EDUMASPUL
JURNAL PENDIDIKAN
Vol. 7 – No. 1, year (2023), page 1598-1608
| ISSN 2548-8201 (Print) | 2580-0469) (Online) |

Meta Analysis Study: The Effect of Mind Mapping on Students' Multiple Intelligence

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Receive: 10/01/2023	Accepted: 10/02/2023	Published: 01/03/2023

Abstrak

Penelitian ini bertujuan untuk mengetahui efek size model pembelajaran mind mapping terhadap multiple intelligence siswa. Jeni penelitian ini adalah meta-analisis. Sampel penelitian ini berasal dari 15 jurnal nasional dan internasional. Proses pencarian sumber data dalam penelitian ini melalui google scholar, ScienceDirect, Wiley dan ProQuest. Kriteria inklusi yang digunakan yakni jurnal atau prosiding yang terindeks Scopus, SINTA, DOAJ dan Web of Science; 2) Mempunyai variabel mind mapping dan multiple intelligence; 3) Jenis penelitian berupa eksperimen atau kuasi eksperimen; 4) mempunyai data mean, standar deviasi dan nilai t. Pengumpulan data dilakukan dengan observasi langsung dan dokumentasi. Analisis data dilakukan dengan menghitung nilai effect size dan standar deviasi dengan bantuan palikasi JSAP. Hasil penelitian ini menunjukan bahwa nilai rata-rata effect size sebesar 0.871 dengan kriteria itinggi. Temuan ini menunjukan bahwa pembelajaran mind mapping memberikan pengaruh terhadap multiple intelligence siswa dalam belajar. Pembelajaran mind mapping membantu siswa lebih dalam mengingat materi pelejaran yang telah diperlajari

Kata Kunci: *Mind Mapping, Multiple Intelligence, Pendidikan, Meta-analisis*

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Abstract

This study aims to determine the effect size of mind mapping learning model on students' multiple intelligence. This research is a meta-analysis. The sample came from 15 national and international journals. The process of searching for data sources in this study through Google Scholar, ScienceDirect, Wiley and ProQuest. The inclusion criteria used are journals or proceedings indexed by Scopus, SINTA, DOAJ and Web of Science; 2) Has mind mapping and multiple intelligence variables; 3) The type of research is experimental or quasi-experimental; 4) has mean, standard deviation and t value data. Data collection is done by direct observation and documentation. Data analysis was carried out by calculating the effect size

value and standard deviation with the help of JSAP application. The results of this study show that the average effect size value is 0.871 with high criteria. This finding shows that mind mapping learning has an influence on students' multiple intelligence in learning. Mind mapping learning helps students better remember the learning material that has been learned.

***Keywords**: Mind Mapping, Multiple Intelligence, Education, Meta-analysis*

Introduction

Multiple intelligence is a multiple intelligence that must be possessed by students in the learning process (Jahroh & Baidi, 2022; Agustin et al., 2021; Oktarina et al., 2021). Asio *et al*., (2021) Multiple intelligence is a multiple intelligence that aims to transform the potential of students in accordance with the field of interest. Multiple intelligence consists of naturalistic, musical, linguistic, verbal, kinesthetic, spatial, interpersonal, intrapersonal and existential intelligence (Hariyati, 2013; Machali, 2014; Dawahdeh & Mai, 2021; Ahamad et al., 2021). Students who have multiple intelligences find it easier to master the subject matter at school (Oktaweri & Festiyed, 2020; Keskin et al., 2021). Furthermore, multiple intelligence encourages students to be more active and creative in learning to achieve student success (Winarti et al., 2019).

Student learning outcomes in facing the era of the industrial revolution 4.0 are still relatively low (Ndia et al., 2020; Elfira et al., 2023). Purba (2021) stated that Indonesian students' multiple intelligence is still low in learning so that learning objectives have not been achieved optimally. Research results Hasanah et al., (2022) The low multiple intelligence of students is influenced by teachers who have not been able to recognize the potential of students. Furthermore, teachers have not been able to develop learning models that can improve multiple intelligence in students. (Septiana & Ikhsan, 2017), so that learning activities do not run well. Research results Asriani et al., (2018) students have low learning outcomes and students have not been able to develop their potential in learning. In addition, students lack initiative in learning, making the learning process teacher-centered (Karmila et al., 2020; Santosa et al., 2021; Suharyat et al., 2023; Ichsan et al., 2023). This requires learning that can encourage students' multiple intelligences in learning.

Mind mapping is a learning that can increase students' knowledge in learning so as to encourage students' multiple intelligences (Pribadi & Susilana, 2021; Suwandi et al., 2021). Mind mapping learning can improve critical thinking skills and concept understanding in students (Kurti, 2022; Magdalena et al., 2014). Research results (Hakim et al., 2019) Mind mapping learning can increase student motivation and learning outcomes, thus encouraging multiple intelligence in students in learning. In addition, learning with mind mapping can increase students' creativity in learning (Abant & Baysal, 2022; Polat, 2021). So, mind mapping helps students and teachers more easily achieve learning goals.

Previous research by Avdagic et al., (2021) Mind mapping can help students to understand and remember the subject matter easily. Mind mapping can improve the quality of student performance in learning (Magdalena et al., 2014) thus helping students to grow multiple intelligences. Research by Leontyeva, (2021) mind mapping can help students in mastering technology that helps the

learning process at school. Research results Priantin (2016) learning with the help of mind mapping develops students' interest and learning achievement. Therefore, many studies on mind mapping in learning activities are still few that describe the size effect of mind mapping on multiple intelligence in students. So, this study aims to determine the size effect of mind mapping learning model on students' multiple intelligence.

Methods

This research is a type of meta-analysis research. Meta-analysis research is a study that analyzes previous studies that can be statistically analyzed (Zulkifli et al., 2022; Suharyat et al. , 2022; Tamur et al., 2020; Santosa et al., 2023; Putra et al., 2023; Musna et al., 2021; Hawes et al., 2022). The data sources in this study are based on 15 national and international journals. Search for data sources through google scholar, ScienceDirect, Wiley and ProQuest. The inclusion criteria used were journals or proceedings indexed by Scopus, SINTA, DOAJ and Web of Science; 2) Have mind mapping and multiple intelligence variables; 3) The type of research is experimental or quasi-experimental; 4) have mean, standard deviation and t value data.

The data collection techniques for this meta-analysis were direct observation and documentation through online databases. According to Bernard et al., (2014) The steps of meta-analysis are 1) determining the problem and inclusion criteria that have been determined; 2) conducting the literature search process and data code; 3) conducting study evaluation; 4) analyzing data statistically and data interpretation. Data analysis in this study calculates the effect size and standard deviation of each study related to the effect of mind mapping on multiple intelligence of students with the help of JSAP application. The effect size criteria in this meta-analysis can be seen in Table 1.

Table 1. Effect Size Categories

Effect size	Category
-0.15 ≤ 0.15	Ignored
0.15 < ES ≤ 0.40	Low
0.40 < ES ≤ 0.75	Medium
0.75 < ES ≤ 1.10	High
1.10 < ES ≤ 1.45	Very High
1. 45 > ES	High Influece

Source: (Suparman et al. 2020; Musna et al., 2021; Rahman et al., 2023; Sofianora et al., 2023; Suryono et al., 2023; Nurtamam et al., 2023)

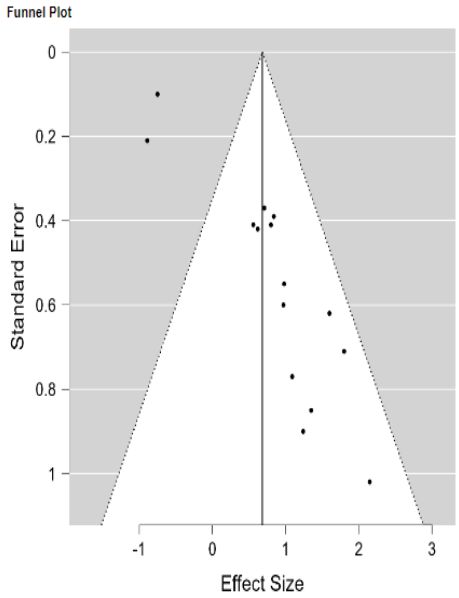
Result and Discussion

From the analysis of data sources through Google Scholar, ScienceDirect, Wiley and ProQuest on the effect of mind mapping learning on multiple intelligence, 35 journals were obtained. However, only 15 journals that meet the inclusion criteria will be used as data sources in this meta-analysis. Furthermore, the effect size of the data sources can be seen in Table 2.

Table 2. Effect of each data source

No	Journal Code	Year	Hedge's	Effect Size Category
1	E1	2020	1.80	High Influence
2	E2	2020	-0.89	Ignored
3	E3	2021	0.56	Medium
4	E4	2022	1.35	Very High
5	E5	2019	0.98	High
6	E6	2019	0.71	Medium
7	E7	2020	0.84	Medium
8	E8	2020	1.60	High Influence
9	E9	2023	2.15	High Influence
10	E10	2023	0.80	Very High
11	E11	2021	-0.75	Ignored
12	E12	2023	1.24	Very High
13	E13	2019	1.09	Very High
14	E14	2018	0.62	Medium
15	15	2023	0.97	Very High
Average effect size value			0.871	High

Based on Table 2. Shows the average effect size value of (ES = 0.871) with high criteria. Furthermore, there are 2 articles whose effect size values are negligible, namely journal code articles E2 and E11. This explains that the application of mind mapping learning provides a significant effect on students' multiple intelligence. The next step is to calculate the publication bias of each study through the funnel flot diagram. Funnel flot of publication bias in this meta-analysis can be seen in Figure 1.



Gambar 1. Funnel Flot Standard Error

Based on Figure 1. Shows that the effect size value is not symmetrical on the vertical line in the funnel flot. These results explain that the effect size is not completely symmetrical, so it is necessary to do the Roshental fail safe N (FSN) test with the help of the JSAP application, the value is 40.00 or 40 / (5.5 + 10) = 1.14 > 1, meaning that the studies analyzed in this study are not prone to publication bias. Furthermore, the Trim and fill test was carried out which can be seen in Table 3.

Table 3. Trim and Fill Test Results

	Omitted studies	Point estimate	Lower limit	Upper Limit	Q-value
Observed Value	2	0.806	0.698	1.856	89.156
Adjusted Value		0.789	0.571	1.092	120.815

Based on Table. 3 shows the results of the Trim and Fill test observed effect size of 0.806 and adjusted effect size of 0.789. In addition, there are 2 journals that were deleted, namely journal codes E7 and E12. The next step is to calculate the heterogeneity value of each study which can be seen in Table 4.

Table 4. Heterogeneity Test Results

Heterogeneity				
Q-Value	**df(Q)**	**P-value**	**I-Squared**	**Q-Table**
104.291	14	0.001	81.190	57.609

Table 4. Shows that the Qvalue of 104.291 > Qtable 57.609 (α = 0.05). This result shows that each study has a heterogeneous effect size value in the random effect model analysis. The next step is to conduct hypothesis testing to determine the effectiveness of mind mapping learning on students' multiple intelligence in learning. Hypothesis testing using random effect model analysis can be seen in Table 6 below.

Tabel 5. Hasil Uji Hipotesis Berdasarkan Random Effect Model

Estimation model	**n**	**Z**	**P**	**Effect Size**	**Standart Error**
Random Effect Size	15	2.831	0.005	0.871	0.241

Table 5. Showing a Z value of 2.831 with a p-value of 0.005, these results conclude that mind mapping learning has a high effect on students' multiple intelligence compared to conventional learning.

Discussion

The application of mind mapping learning has a significant effect on multiple intelligence in the student learning process. It can be seen in Table.2 the average value of the effect size (ES = 0.871) high criteria. This is in line with research (Pratiwi et al., 2018) Mind mapping learning can encourage understanding of learning concepts so that it is deeper in remembering the subject matter. Mind mapping learning helps students to think easily in fostering interest in accordance with the intelligence of students (Akanbi et al., 2021; Al-Jarf, 2021). Intelligence plays an important role in shaping students' skills and abilities in learning (Suhaimi et al., 2022; Ichsan et al., 2022; Santosa et al., 2021; Al-Swalha, 2021). Therefore, mind mapping learning shapes students' learning character according to their intelligence (Avdagic, et al., 2021).

Widiana & Jampel (2016) learning through mind mapping can improve students' creativity and learning outcomes. Mind mapping learning makes students more creative in conducting learning activities (Juniati et al., 2015). So, mind mapping learning is effective for improving students' multiple intelligence in learning. It can be seen in Table. 6 Z value of 2.831 or p-value <0.05. This result is in line with (Mujib et la., 2022) Mind mapping-based learning can encourage students' multiple intelligence in learning. Students who have multiple intelligences will be more easily and motivated according to their potential (Prabha & Aziz, 2020;Ahamad et al., 2021; Sutar & Hariyanto, 2017).

Furthermore, mind mapping helps students and teachers more easily understand information in learning activities (Muqodas et al., 2020). This is due to students' mind mapping learning in describing the concepts and subject matter of students they want (Rajaguguk et al., 2022). Zoubi & Adawi (2019) Multiple intelligence shapes students' character in learning so as to foster students' motivation in learning. In addition, mind mapping learning helps students more quickly push students' knowledge in learning (Wulandari, 2022; Senisum et al., 2022). Knowledge is all information obtained by students from various learning sources (Ferry et al., 2020; Suharyat et al., 2022; Yusuf et al., 2020; Li & Middlemiss, 2022). Therefore, mind mapping learning has a positive impact on supporting students' ability to learn at school.

Conclusion

From this study it can be concluded that the average effect size value is 0.871 with high criteria. This finding shows that mind mapping learning has an influence on students' multiple intelligence in learning. Mind mapping learning helps students better remember the learning material that has been learned. Mind mapping learning encourages students' process in accordance with the type of intelligence they have so that students are easier to learn.

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