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Self-Efficacy and Students' Mathematics Learning Ability in Indonesia: A Meta Analysis Study

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Improving self-efficacy in the learning process of Mathematics is very important as the key to success in learning Mathematics. Self-efficacy in learning mathematics is a belief in one's ability to solve mathematical problems. Many studies have been conducted on the relationship between self-efficacy and students' mathematics learning ability in Indonesia. However, there are different representations or conclusions regarding the results of this study. Therefore, this study aims to examine the relationship of self-efficacy to students' mathematics learning ability in Indonesia using a meta-analysis approach. This study analyzed 40 research publications in national and international journals that were screened with certain eligibility criteria. The effect size in this study was determined by an acceptable 95% confidence level. To support the accuracy of the calculations used JASP software. The results of the study found that the effect size value generated by using the random-effect model estimation in the research analyzed was (M* = 0.65) with the lower limit of the confidence interval (LLM* = 0.51) and the upper limit of the confidence interval (ULM* = 0.80). This correlation measure is included in the strong category. These findings indicate that there is a positive and significant relationship between self-efficacy and students' mathematics learning ability in Indonesia. This means that the higher the self-efficacy, the higher the mathematical ability, and the lower the self-efficacy, the lower the mathematical ability. These findings will provide a solid theoretical foundation to improve students' mathematical achievement in the future.

Keywords: self-efficacy, mathematics, learning ability, meta-analysis, learning

INTRODUCTION

Mathematical skills are important attributes that must be possessed by all citizens because mathematics is involved at every level of understanding such as climate change,

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including describing and predicting and the consequences of these changes (Maass et al., 2019). Mathematics is also a part of basic literacy in addition to mother tongue literacy, second language, science, technology, engineering, arts and culture, computing or programming, finance, and civic education as one of the main competencies possessed by students aged three to 18 years. must have to fulfill their vision. dynamic and evolutionary society in responding to the challenges of change and sustainable national development (Opertti, 2017).

Mathematics is not only related to numbers, but also contains various abilities that can be developed and are useful in everyday life. These abilities include logical thinking, critical thinking, systematic and creative (Ulfa, 2019). Mathematics is an important science (Dwidarti et al., 2019). However, mathematics is often considered a difficult subject and is not even liked by many students. This is because mathematics contains many formulas, definitions and various types of questions so that students feel unsure, anxious and have difficulty solving mathematical problems.

Learning mathematics is a high mental activity, so that in learning mathematics it must be gradual and sequential and based on the experience that has been obtained by students. Students who really learn within themselves will experience changes in behavior that are shown in the form of learning outcomes (Panggabean, 2017). Learning ability is a form of growth or change in a person which is expressed in new ways of behaving thanks to experience and practice, the new behavior for example from not knowing to knowing, the emergence of new understandings, changes in attitudes, habits habits, skills, the ability to appreciate the development of social, emotional, and physical growth traits (Hamalik, 2004).

Indonesian students' ability to learn mathematics in international forums does not necessarily increase. This can be seen from several survey results conducted by international institutions such as the Program for International Student Assessment (PISA) and the Trend in International Mathematics and Science Study (TIMSS) which put Indonesia in an unsatisfactory position among the countries surveyed. . Indonesia's position in the PISA assessment of mathematical literacy is at level one, where Indonesia is ranked 72 out of 78 countries with an average score of 379 out of an international average score of 487 (Schleicher, 2019). This achievement is lower than the highest level, namely level six (Pakpahan, 2016). TIMSS is a study related to mathematics and science organized by the International Association for Evaluation of Educational Achievement (IEA) (Thomson, et al., 2017). The TIMSS assessment focuses on students' cognitive and mathematical content domains. The content domain includes numbers, algebra, geometry, data and probability, while the cognitive domain includes knowledge, application, and reasoning. The survey, which is conducted every four years, places Indonesia in 64th rank out of 72 countries surveyed (Fenanlampir et al., 2019). Based on the survey, the quality of Indonesian mathematical literacy is still low. One of the contributing factors is the low self-confidence of students, positive attitude towards mathematics, and problem solving skills which are closely related to critical thinking skills (Prastyo, 2020).

The results of the PISA study need to be followed up by the Indonesian government to continuously improve the quality of education. International assessments such as those conducted by PISA can provide policymakers and practitioners with a useful reference tool for improving quality, equity and efficiency in education (Schleicher, 2019). the average mathematics lesson is a frightening specter for students in Indonesia, the abstract characteristics of mathematics make students feel insecure in solving math problems. Therefore, in solving mathematical problems, teachers need to improve self-efficacy towards students' abilities. The results of the study also revealed that at high math literacy scores, confidence in abilities or self-efficacy was also high (Tutkun et al., 2014).

Self-efficacy is a person's belief in his ability to organize and perform a series of actions needed to complete certain tasks (Bandura, 1997). Self-efficacy relates to a person's belief that he or she can do something adequate to deal with certain situations (Gibson et al., 2011). With confidence in doing math tasks, high self-efficacy is needed to achieve the desired task or goal. Self-efficacy also describes a person's expectations for success, where previous achievements are also a reference to provide information on the extent to which he is able or successful in delivering his performance (Simon et al., 2015). Students who have low self-efficacy show behavior that easily gives up in solving problems, this behavior also appears when students get information about a material that is considered difficult, then students are less active in asking questions and students tend to not be confident that they are able to learn it or even be able to solve the given problem. As a result, students cannot achieve learning success in learning mathematics, even though students' mathematical abilities can be formed through the formation of self-efficacy abilities (Subaidi, 2016).

Several research results in Indonesia show that self-efficacy has an influence on students' mathematical abilities in Indonesia. This can be seen from the results of research published in national and international journals, including research on the topic of the contribution of self-efficacy to mathematics learning achievement (Maulani et al, 2020), the relationship of student self-efficacy with mathematical problem-solving abilities (Jatisunda, 2017), analysis the relationship of self-efficacy to students' mathematical critical thinking skills (Nurazizah & Nurjaman, 2018), effects of math self-efficacy and math performance (Chandra & Royanto, 2019), self-efficacy to students' mathematical creative thinking skills (Septiani et al., 2018), and there are still many studies in Indonesia that find that self-efficacy affects mathematical ability.

From previous studies, there has been no meta-analysis on students' self-efficacy and mathematics learning abilitiy in Indonesia, so the authors are interested in conducting research with a quantitative meta-analysis approach to prove the corelation of self-efficacy on students' mathematics learning ability in Indonesia. Meta analysis is also able to describe the relationship between studies well, so that it can overcome the differences in results between studies. This finding is expected to contribute to the literature that provides important information for further decision making in improving students' mathematical abilities, especially in Indonesia.

Hypothesis

The correlation meta-analysis hypothesis formulation in this research is:

Ho : There is no significant correlation between self-efficacy and students' mathematics learning ability in Indonesia

Ha : There is a significant correlation between self-efficacy and students' mathematics learning ability in Indonesia

METHOD

Research Design

This study uses a correlation meta-analysis method by reviewing several articles in national and international journals. The purpose of this study is to statistically evaluate the findings of a primary study that examines the relationship between Self-Efficacy and students' mathematics learning ability in Indonesia from 2015 to 2021. The meta-analysis provides an overall evaluation with statistical analysis of quantitative data obtained in independent studies on a particular subject (Cleophas & Zwinderman, 2017; Schwarzer et al., 2015). In general, the stages of meta-analysis in this study follow Borenstein et al. (2009) namely; 1) Determine the inclusion criteria for the analyzed study. 2) Procedures for collecting empirical data and coding study variables. 3) Statistical techniques.

Inclusion criteria

All study articles in the initial search were examined and assessed for further meta-analysis. The inclusion criteria used to screen publications of research results are:

1. Publication year ranges from 2015 to 2021.
2. Research results in Indonesia.
3. Correlational research between self-efficacy and students' mathematics learning ability
4. The variable of mathematical ability that uses an instrument in the form of math test questions.
5. Each article has a minimum sample of 25 participants.
6. Articles must report data on the value of the correlation coefficient (*r*) or the coefficient of determination which shows the magnitude of the influence of the self-efficacy variable on mathematics learning ability.

Data Collection

The primary data in this study is a research on the relationship between self-efficacy and students' mathematics learning ability. Data can be obtained from online databases such as Google Scholar, SCOPUS, Education Resources Information Center (ERIC), Elsevier. The keywords used in the research literature search were "The Relationship of Self-Efficacy AND Mathematics Learning Ability". Based on the search results that matched the specified inclusion criteria, 40 research studies were found that met the criteria specified above. Referring to the opinion of Hunter & Schmidt (2004).) stated that if only 10 studies were studied, it would be said to be small. Therefore, the number of studies used for the meta-analysis in this study can be said to be large. The review of

the evaluation of publication bias (Table 5) in this study shows that these studies used in this analysis is sufficient to estimate the maximum result.

Statistic analysis

The meta-analysis in this study is a correlation meta-analysis. The analysis was carried out with the help of JASP software. The correlation meta-analysis scheme used in this article consists of several steps, namely: (1) transformation of each r-value to the effect size of each study; (2) heterogeneity test; (3) summary effect count; (4) Evaluation of publication bias. The interpretation of the effect sizes of the correlational studies in this article uses the scale suggested by Cohen (1977, 1988). According to the scale, the size classifications are as follows: Effect size $\leq$ 0.10 (Small), 0.10 < Effect size < 0.40 (Medium), Effect size $\geq$ 0.40 (Large).

The heterogeneity test in this study was carried out using the Q parameter approach. If the p-value < 0.05, the estimation model that is suitable for calculating the summary effect is the random effects model. If the p value > 0.05, then a fixed effect model estimate is used (Borenstein et al., 2009; Retnawati et al., 2018; Juandi & Tamur., 2020). Studies containing the statistics required in the meta-analysis require a publication bias test (Retnawati et al., 2018; Juandi & Tamur, 2020; Setiawan et al., 2022). The publication bias test used the File-Safe N (FSN) approach. If the File-Safe N value > (5K+10), where k is the number of studies included in the meta-analysis, then this study has no publication bias problem and can be scientifically justified (Mulen et al., 2001).

FINDINGS

Overview of Primary Studies

From the search results that match the specified inclusion criteria, there are 40 studies that meet the eligibility for further analysis. Table 1 presents the characteristics of research samples published in 2015 to 2021. There are twenty-nine studies (n = 29) belonging to the large correlation category, nine studies (n = 9) belonging to the moderate correlation category, and two studies (n = 2) belonging to the small correlation. Based on education level, there were sixteen studies (n = 16) conducted at the high school level, eighteen studies (n = 18) at the junior high school level, and six studies (n = 6) at the elementary school level.

Table 1
Characteristics of research samples that meet inclusion criteria

No	Year	Author	N	r	Educational Level	Correlation Category
1	2015	Ardyanti & Harini	62	0.47	Senior High school	Large
2	2020	Maulani et al	36	0.56	Senior High school	Large
3	2015	Arifani & Purnami	90	0.29	Junior High School	Medium
4	2018	Kurnia et al	30	0.71	Senior High school	Large
5	2017	Jatisunda	60	0.65	Junior High School	Large
6	2017	Fitriani	34	0.43	Senior High school	Large
7	2018	Amalia et al	31	0.41	Junior High School	Large
8	2019	Siregar	63	0.35	Primary School	Medium
9	2017	Utami & Wutsqa	389	0.10	Junior High School	Small
10	2018	Sugeng et al	66	0.68	Primary School	Large
11	2016	Hutagalung	146	0.74	Senior High school	Large
12	2018	Nurazizah & Nurjaman	34	0.56	Junior High School	Large
13	2017	Yuliyani et al	60	0.98	Senior High school	Large
14	2017	Tustyaningsih	46	0.83	Senior High school	Large
15	2021	Indirawan et al	53	0.01	Junior High School	Small
16	2019	Uran et al	25	0.52	Junior High School	Large
17	2019	Hadiat & Karyati	362	0.13	Senior High school	Medium
18	2021	Sari et al	113	0.75	Junior High School	Large
19	2020	Aprisal & Arifin	47	0.56	Junior High School	Large
20	2018	Muliyanti et al	50	0.45	Primary School	Large
21	2019	Chandra & Royanto	370	0.59	Primary School	Large
22	2020	Umbara & Sudihartinih	30	0.53	Junior High School	Large
23	2020	Umaroh et al	158	0.28	Junior High School	Medium
24	2018	Septiani et al	32	0.39	Junior High School	Medium
25	2018	Hari et al	30	0.75	Junior High School	Large
26	2018	Febrianti et al	36	0.74	Senior High school	Large
27	2020	Muhazir et al. A	346	0.26	Senior High school	Medium
28	2020	Muhazir et al. B	321	0.13	Senior High school	Medium
29	2020	Muhazir et al. C	667	0.19	Senior High school	Medium
30	2019	Yetri et al	50	0.37	Primary School	Medium
31	2019	Zamnah	38	0.60	Senior High school	Large
32	2019	Sari & Sumilah	167	0.62	Primary School	Large
33	2019	Misbahudin	30	0.45	Senior High school	Large
34	2019	Wulansari et al	30	0.40	Junior High School	Large
35	2019	Hendriana & Kadarisma	30	0.78	Junior High School	Large
36	2020	Fitria & Handayani	41	0.61	Senior High school	Large
37	2015	Desmawati et al	142	0.62	Junior High School	Large
38	2021	Agus	56	0.62	Junior High School	Large
39	2018	Somawati	60	0.98	Junior High School	Large
40	2021	Farochman	42	0.41	Senior High school	Large

Effect size of each study

The first analysis stage is to calculate the effect size of each study by transforming the r value of each study. Table 2 presents the results of the transformation of the r value on the effect size of each study. Effect size values range from 0.015 to 2.380. Of the total 40 effect sizes, thirty-one effect sizes (n = 31) were classified as large effects, seven

effect sizes (n = 7) were classified as medium effects, and two studies (n = 2) classified small effects.

Table 2
Effect size and standard error of each study

Study Number	N	r	Effect Size	Variance	Standard Error
1	62	0.466	0.505	0.017	0.130
2	36	0.556	0.627	0.030	0.174
3	90	0.292	0.301	0.011	0.107
4	30	0.714	0.895	0.037	0.192
5	60	0.645	0.767	0.018	0.132
6	34	0.430	0.460	0.032	0.180
7	31	0.408	0.433	0.036	0.189
8	63	0.352	0.368	0.017	0.129
9	389	0.104	0.104	0.003	0.051
10	66	0.680	0.829	0.016	0.126
11	146	0.744	0.959	0.007	0.084
12	34	0.556	0.627	0.032	0.180
13	60	0.983	2.380	0.018	0.132
14	46	0.826	1.175	0.023	0.152
15	53	0.015	0.015	0.020	0.141
16	25	0.524	0.582	0.045	0.213
17	362	0.134	0.135	0.003	0.053
18	113	0.750	0.973	0.009	0.095
19	47	0.556	0.627	0.023	0.151
20	50	0.450	0.485	0.021	0.146
21	370	0.599	0.692	0.003	0.052
22	30	0.530	0.590	0.037	0.192
23	158	0.285	0.293	0.006	0.080
24	32	0.394	0.416	0.034	0.186
25	30	0.751	0.975	0.037	0.192
26	36	0.743	0.957	0.030	0.174
27	346	0.262	0.268	0.003	0.054
28	321	0.134	0.135	0.003	0.056
29	667	0.194	0.196	0.002	0.039
30	50	0.367	0.385	0.021	0.146
31	38	0.602	0.696	0.029	0.169
32	167	0.617	0.720	0.006	0.078
33	30	0.446	0.480	0.037	0.192
34	30	0.400	0.424	0.037	0.192
35	30	0.776	1.035	0.037	0.192
36	41	0.614	0.715	0.026	0.162
37	142	0.622	0.728	0.007	0.085
38	56	0.620	0.725	0.019	0.137
39	60	0.983	2.380	0.018	0.132
40	42	0.410	0.436	0.026	0.160

Heterogeneity Test

The second stage is to test for heterogeneity and select the appropriate estimation model. The heterogeneity test was carried out using the Q parameter approach. Table 3 shows the heterogeneity test results for fixed and random effects using the JASP software. The

results of the analysis show that the value of Q is 801.894 and $p < 0.001$. So it can be concluded, the distribution of effect size in the research analyzed is heterogeneous. This shows that the actual effect size of the analyzed studies is diverse, but in this study no analysis was carried out on the diversity of the data. The degree of variation in effect size between studies is reflected in the I-Squared value (I^2= 95.905) which indicates that 95% of the observed effect sizes reflect the percentage variability due to true heterogeneity. Thus, this study has a high heterogeneity value because I^2>75%. Therefore, the model used to calculate the combined effect size is a random effect.

Table 3
Fixed and random effects

	Q	Df	P	I^2
Omnibus test of Model Coefficients	70.922	1	< 0.001	95.905
Test of Residual Heterogeneity	801.894	39	< 0.001	

Note. p -values are approximate

Summary Effect Using the Random Effects Model

The third step is to calculate the combined effect size (M*). Based on a search using JASP software, the combined effect size (M*) = 0.65, standard error (SE = 0.07) was obtained. The lower limit of the confidence interval (LL_M*) = 0.51 while the upper limit value (UL_M*) = 0.80. To find out whether the hypothesis is accepted or not, it can be seen the p value of the output coefficient. Based on table 4, the p value was found to be less than 0.01. Because p value < 0.01, it can be concluded that there is a significant effect between self-efficacy and students' mathematics learning ability in Indonesia.

Table 4
Coefficient estimation using random-effect model

	M*	SE_{M*}	P	95% Confidence Interval	
				Lower Limit	Upper limit
Estimation	0.65	0.07	<0.001	0.51	0.80

Evaluation of Publication Bias

The final step is to detect publication bias. The evaluation of the issue of publication bias in this study used the File-Safe N method. Table 5 presents the results of Rosenthal's fail-safe N-value diagnosis. Because the value of K = 40 then 5K + 10 = 210. The Fail-Safe N value obtained is (FSN = 12.145) with target significance (α = 0.05) and $p < 0.001$. Since the File-Safe N value is > (5K + 10), this indicates that the meta-analysis carried out has no problems of publication bias and is scientifically justified.

Table 5
Fail-Safe N

File Drawer Analysis			
	Fail-safe N	Target Significance	Observed Significance
Rosenthal	12145	0.05	< 0.001

DISCUSSION

The results of this study indicate that self-efficacy has an effect on students' mathematics learning abilities in Indonesia. These results are in line with research conducted by Tustyaningsih & Sulistyono (2017) which states that self-efficacy has a positive and significant effect on students' mathematical abilities. Similar results were also found by Farochman (2021) who concluded that there was an effect of self-efficacy on mathematics learning achievement. In addition, this finding is also in line with the results of the meta-analysis conducted by Kamsurya et al. (2022) which revealed that self-efficacy affects students' mathematical abilities. These results indicate that self-efficacy is one of the important factors determining the achievement of students' mathematics learning abilities. A person who has high self-efficacy will feel that he is always ready and alert in solving problems without any doubts about his own state. These results certainly prove the consistency and strengthen the theory or previous research..

Many teachers focus on transferring knowledge to students, while many students have problems with noncognitive factors such as self-efficacy or negative attitudes towards mathematics. These factors can hinder learning mathematics, because the use of affective aspect assessment shows a role to improve learning (Qadar et al., 2015). Students' self-efficacy towards mathematics is not permanent but can be changed for the better. For example, Yuliarti, Khanafiyah and Putra researched the development of students' self-efficacy by implementing active learning and the result is that students' self-efficacy can be increased through active learning (Yuliarti et al., 2016) This self-efficacy grows in students whose development is influenced by the student's own circumstances and the environment around them (Finney & Schraw., 2003). Students' self-efficacy is influenced by several factors including teachers, textbooks, learning strategies, and the main thing is the use of everyday problems that exist around students in learning activities. Characteristics of contextual learning that uses students' daily learning environment as a starting point for learning, multi-way interaction (teacher with students or students with students), the existence of models (teacher/student) can increase student self-efficacy (Schunk, 2012).

This study shows that positive perceptions of mathematics lead to higher perceptions of self-efficacy, while negative perceptions lead to lower perceptions of self-efficacy. Success in mathematics is an important determinant of self-efficacy and perceived level of mathematics. Therefore, it is very important to deal with students who are not confident in solving math problems and don't like math subjects. Reviewing the importance of self-efficacy that every student must have, the teacher needs to modify learning strategies in order to increase student self-efficacy. Based on previous research, various learning models and strategies that are reported to be able to increase students' self-efficacy include; realistic mathematics education approach (RME) (Rahman et al., 2018; Siregar & Prabawanto., 2021), Problem-Based Learning (Mahasneh & Alwan., 2018; Saepuloh et al., 2021). ARCS model (attention, relevance, confidence, and satisfaction) (Shin, 2018). In addition to self-efficacy, previous meta-analysis studies also reported that other internal factors that also contributed to the improvement of

mathematics learning abilities include: emotional intelligence (Martaputri et al., 2021), self-concept (Suciati et al., 2020) and Self -confidence (Çiftçi & Yıldız., 2019).

Parents also have an important role in their children's academic achievement, for example, the attitudes and beliefs that parents instill in their children make an important contribution to their high level of academic achievement (Jerrim, 2015; Playek & Pavlin-Bernardic, 2020s). Schools can lead students to look back on past good achievement experiences, which can build positive self-efficacy. Teachers or school counselors can encourage students to reflect on their past successes related to the skills and talents possessed by students to plan for student success now and in the future (Ajisuksmo & Surya, 2019). Alternative learning methods by providing problems that have various solutions can provide benefits so that students with low self-efficacy can enjoy the learning process (Schukajlow et al., 2019). In addition, the use of models in learning also has an impact on students' self-efficacy. The teacher becomes a model, for example giving an example in doing something, but the teacher is not the only model. Models can be designed by involving students (Johnson, 2007) Observing a model that has many similarities with students and can perform tasks well can enhance the student's self-efficacy (Schunk, 2012).

These findings indicate that students who are confident in their performance in mathematics tend to have better mathematics achievement. In particular, students were confident that they could do an excellent job on math tests, they could understand the most difficult material presented in math texts, they could do an excellent job on math assignments, and they could master the skills taught in class. their math. Self-confidence that influences these choices will determine experience and promote opportunities for individuals to take control of life. Self-efficacy determines how much effort is made by the individual, how long the individual will endure when facing obstacles and how steadfast in the face of unfavorable situations.

CONCLUSION

This study aims to determine the relationship of self-efficacy to students' mathematical abilities in Indonesia by using a meta-correlation analysis approach. Based on a meta-analysis of 40 studies on the relationship of self-efficacy to students' mathematical abilities in Indonesia using the random-effect model, the combined effect size value was obtained ($M^* = 0.65$, $p < 0.05$). The results of this study also did not find the problem of publication bias, so that the results of this study can be justified scientifically. In addition, problems related to the different representations of self-efficacy variables with mathematical achievement based on various literatures (some are in the low to high category) become clear after a meta-analysis is carried out, namely the large category. Although these findings indicate that self-efficacy has a significant effect on mathematical ability, these findings are only based on a study of 40 research studies conducted in Indonesia. There are also other studies that cannot be evaluated due to limited methodological knowledge. Therefore, it is recommended to conduct further research by collecting further data to obtain the necessary variables.

The findings of the meta-analysis research show the consistency of the publication of research results on the effect of student attitudes on mathematics achievement in Indonesia, so that the student's attitude variable should be a teacher's concern in teaching mathematics material at every level of formal education. Teachers in learning must be able to grow students' mathematical self-efficacy. Several factors that need to be considered are textbooks, learning strategies, and the main thing is the use of everyday problems that exist around students in learning activities.

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