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SYSTEMATIC LITERATURE REVIEW: THE EFFECT OF LEARNING MODEL ON STUDENTS' MATHEMATICAL LITERACY SKILLS

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ABSTRACT

Mathematical literacy is an important competency that needs to be developed by students in learning mathematics. This study aims to analyze the effect of various learning models on students' mathematical literacy using a quantitative approch to Systematics Literature Review (SLR) with a meta-analysis method. Data were collected through a literature review of relevant articles on mathematical literacy published between 2019 and 2024. The inclusion criteria for the primary study used in this meta-analysis research include the population in the primary study includes students at the junior high school and senior high school levels; the treatments given to the experimental groups are PBL, PJBL, DL, Blended Learning, Flipped Classroom, SIMAS ERIC, RME, PBI, Creative Problem Solving, and CTL, while the treatment given to the control group is the Conventional Learning Model; the outcome in the primary study is mathematical literacy; the type of research is quasi-experimental; statistical data available in the primary study includes sample size, mean, and standard deviation; and the publication year of the primary study is between 2019 and 2024. Of the 80 articles identified, 20 nationally accredited journal articles met the inclusion criteria and were further analyzed using the https://meta-analysis.com/ software to obtain a pooled effect size. The meta-analysis results showed that the implementation of various learning models had a significant impact on improving students' mathematical literacy skills. The study also analyzed several study characteristics, including the year of the study, education level, learning model, and sample size. Statistically, it was found that students' mathematical literacy improvement was influenced by the level of education and the type of learning model applied, with some learning models showing stronger effects depending on students' education level.

Keywords: Mathematical Literacy, Learning Model, Meta Analysis

INTRODUCTION

Mathematical literacy is an important ability that students must have to understand, interpret and apply mathematical concepts in everyday life. This ability is not only needed in the academic realm, but is also very relevant in facing real-world challenges. Hayati & Jannah (2024) mentioned that mathematical literacy is important for students to help them solve problems, especially in everyday life. With mathematical literacy, students can understand and interpret mathematical concepts, develop critical thinking skills, and face various challenges effectively. In addition, mathematical literacy also removes the stigma that math is difficult to understand, so it is important to develop it from basic

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education to higher education. Literacy in general paves the way for students to improve their understanding, critical thinking and success in education and everyday life. According to the Organization for Economic Co-operation and Development (OECD) through the Program for International Student Assessment (PISA) (2017), mathematical literacy is defined as the ability to formulate, apply, and interpret mathematics in various contexts to solve problems. This literacy is important for students to be able to think critically and logically in dealing with various problems in the modern era, including in the context of social and work life.

However, the results of the PISA survey show that the mathematical literacy of Indonesian students is still relatively low, with the majority of students at levels 1 and 2 of the 6 ability levels measured (Mansur, 2018). This shows that many students are only able to solve routine problems and face difficulties when faced with more complex and contextual problems. This limitation is a big challenge for mathematics education in Indonesia, especially in developing deeper mathematical literacy skills.

One important aspect that can influence the improvement of mathematical literacy is the learning model applied at school. Various studies have shown that the application of the right learning model can have a significant effect on students' mathematical literacy. Learning models such as Problem-Based Learning (PBL), Project-Based Learning (PjBL), Discovery Learning, and Blended Learning have been widely tested for their effectiveness in improving students' mathematical literacy skills at various levels of education (Aritonang & Safitri, 2021; Astria et al., 2023; Hia et al., 2024). Research conducted by Muharomah & Setiawan (2020) showed that the application of the Problem-Based Learning (PBL) model can improve students' mathematical literacy skills at the junior high school level, especially in contextual problem solving. Another study conducted by Pramita & Maysarah (2024) revealed that the Flipped Classroom model also had a positive impact on students' mathematical literacy and learning independence.

However, while there are many studies exploring different learning models, the results are still varied and have not been comprehensively summarized. Each study often uses different approaches and methods, making it difficult to compare and integrate the results. Therefore, a systematic literature review is needed to summarize and analyze relevant research results on the effect of learning models on students' mathematical literacy skills.

This research aims to combine, analyze, and synthesize statistically and systematically, findings from two or more studies that examine the effect of various learning models on students' mathematical literacy skills through the Systematic Literature Review (SLR) approach. This research also aims to identify the most effective learning model in improving students' mathematical literacy. Thus, this research is expected to provide useful recommendations for educators and policy makers in developing mathematical literacy. useful for educators and policy makers in developing more effective learning strategies to improve students' mathematical literacy.

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METHODS

This study uses a quantitative method with a Systematic Literature Review approach with a Meta Analysis design, namely reviewing several journal articles. Meta analysis is a statistical method used to systematically combine, analyze and synthesize two or more existing studies to obtain new findings and general conclusions from these studies using study effect sizes (Putri et al., 2022). The primary studies analyzed were related to the effect of the application of learning approaches or models on students' mathematical literacy skills.

The purpose of this study was to statistically and systematically combine, analyze, and synthesize findings from two or more studies examining the effect of the application of Learning Models on students' mathematical literacy skills. The steps that must be taken in meta-analysis research include determining study inclusion criteria; conducting literature searches and selecting studies; conducting study coding; performing statistical analysis by calculating effect sizes, conducting homogeneity tests to determine the analysis model to be used, detecting bias and overcoming bias, testing null hypotheses, analyzing study characteristics and making interpretations of the analysis results (Retnawati et al., 2018)

The inclusion criteria for the primary study used in this meta-analysis research include the population in the primary study includes students at the junior high school and senior high school levels in Indonesia; the treatments given to the experimental groups in the primary study are Problem Based Learning, Project Based Learning, Discovery Learning, Blended Learning, Flipped Classroom, SIMAS ERIC, RME, Problem Based Instruction, Creative Problem Solving, and Contextual Teaching and Learning (CTL); while the treatment given to the control group in the primary study is the Conventional Learning Model; the outcome in the primary study is mathematical literacy; the type of research in the primary study is quasi-experimental with a randomized control group pretest-posttest design, randomized control group posttest only design, nonequivalent group pretest-posttest design, and nonequivalent group posttest only design; statistical data available in the primary study includes sample size, mean, and standard deviation; and the publication year of the primary study is between 2019 and 2024.

In conducting a literature search in the form of journal articles that have research topics on the effect of the application of Learning Models on students' mathematical literacy skills. The keywords used by the author to facilitate the search for journal literature include "Mathematics Education", "Mathematics Education", "Mathematics Learning", and "Mathematics Teaching" then keywords to search for article literature include "Mathematical Literacy", "Mathematics Literacy" and "Mathematical literacy". From the literature search, 80 journal articles with publication years 2019-2024 were obtained. Furthermore, the 80 articles were selected by the author by adjusting to the inclusion criteria that the author had previously determined. Studies that met the inclusion criteria were 20 articles, namely studies conducted by Astuti (2020); Faisal et al. (2024); Musaad et al. (2023);

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Tabun et al., (2020); Aritonang & Safitri (2021); Hia et al. (2024); Astria et al. (2023); Pernandes & Asmara (2020); Pratiwi & Tita Rosita (2024); Mutiasari et al. (2024); Pramita & Maysarah (2024); Ornawati et al. (2023); Sari et al. (2022); Rohana et al. (2021); Widiastuti & Kurniasih (2021); Yunita et al. (2024); Muharomah & Setiawan (2020); Ralmugiz & Kusumawati (2020); Aula et al. (2019); and Fatwa et al. (2019), which resulted in 21 studies presented in table 1 below.

Table 1. Studies Used in the Meta-Analysis

Study Code	Research Title	Year/Journal Name
Study 1	Pengaruh Problem Based Learning Terhadap Kemampuan Literasi Matematis Siswa Kelas VII Di SMP Negeri 1 Bobotsari.	2020/AlphaMath: Journal of Mathematics Education (Sinta 4)
Study 2	Pengaruh Model Pembelajaran Problem Based Learning Terhadap Peningkatan Kemampuan Literasi matematis.	2024/AKSIOMA: Jurnal Program Studi Pendidikan Matematika (Sinta 2)
Study 3	Pengaruh Model Problem Based Learning Untuk Meningkatkan Kemampuan Literasi matematis Pada Materi Penyajian Data.	2023/AXIOM: Jurnal Pendidikan dan Matematika (Sinta 3)
Study 4	Kemampuan Literasi Matematis Siswa Pada Pembelajaran Model Problem Based Learning (PBL)	2020/Edumatica: Jurnal Pendidikan Matematika (Sinta 3)
Study 5	Pengaruh Blended Learning Terhadap Peningkatan Literasi matematis Siswa	2021/Jurnal Cendekia: Jurnal Pendidikan Matematika (Sinta 4)
Study 6	Pengaruh Model Pembelajaran Discovery Learning Terhadap Kemampuan Literasi Matematis Siswa.	2024/Indo-MathEdu Intellectuals Journal (Sinta 6)
Study 7	Pengaruh Model Pembelajaran Project Based Learning Terhadap Kemampuan Literasi Matematis Siswa Di SMA Negeri 6 Kepahiang	2023/RANGE: Jurnal Pendidikan Matematika (Sinta 4)
Study 8	Kemampuan Literasi Matematis Melalui Model Discovery Learning di SMP	2020/Jurnal Pendidikan Matematika Raflesia (Sinta 4)

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Study 9	Penerapan Model Problem Based Learning untuk Meningkatkan Kemampuan Literasi Matematis Siswa	2024/Suska Journal of Mathematics Education (Sinta 4)
Study 10	Pengaruh Model Pembelajaran Problem Based Learning Konteks Budaya Bengkulu Terhadap Kemampuan Literasi matematis Siswa Smpi Al-Azhar 52 Kota Bengkulu	2024/Lebesgue: Jurnal Ilmiah Pendidikan Matematika, Matematika dan Statistika (Sinta 4)
Study 11	Pengaruh Model Pembelajaran Flipped Classroom Terhadap Kemampuan Literasi Matematis dan Kemandirian Belajar Matematis Siswa	2024/Euclid (Sinta 3)
Study 12	Pengaruh Model Pembelajaran Problem Based Learning Terhadap Kemampuan Literasi Matematis Ditinjau Dari Gaya Belajar Siswa SMP	2023/Delta: Jurnal Ilmiah Pendidikan Matematika (Sinta 4)
Study 13	Pengaruh Model Simas Eric Terhadap Kemampuan Komunikasi Matematis Dan Literasi Matematis	2022/Laplace: Jurnal Pendidikan Matematika (Sinta 5)
Study 14	Pengaruh Model Pembelajaran Creative Problem Solving Terhadap Kemampuan Literasi Matematis Siswa SMAN 6 Prabumulih	2021/Indiktika: Jurnal Inovasi Pendidikan Matematika (Sinta 3)
Study 15	Pengaruh Model Problem Based Learning Berbantuan Software Cabri 3D V2 terhadap Kemampuan Literasi Numerasi Siswa	2021/Jurnal Cendekia: Jurnal Pendidikan Matematika (Sinta 4)
Study 16	Pengaruh Penerapan Model Contextual Teaching and Learning (CTL) dan Problem Based Learning (PBL) Terhadap Kemampuan Literasi Numerasi di SMP	2024/Jurnal Cendekia: Jurnal Pendidikan Matematika (Sinta 4)
Study 17	Pengaruh Penerapan Model Contextual Teaching and Learning (CTL) dan Problem Based Learning (PBL) Terhadap Kemampuan Literasi Numerasi di SMP	2024/Jurnal Cendekia: Jurnal Pendidikan Matematika (Sinta 4)

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Study 18	Penerapan Model Pembelajaran Problem Based Learning untuk Meningkatkan Kemampuan Literasi Matematis Siswa SMP	2020/UNION: Jurnal Pendidikan Matematika (Sinta 4)
Study 19	Efektivitas Pendekatan Realistic Mathematics Education Dalam Meningkatkan Kemampuan Literasi Matematis Siswa	2020/*Math Educa Journal* (Sinta 5)
Study 20	*Mathematical Literacy Ability Viewed From Student's Learning Style Based on Gender Differences on PBL Assistance Project Assessment*	2019/*Unnes Journal of Mathematics Education Research* (Sinta 4)
Study 21	Kemampuan Literasi Matematis Siswa melalui Model Pembelajaran Problem Based Instruction	2019/Mosharafa: Jurnal Pendidikan Matematika (Sinta 2)

Next, the researcher conducted study coding. The research instruments used in this step are coding protocols which include paper or computerized coding forms, and coding manuals, which are guides containing instructions on how to code each item according to the data available in the primary study (Amelia et al., 2022). Study coding includes some information that will be used in the meta-analysis process, namely study code; author; year of publication; mean, standard deviation and sample size of the experimental group; mean, standard deviation and sample size of the control group; research year; education level; and sample size. The study year ranged from 2019 to 2024; the education level was divided into two categories, namely junior high school/MTs and senior high school/MTs/SMK; while the sample size was divided into two categories, namely less than or equal to 30 and more than 30. The coding results are shown in table 2 below.

Table 2. Study Coding

No	Variable	Group	Frequency
1	Education Level	SMP	15
		SMA	6
2	Research Year	2019-2020	7
		2021-2022	4
		2023-2024	10
3	Sample Size	30 or less	9
		31 or more	12

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4	Learning Model	*Blended Learning*	1
		Creative Problem Solving	1
		CTL	1
		Discovery Learning	2
		Flipped Classroom	1
		PBI	1
		PBL	11
		PJBL	1
		RME	1
		SIMAS ERIC	1

After the coding process was done, the authors calculated the effect size. Because the author will measure the difference between two independent groups, namely the experimental group given a learning model other than conventional and the control group given conventional learning and the primary study used in this meta-analysis research has a small sample size and standard deviation for the sample, the effect size used in this study is the effect size based on the standardized mean difference, namely Hedges's g (Fritz et al., 2012).The interpretation of the effect size that will be used in this meta-analysis study is the classification according to Cohen presented in table 2 (Cohen et al., 2007)

Table 3. Interpretation of Effect Size

ES	Interpretation of Effect Size
$0{,}20 < ES \leq 0{,}50$	Small Effect
$0{,}50 < ES \leq 1{,}00$	Moderate Effect
$ES > 1{,}00$	Big Effect

After the effect size is calculated, then a homogeneity test is carried out to determine the analysis model to be used using the p-value on the Q-statistic (Cooper et al., 2017; Retnawati et al., 2018). If the p-value<0.05, then the distribution of the effect sizes of the primary studies used in the meta-analysis is heterogeneous, so the analysis model used is a random effects model while if the p-value>0.05, then the distribution of the effect sizes of the primary studies used in the meta-analysis is homogeneous, so the analysis model used is a fixed effects model (Retnawati et al., 2018). Furthermore, so that the studies used in this meta-analysis represent all studies that address the same research question and no claims arise that the studies published and used in this meta-analysis are not only studies with significant results, the authors need to detect and overcome publication bias. Some methods that can be done to

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detect and overcome publication bias include funnel plots and Rosenthal's Fail-Safe N (FSN) (Retnawati et al., 2018).

The first step in detecting publication bias is to use a funnel plot. If the distribution of study effect sizes appears asymmetrical or not fully symmetrical, it is necessary to use Rosenthal's Fail-Safe N (FSN) to help determine whether there is a possibility of publication bias or not (Tamur et al., 2020). If the $\frac{FSN}{(5k+10)} > 1$ where k is the number of studies included in the meta-analysis then the study is resistant to publication bias. If there is no publication bias, then the authors can directly continue the analysis process. Using a predetermined analysis model, the authors can conduct a null hypothesis test. If the p-value < 0.05, then the null hypothesis is accepted, namely the application of the Problem-based Learning Model, project-based learning, Discovery Learning, Blended Learning, Flipped Classroom, Simas Eric, Problem Based Instruction, RME, Creative Problem Solving, and Contextual Teaching and Learning (CTL) has a significant effect on students' mathematical literacy skills compared to the Conventional Learning Model. If the analysis model used is a random effect model, which means that there are differences in study characteristics, then the author can analyze the study characteristics and then interpret the results of the analysis (Amelia et al., 2022).

FINDINGS

This meta-analysis research aims to determine the effect size of the combined application of problem-based learning, project-based learning, Discovery Learning, Blended Learning, Flipped Classroom, Simas Eric, Problem Based Instruction, RME, Creative Problem Solving, and Contextual Teaching and Learning (CTL), on students' mathematical literacy skills. The first stage of the analysis was to calculate the effect of each primary study. Based on the overall calculation, the effect sizes of each study are presented in Table 4 below.

Table 4. Effect Size Transformation of Each Study

Study Code	Author	Effect Size	Interpretation of Effect Size	SE	Lower Limit	Upper Limit
Study 1	Ajie Dina Kis Puji Astuti	0,587572	Medium	0,254342	0,090185	1,099648
Study 2	Muhammad Faisal, et al.	2,074745	Large	0,322848	1,461638	2,744436
Study 3	Faida Musaad, et al.	1,979120	Large	0,341578	1,330537	2,690867

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Study 4	Heka M. Tabun, et al.	3,289331	Large	0,393841	2,550541	4,114682
Study 5	Indah Aritonang & Islamiani Safitri	3,340324	Large	0,373539	2,638295	4,119437
Study 6	Oidika Mawarni Hia, et al.	0,518392	Medium	0,270445	-0,011838	1,063576
Study 7	Ririn Astria, et al.	2,052610	Large	0,289181	1,501976	2,647866
Study 8	Ozi Pernandes & Adi Asmara	0,922177	Large	0,254334	0,428657	1,437311
Study 9	Ana Pratiwi & Neneng Tita Rosita	0,816858	Large	0,308634	0,215824	1,447777
Study 10	Fitria Mutiasari, et al.	0,526983	Medium	0,259905	0,017810	1,050023
Study 11	Desy Pramita & Siti Maysarah	0,610404	Medium	0,252788	0,116362	1,119456
Study 12	Visi Ornawati, et al.	2,217891	Large	0,320275	1,610376	2,881792
Study 13	Eli Puspita Sari, et al.	0,786517	Medium	0,264767	0,271105	1,322627
Study 14	Rohana, et al.	0,740813	Medium	0,244550	0,264431	1,233781
Study 15	Elok Rintarti Widiastuti & Meyta Dwi Kurniasih	1,023304	Large	0,235764	0,566681	1,499861
Study 16	Wiwin Yunita, et al. (a)	0,765430	Medium	0,252676	0,273411	1,275673
Study 17	Wiwin Yunita, et al. (b)	0,696137	Medium	0,251153	0,206313	1,202536

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Study 18	Nita Nurul Muharomah & Erwan Setiawan	0,778662	Medium	0,291983	0,209750	1,372965
Study 19	Uke Ralmugiz & Mike Kusumawati	5,458737	Large	0,559698	4,419141	6,641983
Study 20	Maulida Fatma Reza Aula, et al.	0,480741	Small	0,241583	0,007330	0,965078
Study 21	Vika Conie Fatwa, et al.	1,827982	Large	0,326897	1,205448	2,506475

Based on Table 4, the overall range of effect sizes is 0.480741 to 5.458737, with a 95% confidence level. Based on the classification, eleven effect sizes had large positive effects (n=11); nine effect sizes had medium effects (n=9); and one effect size had small effects (n=1). These effect sizes indicate variations in the effectiveness of the interventions measured in each study.

The table also shows that the study coded Uke Ralmugiz & Mike Kusumawati (Study 19) had the largest effect size, which was 5.459. Meanwhile, the study coded Maulida Fatma Reza Aula, et al (Study 20) reported the smallest effect size of 0.481. Overall, the results of this meta-analysis show that most studies have large effect sizes, indicating that the measured interventions are likely to have a significant impact on the tested variables. The lower limit of the 95% confidence interval of the effect size was in the range of 0.007 to 4.419, while the upper limit ranged from 0.965 to 6.642. The overall effect size of the study was approximately 1.16. This effect size is accepted as a large effect.

Table 5. Heterogeneity Test

Heterogeneity				
Chi square	**df(Q)**	**P-value**	**I-squared**	**Tau²**
204,906	20	0,000	90,239	0,767

The second stage is to test heterogeneity and select the estimation model. Based on Table 5, the value of degrees of freedom df(Q)=20 and the P-value is 0.000. This indicates that the effect size is heterogeneous at ($p<0.05$), i.e. the actual effect size varies between studies. The I-squared value is 90.239 which indicates that 90% of the variability in effect size is due to heterogeneity. Furthermore, the relatively high Tau² value of 0.767 also indicated substantial differences among the studies.

To detect publication bias, the Fail-Safe N test was used. Of the 21 studies, the FSN value obtained was 2310. With the formula $\frac{FSN}{(5k+10)} = \frac{2310}{(5(21)+10)} = 20.087 > 1$. It can be seen that $\frac{FSN}{(5k+10)} > 1$,

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indicating that this meta-analysis meets sufficient tolerance for publication bias. Furthermore, Table 6 presents the results of the meta-analysis of primary studies using the fixed effects model and the random effects model.

Table 6. Comparison of Results Based on Estimation Model

No	Estimation Model	n	Z	p-value	Effect Size	Standard Error	95% CL	
							Lower Limit	Upper Limit
1	Fixed-Effect	21	18,662	0,00000	1,155	0,0619	1,034	1,277
2	Random Effect	21	7,169	0,00000	1,434	0,200	1,042	1,826

The last step is to calculate the p-value to test the research hypothesis. Based on Table 6, the random effects model was used due to the homogeneity test results. The 95% confidence interval for the random effects model ranges from 1.034 to 1.042. The analysis results show a p-value of 0.000, which means the p-value <0.05. So, it can be concluded that overall the application of learning models from each study provides a more significant influence on students' mathematical literacy skills compared to the application of conventional learning models. In addition, this study obtained a combined effect size of 1.434, so that based on Cohen's classification, the combined effect size is classified as a strong effect size. Thus, the application of learning models from each study has a strong influence on students' mathematical literacy skills.

After knowing that the distribution of the effect size of the primary study is heterogeneous, the author will then analyze the characteristics of the study that cause heterogeneity in students' mathematical literacy skills. The results of the meta-analysis for the study characteristics of education level, research year, sample size, and Learning Model are presented in Table 7.

Table 7. Results of Meta-Analysis of Each Study Characteristic

No	Variable	Group	n	Combined Effect Size	Test of null (2-tail)		Heterogenity		
					Z	p	Between Classes Effect	df (Q)	P
1	Education Level	SMP	15	1,466	6,007	0,000	0,05	1	0,824
		SMA	6	1,365	3,579	0,000			
2	Research Year	2019-2020	7	1,827	3,742	0,000	1,334	2	0,504
		2021-2022	4	1,430	2,925	0,000			
		2023-2024	10	1,208	5,339	0,003			
3	Sample Size	30/less	9	1,882	4,721	0,000	1,294	1	0,095
		31/more	12	1,131	5,380	0,000			

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4	Learning Model	*Blended Learning*	1	3,340	8,942	0,000	1,239	9	0,000
		Creative Problem Solving	1	0,741	3,029	0,002			
		CTL	1	0,765	3,029	0,002			
		Discovery Learning	2	0,731	3,624	0,000			
		Flipped Classroom	1	0,610	2,415	0,016			
		PBI	1	1,828	5,592	0,000			
		PBL	11	1,281	5,298	0,000			
		PJBL	1	2,053	7,098	0,000			
		RME	1	5,459	9,753	0,000			
		SIMAS ERIC	1	0,787	2,971	0,003			

DISCUSSION

According to the results of the analysis in Table 7, the effect size in the study conducted in junior high schools of 1.466 (large effect) was not significantly different from the effect size in the study conducted in senior high schools of 1.365 (large effect). The results of the heterogeneity test showed that the average effect size between education levels was different (Q=0.05 and p>0.05). It can be said that the application of learning models to mathematical literacy skills is very effective and influential at the junior and senior high school levels.

Based on the year of research, research conducted from 2019 to 2020 has an effect size of 1.827 (very large effect) in the same category as the effect size in research between 2021 to 2022 has an effect size of 1.430 (very large effect), also in the same category as the effect size in research between 2023 to 2024 has an effect size of 1.208 (very large effect). The Q value was found to be 1.334 and p>0.05. This means that there is no difference in the average effect size between the year groups. This implies that the applied learning model remains consistent in its effectiveness over different time periods, suggesting that the learning methodology and approach used is relevant despite curriculum changes and technological developments.

Based on sample size, both studies with a range of 1-30 students (effect size 1.882) and a range of 31 or more students (effect size 1.131) showed large effects. The results of the heterogeneity test showed that the average effect sizes of the two study groups were not different (Q=1.294 and p>0.05). Thus

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there was no evidence of significant heterogeneity between the results from studies with different sample sizes. This indicates that the applied learning model remains effective regardless of the sample size used.

Based on the learning model, the RME (Realistic Mathematics Education) model shows the highest effect compared to PBL, PjBL, Discovery learning, Blended Learning, Flipped Classroom, Simas Eric, Problem Based Instruction, Creative Problem Solving, and Contextual Teaching and Learning (CTL). Thus, there is a significant difference in the effect of learning on students' mathematical literacy based on the learning model and all other models also show a significant effect. The heterogeneity test shows that there is a significant difference between different learning models (Qb=1.239, df=9, p<0.000) meaning that there is a significant difference between different learning models and not all learning models have the same level of effectiveness in improving mathematical literacy. Therefore, choosing the right learning model is very important to achieve optimal results in teaching mathematical literacy. The RME learning model as the learning model with the highest effect size, can be the main choice for educators who want to achieve optimal results.

Overall, the results of the meta-analysis confirmed that the implemented learning models were effective in improving students' mathematical literacy across different levels of education, years of research and sample sizes. However, there were significant variations in effectiveness between learning models. However, there were significant variations in effectiveness between learning models. The RME (Realistic Mathematics Education) model was mentioned as the most effective learning model, emphasizing the importance of selecting the right model for optimal results. With the RME learning model, students actively participate in learning so that students' problem solving skills are optimized (Soraya, 2022). The RME learning model can be used as a learning model that will enhance character education and improve students' mathematical literacy as they learn mathematics (Fitriani & Lubis, 2022). This is supported by the results of the study where the improvement of mathematical literacy of students who received learning with the RME approach was better than students who received learning with a scientific approach. From the results of the mathematical anxiety scale, it shows that the mathematical anxiety of students who get learning with the RME approach is mostly negative, meaning that most students are not anxious when learning is done using the RME approach (Komala & Erma Monariska, 2023). Based on this research, not all learning models have the same level of effectiveness, so learning planning must be adjusted to the context and needs of students. Thus, this meta-analysis provides a strong basis for educators and researchers to to select innovative, relevant and effective learning models in different educational contexts.

CONCLUSION AND SUGGESTION

Through the results of a meta-analysis using 21 studies from 20 articles that discuss the effect of learning models on students' mathematical literacy skills, information was obtained that the combined

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effect size of the primary study was 1.434 which was classified as a large effect size based on Cohen's classification. Thus, it can be concluded that overall the application of each study's Learning Model including, PBL, PjBL, Discovery Learning, Blended Learning, Flipped Classroom, SIMAS ERIC, Problem Based Instruction, RME, Creative Problem Solving, and Contextual Teaching and Learning (CTL) has a strong and more significant influence on students' mathematical communication skills compared to the application of Conventional Learning Models. In addition, in terms of some study characteristics, the effect of learning to improve students' mathematical literacy skills is influenced by the level of education, where the highest effect size is obtained at the high school level, and is also influenced by the learning model, where the highest effect size is obtained in the RME learning model. However, the application of learning to improve students' mathematical literacy skills was not influenced by the year of the study and the sample size. Based on these findings, it contributes for teachers to apply the right learning model that has a good effect in improving students' mathematical literacy skills according to the level.

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