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A meta-analysis: the effect of the means-ends analysis model on student learning outcomes

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ABSTRACT
This study aims to determine the effect of the model *Means-Ends Analysis* on student learning outcomes (SD, SMP, SMA) and subjects (Mathematics, Social Sciences, Science). The data from this research is collected through indexing databases such as Google Scholar,*Sinta*and the Garuda Portal. From search results with keywords *means-ends analysis*and learning outcomes from 2013 to 2020 found 45 articles that met the research requirements. The results of the search for 45 data will be filtered to look for the values of N, Fcount, tcount, and rcount. The research method uses Meta-Analysis with a learning model *menas-ends analysis* on student learning outcomes. The results showed thatobtained summary effect value of 0.66 or 66%, including the strong category in influencing the improvement of student learning outcomes. The results of the moderator variable data analysis show that at the SD level it has an influence of 81% which indicates that the influence is very strong. Meanwhile, at the junior and senior high school levels, they have the same strong influence, namely, 64% and 66%. This shows that the Means-Ends Analysis method is suitable for all levels. Then for the results of the classification data analysis subjects obtained the strongest influence, namely social studies subjects with an effect of 75%. Meanwhile, mathematics has a strong effect of 68% and science has a moderate effect of 53%.

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1. INTRODUCTION

Education is one important aspect in improving the quality of Human Resources (HR) of a nation (Diputra 2020). Education can also be understood as a process of transforming values, norms and knowledge which is carried out consciously, continuously and systematically and can be measured and tested academically and can be justified (Siboro 2020). Every human being has the right to get a proper education in order to improve his life in the future. Therefore, various efforts have been made by the government to improve education that is compiled and perfected through various policies and curricula (Susanti 2018). The curriculum has a strategic position because in general it is a description of the vision, mission, and educational goals of a nation (Sunita 2019).

The learning process can affect the quality of education in Indonesia (Sunita 2019). The learning process itself will determine the level of success in learning. There are two factors that influence learning success, namely internal and external factors (Mulasari, Wulandari, and Putra 2020). Internal factors (factors contained in students) consist of intelligence, talent, motivation and persistence, while external factors (factors from outside the student) include the learning environment, methods, learning models and facilities and infrastructure.

Selection of a good learning model can improve student learning outcomes. One learning model that can be applied in improving student learning outcomes is MEA (Means-Ends Analysis). In language, Means Ends Analysis consists of 3 words, namely "Means" which means way, "Ends" which means objective and "Analysis" which means to investigate systematically (Qusairy and Watoni 2017). Thus, AEC can be interpreted as a strategy for analyzing problems in various ways in order to achieve the desired final goal.

To determine the effect of the Means Ends Analysis learning model on student learning outcomes, further analysis is needed through research related to the learning model using Meta Analysis in improving student learning outcomes. This study aims to determine the level of influence of the Means Ends Analysis (MEA) learning model on student learning outcomes at the levels of Elementary School (SD), Junior High School (SMP), and Senior High School (SMA) as well as Mathematics and Social Sciences subjects. IPS), and Natural Sciences (IPA).

2. METHOD

a. Research design

This type of research is a meta-analysis. Meta-analysis is research conducted by researchers by summarizing, reviewing and analyzing research data from several pre-existing research results. This research belongs to the nature of exploration. Exploration is meant here as data collection

b. Data Collection Techniques

The data collection technique of the researcher was done by tracing articles contained in online journals, thesis or dissertation results in the repository, using Google Cedekia, Sinta, and Garuda forte with the keyword `` Means-Ends Analysis of Learning Outcomes ".

c. Data Analysis Techniques

(1) medo the labeling or numbering of the selected articles;

(2) write the Fisher test (F), students test (t), correlation test (r), and the number of research subjects (N);

(3) convert F and t values to r values, with the following formula;

$$F = t^2 \quad (1)$$

$$t = \sqrt{F} \quad (2)$$

$$r = \frac{t}{\sqrt{t^2 + N - 2}} \quad (3)$$

(4) calculate the effect size (ES) and standard error (SE), with the formula;

$$z = ES = 0{,}5 \times \ln \frac{1+r}{1-r} \quad (4)$$

$$SE = \sqrt{\frac{1}{N-3}} \quad (5)$$

(5) perform data analysis assisted by JASP software;
(6) interpreting the results of data analysis or output from the JASP software; (7) analyzing the results found from the articles which became the data reference;

(7) Finally, draw conclusions from the research results.

3. RESULTS AND DISCUSSION

Results of Data Analysis

The search results obtained were in accordance with the terms and criteria for 45 articles. The data collected in the study were Fisher's test value (F), student test (t), correlation test (r), number of research subjects (N) Effect Size (ES) and Standard Error (SE). Meanwhile, learning methods or media, as well as levels, can be used in the process of further data discussion or analysis with certain additional provisions.

Table 1. The results of the convergence of f and t to r, ES and SE

No.	Author Name, Year	Level	Course	Number of Students (N)	f-count	t-count	r-count
1	Siboro, 2019	Junior High	IPA	50		3.37	0.43742
2	Jacob, 2019	Junior High	IPA	78		14,066	0.84999
3	Swandewi, 2018	High school	Mathematics	25		2,675	0.48712
4	Juliantini, 2020	SD	Mathematics	23		3.91	0.64907
5	Goddess, 2020	SD	IPS	275		7.01	0.39057
6	Hernawati, 2020	SD	Mathematics	130		2,128	0.18485
7	Nurmalasari, 2016	SD	Mathematics	65		2,174	0.26417
8	Mawaddah, 2020	Junior High	Mathematics	30		3.14	0.51032
9	Grasella S, 2018	High school	Mathematics	148		2.41	0.1956
10	Septiani, 2016	High school	IPS	31			0.5366
11	Ifana, 2016	High school	IPA	569		2.03	0.08494
12	Nastiti, 2016	Junior High	Mathematics	32		0.09	0.01643
13	Putri LPD, 2019	Junior High	Mathematics	30		3.85	0.58834
14	Habibah, 2016	Junior High	Mathematics	32		1,672	0.29196
15	Juhrani, 2017	Junior High	Mathematics	20		4.7	0.7423

16	Harti, 2014	SD	Mathematics	45	4.11	0.53108
17	Yunita, 2015	SD	Mathematics	23	45,834	0.99504
18	Kusumayanti, 2012	SD	Mathematics	145	23.85	0.89393
19	Fleet, 2012	SD	Mathematics	52	9,309	0.79632
20	Juanda, 2014	Junior High	Mathematics	62	9,636	0.7794
21	Hernaeny, 2018	High school	Mathematics	40	8,029	0.79318
22	Palupi, 2016	Junior High	Mathematics	41	6.64	0.72844
23	Mulasari, 2020	SD	Mathematics	182	2,632	0.19251
24	Sari, 2018	High school	IPS	190	23,982	0.86813
25	Hartini, 2015	High school	IPA	30	2,789	0.46627
26	Efuansyah, 2017	Junior High	Mathematics	40	7.91	0.78876
27	Susanti, 2019	Junior High	Mathematics	53	2,242	0.29953
28	Kumalasari, 2013	Junior High	Mathematics	31	6.76	0.78216
29	Nafi'ah, 2019	Junior High	Mathematics	47	3.28	0.43926
30	Harahap, 2017	Junior High	Mathematics	30	3.81	0.58432
31	Putri, 2019	High school	Mathematics	29	3.19	0.52319
32	Wulandari, 2019	Junior High	Mathematics	25	5.38	0.74647
33	Wijayanti, 2017	Junior High	Mathematics	60	1,7951	0.22942
34	Ariyanti, 2019	Junior High	Mathematics	58	2.61	0.32932
35	Yulita, 2015	MAN	IPA	30	1.17	0.21589
36	Susanti, 2018	Junior High	Mathematics	50	1.16	0.16513
37	Rohimah, 2020	High school	IPS	60	2.94	0.36014
38	Rajagukguk, 2019	Junior High	Mathematics	31	8.69	0.85002
39	Susanti, 2017	Junior High	Mathematics	444	7.91	0.35214
40	Sari, 2016	SD	Mathematics	65	2,174	0.26417
41	Septa, 2019	High school	IPS	61	6.46	0.64365
42	Heryani, 2016	Junior High	Mathematics	60	2.67	0.33084
43	Sunita, 2019	High school	Mathematics	68	9.1062	0.7462

44	Nasution, 2019	Junior High	IPS	64	8.89	0.74859
45	Putri, 2018	Junior High	IPA	42	2,411	0.35621

Discussion

Furthermore, the authors test the hypothesis and test publication bias against the data that has been obtained. In the meta-analysis using JASP software, what is seen in the conclusion is the z value and p-value in the Coefficients table. The hypothesis is as follows.

H_0: true effect size = 0 - Application of learning models *means-ends analysis* does not affect student learning outcomes (SD, SMP, SMA) and subjects (Mathematics, Science, Social Sciences)

H_1: true effect size ≠ 0 - Application of learning models *means-ends analysis* affect student learning outcomes (SD, SMP, SMA) and subjects (Mathematics, Science, Social Sciences)

Based on the simulation results, the JASP output is obtained as follows.

a. Hypothesis testing

The entire data hypothesis test can be seen based on the z value and p-value in the JASP output table according to table 2.

Table 2. JASP output coefficients

Coefficients				
	Estimate	**Standard Error**	**z**	**p**
intercept	0.664	0.075	8,884	<.001

Note. Wald test.

Interpretation:

In table 2 of the coefficients above, it can be seen that the z value is 8.884 and the p-value is 0.001, which means it is smaller than the significance value of 5% (0.05). This means that the Ho hypothesis is rejected, in this case the true effect size is not equal to 0, in other words, the problem based introduction learning model has a significant effect on student learning outcomes.

JASP simulation results based on levels in output perolwh

(1) Hypotheses for Elementary School Level (SD)

Coefficients				
	Estimate	**Standard Error**	**z**	**p**
intercept	0812	0.269	3,021	0.003

Note. Wald test.

Interpretation:

In the table about coefficients above, it can be seen that the z value is 3.021 and the p-value is 0.003, which means it is smaller than the significance value of 5% (0.05). This means that the hypothesis H0 is rejected, in this case the true effect size is not equal to 0, in other words, the problem based introduction method learning has a

significant effect on student learning outcomes at the elementary school level.

(2) Hypothesis for Junior High School (SMP)

Coefficients

	Estimate	Standard Error	z	p
intercept	0.636	0.078	8,125	<.001

Note. Wald test.

Interpretation:

In the table about coefficients above, it can be seen that the z value is 8.125 and the p-value is 0.001 which means it is smaller than the significance value of 5% (0.05). This means that the hypothesis H0 is rejected, in this case the true effect size is not equal to 0, in other words, the learning problem based instruction model has a significant effect on student learning outcomes at the junior high school level.

(3) Hypothesis for High School Level (SMA)

Coefficients

	Estimate	Standard Error	z	p
intercept	0.664	0.171	3,895	<.001

Note. Wald test.

Interpretation:

In the table about coefficients above, it can be seen that the z value is 3.895 and the p-value is 0.001 which means it is smaller than the significance value of 5% (0.05). This means that the hypothesis H0 is rejected, in this case the true effect size is not equal to 0, in other words the means-ends analysis model learning has a significant effect on student learning outcomes at the high school level.

While the simulation results of data output based on subjects are;

(1) Hypotheses for Mathematics Subjects

Coefficients

	Estimate	Standard Error	z	p
intercept	0.683	0.094	7,244	<.001

Note. Wald test

Interpretation:

In the table about coefficients above, it can be seen that the z value is 7,244 and the p-value is 0.001 which means it is smaller than the significance value of 5% (0.05). This means that the hypothesis H0 is rejected, in this case the true effect size is not equal to 0, in other words the means-ends analysis method of learning has an effect. significant towards student learning outcomes in Mathematics.

(2) Hypothesis Results for Natural Sciences Subjects (IPA)

Coefficients

	Estimate	Standard Error	z	p
intercept	0.532	0.218	2,443	0.015

Coefficients

	Estimate	Standard Error	z	p

Note. Wald test.

Interpretation:

In the table about coefficients above, it can be seen that the z value is 2.443 and the p-value is 0.001 which means it is smaller than the significance value of 5% (0.05). This means that the hypothesis H0 is rejected, in this case the true effect size is not equal to 0, in other words the means-ends analysis method of learning has an effect. significant towards student learning outcomes in science subjects.

(3) Hypothesis Results for Social Sciences Subjects (IPS)

Coefficients

	Estimate	Standard Error	z	p
intercept	0.747	0.155	4,832	<.001

Note. Wald test.

Interpretation:

In the table about coefficients above, it can be seen that the z value is 4.832 and the p-value is 0.001 which means it is smaller than the significance value of 5% (0.05). This means that the hypothesis H0 is rejected, in this case the true effect size is not equal to 0, in other words the means-ends analysis method of learning has an effect. significant towards student learning outcomes in social studies subjects.

b. Publication Bias Test

This test is conducted to see whether the collected data can be used as a representative sample of the population. This test can be seen using the values in the Rank Correlation and Regression Method outputs.

Based on the simulation results from JASP, the output is obtained

Table 3. Rank Correlation

Rank correlation test for funnel plot asymmetry		
	Kendall's τ	**p**
Rank test	0.211	0.044

Table 4. Regression Test

Regression test for Funnel plot asymmetry ("Egger's test")		
	z	**p**
sei	1,837	0.066

Interpretation:

In table 3 related to Rank correlation, it can be seen that Kendall's value is 0.211 which shows the large correlation coefficient between the effect size and the variance.

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Furthermore, table 4 shows that the z value which is the large regression coefficient is 1.837, while the p-value is 0.625 which is greater than 0.05 which indicates that the hypothesis H0 is rejected, in other words there is no indication of publication bias.

c. File-Safe N

Table 5. File Drawer Analysis

Drawer Analysis files	Fail-safe N	Target Significance	Observed Significance
Rosenthal	17328,000	0.050	<.001

Table 5. It shows how many studies that have an average effect size equal to 0 that must be added to the research sample so that the research results are free from publication bias. Based on Table 5. Above, it can be seen that the Fail-safe N value is1,732 publications that must be added. This value is not mandatory if based on the results of the Rank Correlation and Regression Method there is no indication of publication bias.

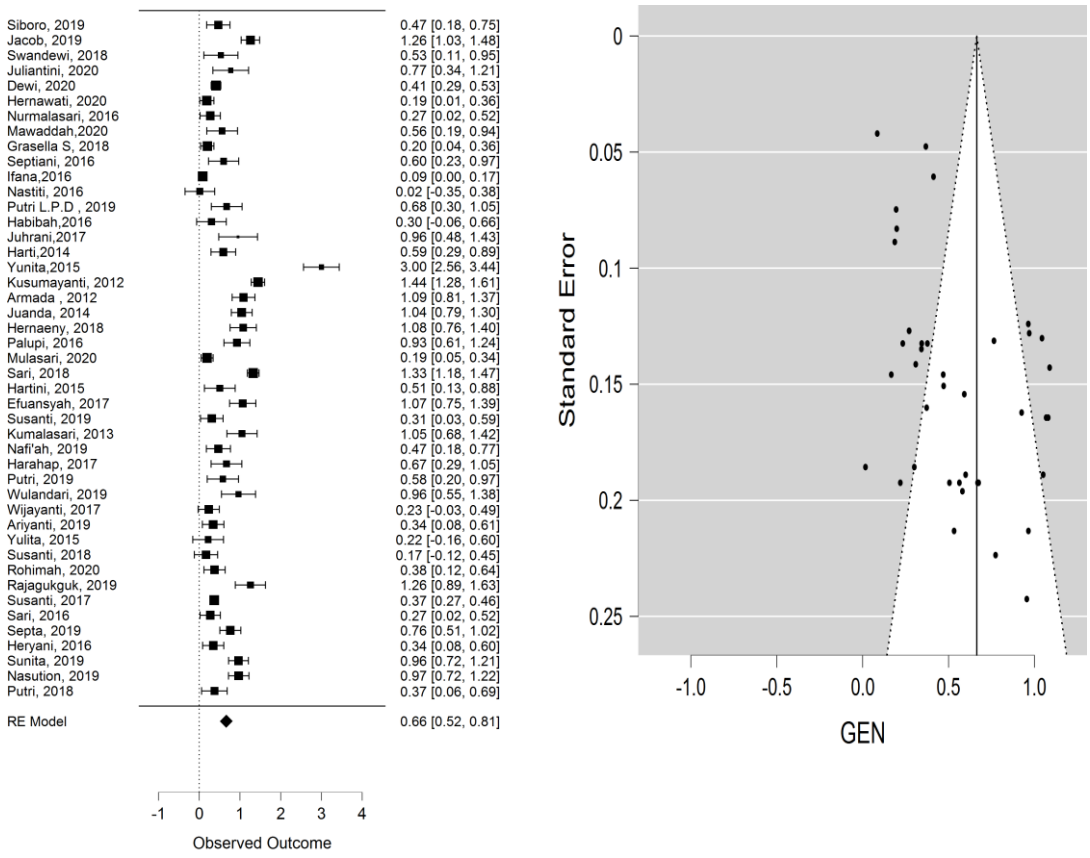

Figure 1. Trims and Fill

Based on the results of the publication plot in Figure 1 above, it can be seen that there is no missing study which is marked with the circumference between open, all closed circles. Furthermore, from the forest plot image, the summary effect value is 0.66, in other words the effect of the means-ends analysis learning model has an effect on improving student learning outcomes by 66%, while 34% is influenced by other factors.

d. Moderator Variables

The results of the moderator variable analysis are needed to see how much influence it has at the level and subject level. The results of data analysis using JASP are in accordance with Table 6 below.

Table 6. Variable Data Analysis Results

No.	Category	Estimate	Z	Kendall's	RE Models	Category
1	SD	0.812	3,021	0.494	0.81	Very strong
2	Junior High	0.636	8,125	0.160	0.63	strong
3	High school	0.664	3,895	0.242	0.66	Strong
4	Mathematics	0.638	7,244	0.322	0.68	Strong
5	IPA	0.532	2,443	0.138	0.53	Moderate
6	IPS	0.747	7,244	-0,200	0.75	Strong

Interpretation:

From the table above we can see the strongest influence on the learning model. It is clear that the means ends analysis learning model is very strong at the elementary level which is more influential, namely with a percentage of 0.81 or 81%, while at the high school and junior high school levels the influence of the learning model is equally strong, namely 0.66 and 0.63 or 66 % and 63%. Then from the results of the analysis on the subject of strong means-ends analysis on social studies subjects with an effect of 0.75 or 75%. Meanwhile, for Mathematics, an influence of 0.68 or 68% is obtained, which means that the influence is strong. And for science subjects it has a moderate effect of 0.53 or 53%.

4. CONCLUSION

Sourced from the results of data analysis and discussion, it can be concluded that the effect of means-ends analysis models is suitable for use at levels (SD, SMP, SMA) and subjects (Mathematics, Science, Social Sciences) in improving student learning outcomes. This has been tested using the meta-analysis method with the help of JASP software which shows that the summary effect value is 0.66 or 66%, including the moderate category to have an effect on improving student learning outcomes.

Referring to the results of the moderator variable data analysis on the means-ends analysis model shows that the strong influence on the elementary level is up to 0.81 or 81%. Meanwhile, at the junior and senior high school levels, the effect is only 63% and 66%. This shows that the problem based introduction learning model is quite suitable to be applied at the elementary level. Then the classification in the means-ends analysis method has a strong influence on the Social Studies and Mathematics subjects, namely up to 7,369 and 6,937, while in the science subject it does not really have an effect, namely 44%.

Based on the above conclusions, the researcher provides suggestions, namely, the teacher is able to apply the means-ends analysis model to be used as a reference in improving student learning outcomes. In addition, teachers are expected to use the appropriate learning model according to the subject, so that students are able to actively engage in learning activities.

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