other words, in other studies, the source of publication can be seen as a significant influence or difference in research.

Research Year

Based on the results that have been obtained on the measure of the effect in the study on the year of study, namely, the p-value = 0.000 < 0.05. Therefore, the results of this calculation, H1, are rejected, indicating a difference in the influence of the discovery learning model in mathematics learning by year of study. This is in line with the research (Devita Anjarwati D. J., 2022); in this analysis, research conducted in the last period had a relatively greater impact than in the previous three periods. However, this did not change the uniformity of the mean effect size across the study groups. These findings are supported by a previous meta-analysis (Mahmudah, 2021) that examined variations in primary research results by study year. In addition, if viewed based on the level of education, it can be seen that the impact is increasing along with the increase in the level of education. At the junior high school, high school, and university levels, each had an impact of 0.423, 0,554, and 2,059. This shows that the higher the level of education at which the Geogebra-assisted Discovery Learning Model is applied, the greater the effectiveness of students' mathematical critical thinking skills.

Number of Meetings

Based on the results obtained from the study on the number of meetings, the p-value is 1,000 > 0.05. So, the results of calculation H1 are accepted, meaning that there is no difference in the influence of the discovery learning model on mathematics learning based on the number of meetings. This is in line with the findings (Ni Komang Atik Astiti, 2021), showing that after applying the discovery learning model, there was an increase in the average percentage of students' science learning achievement. The increase in the average percentage of science learning achievement reached 12.27%, while the level of classical completeness increased by 21.21%. However, based on the data on student science learning achievement obtained in the final exam of the first cycle, it has not met the standards that have been set.

CONCLUSION

The results of the analysis show that the influence of the discovery learning model on mathematics learning is obtained. This is in line with the results of the analysis under hypothesis 1 (H0), namely "whether the average size effect presents the intervention of each discovery learning model in high school is different, all significant and zero," based on the previously explained results, which reject H0. Therefore, there is an average size effect that presents the intervention of each discovery learning model at all levels of education, which is different, all significant, and zero. Hypothesis 2, which reads "whether there is a difference in the effect of discovery learning implementation based on categorical variables",

revealed that, based on the results of the moderator's analysis, there are differences in sample size, research year, and publication source that can affect the size of the study effect.

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