**META-ANALYSIS OF MIND MAPPING IN VOCABULARY LEARNING OF THE PAST DECADE**

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**Abstract:** The type of research used is meta-analysis research aimed at determining the level of effectiveness or quality of mind mapping in vocabulary learning, including at elementary, middle, high school, and college levels. This quality was examined using several previous research results that collected data with inclusion and exclusion conditions from the Google Scholar, DOAJ, and Scopus databases. The search results found up to 51 dates that met the requirements with the number of students (N), F-counts, t-counts, and r-counts. The results of data analysis obtained by the simulation software JASP showed that the impact on learning media vocabulary based on mind mapping is 73% significant, which included the High category. The moderator variable is the lowest level of education, the high impact of using mind mapping, namely the college level, with an estimate of the effect of 0.569, Based on the number of participants, the application of mind mapping has more influence on participants totaling more than 30 students with an estimate of 0.928 (strong category), while the lowest effect is seen from the number of participants who collected more than 91 students with an estimate of 0.529, meaning that this mind mapping learning model is most appropriate to be applied in high school rows with more than 30 participants in order to maximize student learning outcomes.

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**Keywords:** *Mind Mapping;* *Vocabulary;* *Level Education.*

# INTRODUCTION

Vocabulary acquisition plays an important role in mastering a language (Susanto, 2017), It cannot be argued that vocabulary plays a fundamental role in helping students to communicate both in spoken and in written form (Noprianto & Purnawarman, 2019), Vocabulary is quite important in learning language whether in ancient or not (Respati et al., 2019), Vocabulary in the English language is cwonsidered to be one of the sub-skills of the four integrated skills (writing, reading, speaking, and listening) (Hasemhi, 2021), vocabulary is seen as an important component of language (Basuki et al., 2018), Good mastery of vocabulary will enable someone to communicate with others effectively and vice versa (Octaviana et al., 2019), Vocabulary acquisition has received a great deal of attention in second-language education (Otto, 2021), the study of vocabulary is at the center while learning a new language (Abduramanova, 2020), The meaning of new words is very often emphasized, both in books and in verbal communication. (Sabri et al., 2019), Without mastering vocabulary, the students will get difficulties when they are communicating with each other (Octaviani et al., 2019).

This research is about mind-mapping media in learning vocabulary and how influence mind-mapping media in vocabulary. Mind mapping is defined by the Online business dictionary as a graphical technique for visualizing connections between several ideas or pieces of information (Al Shdaifat et al., 2019), Using mind mapping technique can create new something because it can stimulus for thinking through association branch in which we have written (Megawati et al., 2021), Mind mapping is a pedagogical technique which involves visual realization of ideas (Alhajaji et al., 2020), Mind mapping is a pattern, which at least consists of picture, symbol and color those are not just help the students to understand the vocabulary knowledge but also make the students feel good, enjoyable, and attract their brain which at last leads them to have interest in mastery vocabulary knowledge (Setianingsih et al., 2019), Mind maps have been used in foreign language teachings as a tool to activate students’ prior knowledge of a topic and assist them in organizing and recalling vocabulary (Luangkrajang, 2022), In other hand, mind mapping is a beneficial learning tool to help students brainstorming any topic and thinking creatively (Panggabean et al., 2019), In this study, mind-mapping technique was chosen to be used in increasing students' vocabulary (Delatu et al., 2020).

The use of mind mapping-based vocabulary learning media at the elementary school level is widespread (a/p Prabha & Abdul Aziz, 2020; Afriansya, 2019; Alwattar & Al-Balhan, 2018; Hanjani, 2018; Kim & Kim, 2012; Kusuma, 2015; Sadek Muhammad et al., 2019; Wu & Chen, 2018). Kusuma (2015) conducted an elementary school research discussing the results of The effect of Mind Mapping techniques on the Vocabulary Mastery with a total of 44 students and concluded that mind-mapping-based vocabulary learning media can improve student achievement with a count of r 0.801, while Kim (2012) conducted a study discussing learning styles and educational outcomes with a total of 31 students using Digital Mind Map as a Study tool in elementary english class and obtained a t-score of 14.19. And also Alwattar & Al-Balhan (2018) conducted a study on the effectiveness of the e-mind mapping strategy on the proficiency level of sixth-grade students in learning vocabulary with a total of 60 students and obtained an F-score of 1,684.

While many have also conducted research at the junior high school level such as (AalSaud, 2019; Ansi & Sambayu, 2020; El-beltagy, 2019; Luangkrajang, 2022; RI, 2019; Sahrawi, 2013; Selvarajasingam et al., 2021; Syafrizal et al., 2018; Zahra, 2015). Syafrizal et al (2018) has conducted research on The Effectiveness of using Mind Mapping Strategy and Making Inference toward Students’ Vocabulary Achievement with a total of 30 students and obtained the result that mind mapping-based vocabulary learning media can improve student learning outcomes with an F value of 0.120, While Sahrawi (2013) conducted research at the junior high school level which discusses the Effectiveness Of Mind Mapping For Teaching Vocabulary with 112 students and obtained the results that vocabulary learning with Mind mapping media can improve learning outcomes with a calculated r value of 0.950, While Zahra (2015) conducted research with a total of 32 students at middle school and concluded that mind mapping-based vocabulary learning media can improve students’ learning outcomes with a calculated r-value of 0.750.

And also mind mapping research in senior high school has been carried out (Elkareem et al., 2019; Heidari & Karimi, 2015; Khodabandeh, 2021; Nia & Pratama, 2019; Unismuh, 2019; Waloyo, 2017; Wikandari, 2022). (Heidari & Karimi, 2015) has conducted research at the senior high school level which discusses The Effect of Mind Mapping on Vocabulary Learning can improve student learning outcomes with a total of 40 students and obtained an F score of 721,210. (Wikandari, 2022) also researched learning vocabulary using mind mapping can improve students learning outcomes with a total of 29 students and obtained an r value of 0.422, the last one is (Khodabandeh, 2021) has conducted the research about the impact mind mipping can improve students vocabulary with a total of students 35 and obtained t score is 19.248.

Finally, the use of mind-mapping-based vocabulary learning media is widespread at college level (Al-Jarf, 2015; Alhajaji et al., 2020; Cao & Ismail, 2022; Hakim, 2022; Khudhair, 2016; Liu, 2016; Masoud & Ibrahim, 2017; Putra, 2012; Saad, 2019). Putra (2012) Has conducted research at the College level on the Application of Mind Mapping Techniques in Vocabulary Teaching with a total of 40 students and obtained an r value of 0.349, and also Masoud & Ibrahim (2017) researched mind mapping to teach vocabulary can improve students learning outcomes with a total of 62 students with an F score of 0.007, the last one is Alhajaji (2020) conducted the research about The study investigating the effect of employing Games, Mind-mapping and Twitter Hashtags as the GMT technique, on female Saudi university students’ achievement in English vocabulary can improve learning outcomes with a total of 64 students and obtained a t value is 0.122.

From All the statements Above, the information was gained that a lot of research related to mind mapping-based vocabulary learning media was done in learning. But so far there has been no research that further discusses the magnitude of the impact of the use of mind mapping on learning outcomes at all levels of education. And in this article, the author explains about impact mind mapping to teach vocabulary at all education levels such as collage, Senior High School, Junior High Scholl, and Elementary School.

# METHOD

This research is a kind of meta-analysis research. Meta-analysis is research conducted by researchers in a way to collect research data, summarize, review, and analyze research data from several previous research results (Ratu et al., 2022). The data source was taken in 2012-2022 with keywords “MIND MAPPING” OR “VOCABULARY LEARNING”. The procedure research,

according to Figure 1

Figure 1.

1. Search articles from the Google Scholar indexer database, DOAJ, and Scopus according to the criteria mentioned above.
2. Microsoft Excel encoding and tabulation includes year of publication, author name, country, level, class, value N, F-count, T-count, and R-count.
3. Converting F and t values ​​to r values ​​with the formula:

(1)

𝑡 = (2)

r (3)

1. Calculation of Effect Size (ES) and Standard Error (SE) values

𝑧 = 𝐸𝑆 = 0,5 (4)

𝑆𝐸 = (5)

1. Run simulations and data analysis with JASP software
2. The analysis of the results found from the articles is a data reference
3. Draw conclusions from the results of the meta-analysis.

**Table 1.** Classification of Glass's effect sizes

|  |  |
| --- | --- |
| Effect Size (ES) | Category |
| 𝐸𝑆 ≤ 0.15 | Negligible effect |
| 0.15 < 𝐸𝑆 ≤ 0.40 | Small effect |
| 0.40 < 𝐸𝑆 ≤ 0.75 | Moderate effect |
| 0.75 < 𝐸𝑆 ≤ 1.10 | High Effect |
| 1.10 < 𝐸𝑆 ≤ 1.45 | Very High Effect |
| 1.45 < 𝐸S | High Influence |

# RESULTS AND DISCUSSION

1. **Data Selection Results**

The results of the data set search yielded 113 data, according to the inclusion and exclusion criteria 51 and the data did not match the inclusion and exclusion criteria is 62. The data collected in this study are the Fischer test score (F), student test (t), correlation test (r), and amount of research data (N). During the learning method, levels can also be processed or further data analysis can be carried out with certain conditions. From the collected data that there are values ​​of F and t, these two values ​​need to be changed to the value of r, as well as the value of ES according to equation (4) and SE according to equation (5). Regarding the conversion results according to Table 2 below.

**Table 2.** Results of Data Selection and ES and SE Values

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| No | Study | Level | N | R | ES | SE | Category |
| 1 | Study 1 | Junior High School | 25 | 0.872 | 1.342 | 0.213 | High Effect |
| 2 | Study 2 | Elementary School | 31 | 0.935 | 1.696 | 0.189 | High Effect |
| 3 | Study 3 | Collage | 40 | 0.349 | 0.364 | 0.164 | Small Effect |
| 4 | Study 4 | Junior High School | 112 | 0.950 | 1.831 | 0.096 | High Effect |
| 5 | Study 5 | Collage | 150 | 0.716 | 0.899 | 0.082 | Moderate effect |
| 6 | Study 6 | Collage | 60 | 0.009 | 0.009 | 0.132 | Negligible effect |
| 7 | Study 7 | Junior High School | 32 | 0.750 | 0.974 | 0.186 | Moderate effect |
| 8 | Study 8 | Elementary School | 26 | 0.486 | 0.531 | 0.209 | Moderate effect |
| 9 | Study 9 | Collage | 50 | 0.782 | 1.050 | 0.146 | High Effect |
| 10 | Study 10 | Elementary School | 23 | 0.584 | 0.669 | 0.224 | Moderate effect |
| 11 | Study 11 | Collage | 40 | 0.937 | 1.714 | 0.164 | High Effect |
| 12 | Study 12 | Elementary School | 18 | 0.509 | 0.561 | 0.258 | Moderate effect |
| 13 | Study 13 | Collage | 74 | 0.112 | 0.112 | 0.119 | Negligible effect |
| 14 | Study 14 | Junior High School | 25 | 0.806 | 1.117 | 0.213 | High Effect |
| 15 | Study 15 | Collage | 62 | 0.327 | 0.339 | 0.130 | Small Effect |
| 16 | Study 16 | Senior High School | 36 | 0.892 | 1.431 | 0.174 | High Effect |
| 17 | Study 17 | Elementary School | 44 | 0.306 | 0.316 | 0.156 | Small Effect |
| 18 | Study 18 | Collage | 60 | 0.745 | 0.961 | 0.132 | Moderate effect |
| 19 | Study 19 | Collage | 100 | 0.068 | 0.068 | 0.102 | Negligible effect |
| 20 | Study 20 | Elementary School | 80 | 0.394 | 0.416 | 0.114 | Small Effect |
| 21 | Study 21 | Collage | 151 | 0.338 | 0.352 | 0.082 | Small Effect |
| 22 | Study 22 | Collage | 21 | 0.316 | 0.327 | 0.236 | Small Effect |
| 23 | Study 23 | Elementary School | 71 | 0.248 | 0.253 | 0.121 | Small Effect |
| 24 | Study 24 | Junior High School | 77 | 0.304 | 0.313 | 0.116 | Small Effect |
| 25 | Study 25 | Junior High School | 20 | 0.929 | 1.648 | 0.243 | High Effect |
| 26 | Study 26 | Senior High School | 69 | 0.917 | 1.569 | 0.123 | High Effect |
| 27 | Study 27 | Junior High School | 91 | 0.114 | 0.115 | 0.107 | Small Effect |
| 28 | Study 28 | Junior High School | 116 | 0.278 | 0.286 | 0.094 | Small Effect |
| 29 | Study 29 | Senior High School | 60 | 0.275 | 0.283 | 0.132 | Small Effect |
| 30 | Study 30 | Senior High School | 66 | 0.606 | 0.703 | 0.126 | Moderate effect |
| 31 | Study 31 | Collage | 64 | 0.015 | 0.015 | 0.128 | Negligible effect |
| 32 | Study 32 | Collage | 90 | 0.214 | 0.217 | 0.107 | Small Effect |
| 33 | Study 33 | Elementary School | 66 | 0.009 | 0.009 | 0.126 | Negligible effect |
| 34 | Study 34 | Senior High School | 69 | 0.917 | 1.569 | 0.123 | High Effect |
| 35 | Study 35 | Senior High School | 60 | 0.028 | 0.028 | 0.132 | Negligible effect |
| 36 | Study 36 | Collage | 72 | 0.695 | 0.858 | 0.120 | Moderate effect |
| 37 | Study 37 | Collage | 60 | 0.666 | 0.804 | 0.132 | Moderate effect |
| 38 | Study 38 | Senior High School | 50 | 0.973 | 2.154 | 0.146 | High Effect |
| 39 | Study 39 | Collage | 38 | 0.753 | 0.980 | 0.169 | High Effect |
| 40 | Study 40 | Collage | 40 | 0.076 | 0.076 | 0.164 | Negligible effect |
| 41 | Study 41 | Collage | 33 | 0.872 | 1.341 | 0.183 | High Effect |
| 42 | Study 42 | Senior High School | 35 | 0.958 | 1.924 | 0.177 | High Effect |
| 43 | Study 43 | Collage | 60 | 0.900 | 1.475 | 0.132 | High Effect |
| 44 | Study 44 | Collage | 79 | 0.117 | 0.117 | 0.115 | High Effect |
| 45 | Study 45 | Collage | 30 | 0.130 | 0.131 | 0.192 | Negligible effect |
| 46 | Study 46 | Junior High School | 40 | 0.536 | 0.598 | 0.164 | Moderate effect |
| 47 | Study 47 | Senior High School | 22 | 0.422 | 0.450 | 0.229 | Moderate effect |
| 48 | Study 48 | Collage | 42 | 0.410 | 0.435 | 0.160 | Moderate effect |
| 49 | Study 49 | Senior High School | 64 | 0.810 | 1.127 | 0.128 | High Effect |
| 50 | Study 50 | Collage | 42 | 0.735 | 0.940 | 0.160 | Moderate effect |
| 51 | Study 51 | Senior High School | 29 | 0.154 | 0.155 | 0.196 | Small Effect |

Based on Table 2. Above, which contains 51 eligible data. Divided into 7 data from the elementary school level, 9 data from the junior high school level, 11 data from the high school level, and 24 from the college level.

Next, the authors performed a hypothesis test and a publication bias test on the collected data. In a meta-analysis using JASP software seen while concluding, the z and p values ​​are shown in the coefficient table. The hypothesis is as follows:

Hypothesis 1: Using mind mapping is effective to improve student learning outcomes in vocabulary learning

Hypothesis 2: There is no publication bias from the data used in the research

1. **Hypothesis Test**

In the first stage, a heterogeneity test was carried out to see the categories data whether using fixed or random effects. As for the results according to Table 3.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 3.** Fixed and Random Effects | | | | | | | |
|  | | **Q** | | **df** | | **P** | |
| Omnibus test of Model Coefficients |  | 75.082 |  | 1 |  | < .001 |  |
| Test of Residual Heterogeneity |  | 964.368 |  | 50 |  | < .001 |  |
|  | | | | | | | |
| From JASP's results obtained via vocabulary learning media using mind mapping analysis, it can be seen that the data are heterogeneous with a large Q=964,368 and a value of p<0.001. Next, consider the estimate of the mind mapping in Vocabulary Learning according to Table 4.   | **Table 4.** Output JASP coefficients | | | | | | | | | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | | **Estimate** | | **Standard Error** | | **z** | | **P** | | | Intercept |  | 0.734 |  | 0.085 |  | 8.665 |  | < .001 |  | |  | | | | | | | | | | | *Note.*  Wald test. | | | | | | | | | | | In Table 4 on the coefficients, you can see that the z-score is 8,665 and the p-value is 0.001, less than the 5% significance level (0.05). This means that the hypothesis is accepted, in this case, the true effect size is not equal to 0, in other words, all vocabulary learning based on mind mapping has a significant impact on student learning outcomes 75%, while 25%% of other factors are influenced. a publication bias test was performed. This test is performed to see if the data collected can be used as representative of the population. This test can be viewed by the value in the returned rank correlation and regression test. Based on the results using JASP, the output shown in Table 5 and Table 6 below is obtained.   | **Table 5.** Rank correlation | | | | | | | --- | --- | --- | --- | --- | --- | |  | | **Kendall's τ** | | **p** | | | Rank test |  | 0.217 |  | 0.026 |  | |  | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | |
|  | | | | | | | |

| **Tabel 6**. Regresstion test | | | | | |
| --- | --- | --- | --- | --- | --- |
| Regression test for Funnel plot asymmetry ("Egger's test") | | **z** | | **P** | |
|  |  | 1.381 |  | 0.167 |  |
|  | | | | | |

In Table 5 for rank correlation and regression, Kendall's score on mind mapping learning media can be seen as 0.217, indicating a large correlation coefficient between effect sizes and variance. In Table 6, the value of z represents the magnitude of the regression coefficient of 1.381 and the p-value of 0.167 is greater than the value of 0.05, showing that the second hypothesis is accepted, in other words, no identified publication bias.

#### Funnel Plot

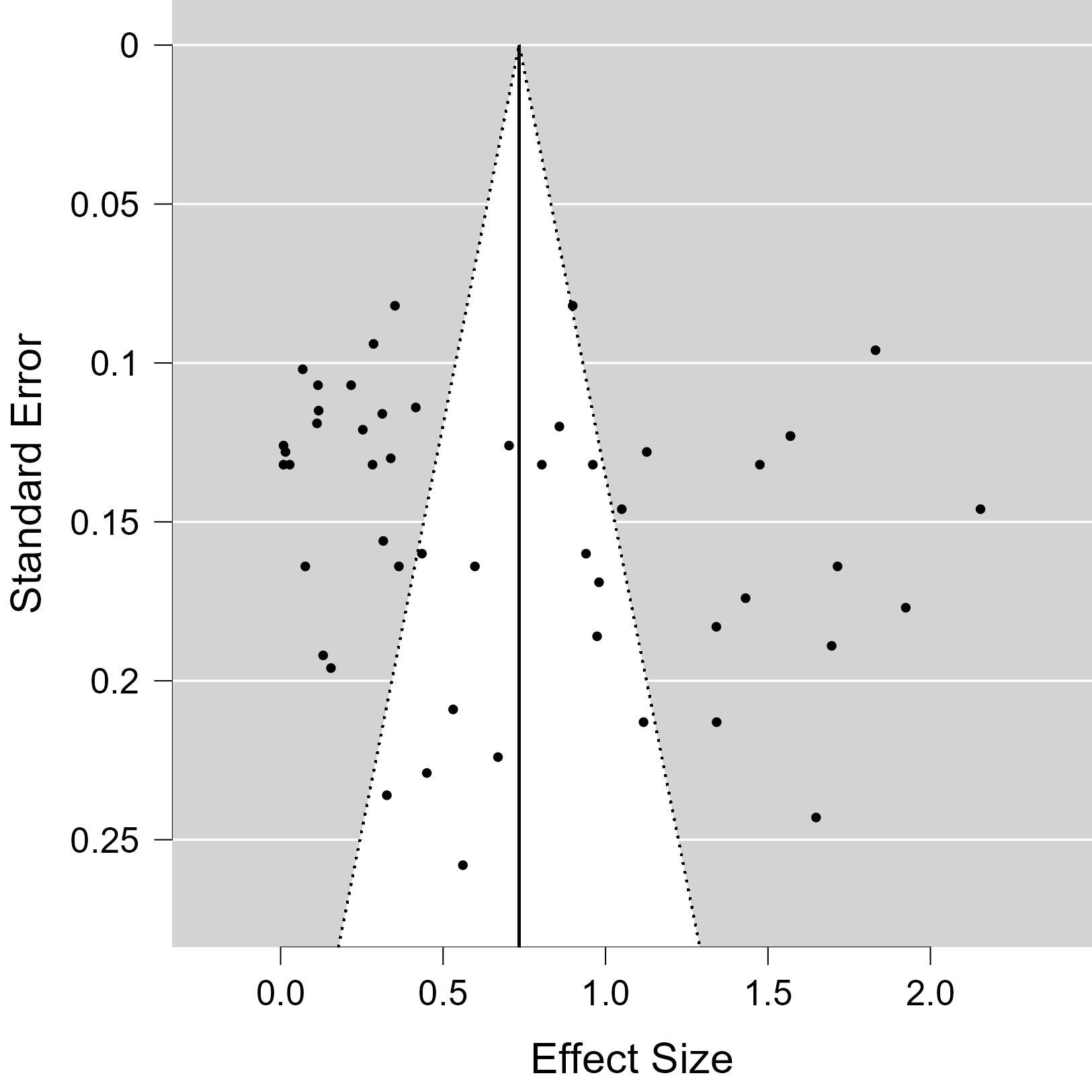


Figure 2.

Based on the results of the publication plotted in Fig. above, it can be seen that no missing studies are marked as open circles, all closed circles. In addition, from the forest plot image, a summary effect value of 0.73 with words, which is impacted by another effect of the mind mapping learning model, increases student motivation and learning outcomes by 73%, while 27% through other factors are influenced.

Finally, the author conducted a moderator variable test to see the level of influence of several other variables such as level of education, country, publication years, and a number of participants. The results are according to the table below.

1. **The Influence of Mind Mapping on Vocabulary Based on Education Level and Country**

Moderator variable analysis is needed to determine how much influence mind mapping as a vocabulary learning media has on education and country levels.

**Table 7.** The Influence of Mind Mapping Based on Level Education and Country

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **Interval** | **N** | **Q-Test** | **Estimate** | **I2 (%)** | **RE Model** | **Category** |
| Level | College | 24 | 286.787 | 0.569 | 92.556 | 0.57[0.57,0.90] | Moderate effect |
|  | Senior High School | 11 | 251.259 | 1.039 | 96.191 | 1.04[0.60,1.84] | High Effect |
|  | Junior High School | 9 | 226.849 | 0.900 | 95.248 | 0.90[0.49,1.31] | High Effect |
|  | Elementary School | 7 | 75.570 | 0.606 | 93.410 | 0.61[0.18,1.03] | Moderate effect |
| country | Indonesia | 20 | 452.141 | 0.788 | 95.902 | 0.79[0.51,1.07] | High Effect |
|  | Non-Indonesia | 31 | 452.757 | 0.698 | 94.018 | 0.70[0.49,091] | Moderate effect |

The table above shows that the effect of using Mind Mapping media in learning vocabulary at the educational level is relatively strong at the high school level with an estimate of 1,039, while at the college level it is 0,569, at the junior high school level it is 0,900, and finally at the elementary level it is 0,606. So this shows that mind mapping-based vocabulary learning media is very suitable for use at the senior high school level. And also the use of mind mapping in Indonesia is very suitable for use because the estimate is 0.788 while outside Indonesia the estimate is 0.698.

1. **The Influence of Mind Mapping on Vocabulary Based on Moderators’ Variable**

At this stage, the author analyzes the data to determine the level of influence of learning outcomes using mind mapping when viewed based on publication years, and Amount of participants. The following table presents JASP output based on publication years and Amount of Participant.

**Table 8.** The Influence of Mind Mapping Based on Publication Years and Participants

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **Interval** | **N** | **Q-Test** | **Estimate** | **I2 (%)** | **RE Model** | **Category** |
| Publications Year | 2012-2019 | 30 | 534.322 | 0.734 | 94.508 | 0.73[0.53,0.94] | Moderate effect |
| 2020-2022 | 21 | 964.368 | 0.734 | 94.850 | 0.73[0.57,0.90] | Moderate effect |
| Amount of Participants | 0-30 | 10 | 48.978 | 0.688 | 81.575 | 0.69[0.37,100] | Moderate effect |
| 31-60 | 21 | 358.277 | 0.928 | 94.316 | 0.93[0.65,1.20] | High Effect |
| 61-90 | 14 | 257.796 | 0.543 | 95.005 | 0.54[0.26,0.83] | Moderate effect |
| More Than 91 | 6 | 245.568 | 0.529 | 98.108 | 0.59[0.05,1.13] | Moderate effect |

At the publication years interval, mind mapping has the same effect on vocabulary learning because the estimates for 2012-2019 and 2020-2022 are the same as the estimate of 0,734 in the high category. Finally, in the category of a number of participants, mind mapping is very influential with the number of participants being more than 31 people with an estimate of 0.928.

# CONCLUSION

Based on the results of this study, Mind Mapping is very influential on Vocabulary learning where the results show that 73% of the value of its influence on student learning outcomes is included in the High category. Then, it can be seen from the moderator table that the most influential on Mind Mapping media in vocabulary learning is at the high school level with an estimate of 1,039, the effect on student learning outcomes which is the very strong category. Meanwhile, at the College level, the effect is quite low the estimate is only 0.569 which is included in the low category. And also the use of mind mapping in Indonesia is very suitable for use because the estimate is 0.788, while outside Indonesia the estimate is 0.698. Furthermore, from the moderator table, it can also be seen that in the publication years, 2012-2019 and 2020-2022 both are very influential because the estimates of both are high around 0.734. Meanwhile, judging from the number of participants, 31-60 had the most influence on vocabulary. which has little influence found in participants with several More Than 91 with an estimate of 0.529.

In this meta-analysis study, several weaknesses, such as the number of primary studies indexed by Scopus and the number of literature search engines, were relatively small. Several substantive characteristics, such as mind mapping treatment duration, study area, and study year, were not observed. Therefore, for further meta-analysis studies, particularly on the effect of mind mapping implementation on increasing students' vocabulary, the number of primary studies indexed by Scopus and the number of literature search engines should be increased. Likewise, substantive characteristics such as mind-mapping treatment duration, study area, and study year should be included in the meta-analysis study as they could potentially influence the heterogeneity of effect sizes.

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