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Self-Efficacy and Mathematical Ability: A Meta-Analysis of Studies Conducted in Indonesia

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Annotation. This study aims to examine the relation between self-efficacy and mathematical ability based on educational level and geographical location. This study employed meta-analysis by involving 30 empirical studies and 2,298 participants. Results revealed that mathematical ability and self-efficacy had a moderate positive relationship (r = 0.553). Furthermore, geographical location and educational level were not the moderating factors affecting the strength of the relation between mathematical ability and self-efficacy.

Keywords: *mathematical ability, meta-analysis, self-efficacy.*

Introduction

Mathematical ability, a mathematical process skill, should be known by students and is obtained by studying in the school. It is required to be achieved by students that they can think and reason mathematically. In addition, technological and scientific development in the 21st century requires them to have adaption skills such as critical thinking, communication, information literacy, creativity, critical thinking, innovation, collaboration, and problem-solving (Sanabria & Arámburo-Lizárraga, 2017; Silber-Varod et al., 2019; Voogt & Roblin, 2012). The National Council of Teachers of Mathematics (NCTM) (2000) mentioned that communication and problem-solving are two of the mathematical process standards in which students have to progress by learning mathematics. So,

mathematical ability is an important skill for supporting students in 21st-century learning. Mathematics learning processes are affected by some factors such as cognition (Dori et al., 2018; Sullivan et al., 2016), motivation (Mercader et al., 2017; Ng et al., 2016), and strategy (Tambunan, 2018; Thiessen & Blasius, 2008). Meanwhile, self-efficacy is one of the motivation and cognition constructs (Wang & Sun, 2020). Bandura (1997) defined self-efficacy as beliefs in one's capabilities to execute and organize the courses of action required to produce the given attainment. It means that self-efficacy has an urgent role in the mathematics learning process. As a consequence, students' self-efficacy level will relate to their mathematics achievement, specifically regarding mathematical ability. Therefore, to acquire the best mathematical ability, students should have the highest self-efficacy.

Many empirical studies regarding the relation between students' mathematical ability and students' self-efficacy have been conducted widely in Indonesia. Some studies revealed that students' self-efficacy was significantly related to students' mathematical ability (Agus, 2021; Aprisal & Arifin, 2020; Febrianti et al., 2018; Hendriana & Kadarisma, 2019; Kurnia et al., 2018; Nurazizah & Nurjaman, 2018; Nurseha & Apiati, 2019). Several studies, however, showed that students' mathematical ability did not relate to students' self-efficacy significantly (Akuba et al., 2020; Hadiat & Karyati, 2019; Husna & Yani, 2018; Profitasari et al., 2020; Septiani et al., 2018; Sunarti, 2020). These reports indicate that the relation between self-efficacy and mathematical ability is inconsistent. As a consequence, it does not provide an accurate conclusion.

Furthermore, the reports of these empirical studies also showed that students' mathematical ability and students' self-efficacy had a strong positive relationship (Febrianti et al., 2018; Hari et al., 2018; Hendriana & Kadarisma, 2019; Hutagalung, 2016; Kurnia et al., 2018; Pratiwi et al., 2019). Meanwhile, several studies reported that students' mathematical ability and students' self-efficacy had a moderate positive relationship (Almingtias et al., 2018; Amalia et al., 2018; Jatisunda, 2017; Misbahudin, 2019; Rahmi et al., 2017; Siregar, 2019; Wulansari et al., 2019; Zamnah, 2019). Moreover, several studies revealed that students' mathematical ability and students' self-efficacy had a weak positive relationship (Akuba et al., 2020; Disai et al., 2018; Hadiat & Karyati, 2019; Husna & Yani, 2018; Khotimah et al., 2020; Profitasari et al., 2020; Septiani et al., 2018; Sunarti, 2020; Umaroh et al., 2020). These reports interpret that the strength of relation between mathematical ability and self-efficacy is heterogeneous. The heterogeneity indicates that there are some potential factors moderating the various strengths of the relation between both.

The inconsistent and heterogeneous relationship between self-efficacy and mathematical ability inform that clear and precise conclusion related to the relationship among the variables has not been found. On the other hand, the information providing the conclusion is urgently needed by mathematics educators such as teachers and lecturers. This is due to self-efficacy is one of the psychological factors in the learning process involving academic emotion and motivation (Suparman et al., 2021). As a consequence, mathematics teachers or lecturers have to ensure that students have high motivation

in learning mathematics in which if students' motivation is low, the facilitators have to design mathematics learning enhancing students' motivation. In addition, mathematical ability is the skills that have to be mastered by students to achieve the best mathematics academic outcome. Therefore, a series of quantitative methods synthesizing the large relevant literature is required to provide a clear and precise conclusion regarding the relationship between mathematical ability and self-efficacy.

Literature Review

Self-Efficacy

Some experts defined self-efficacy as a belief of individuals to carry out some tasks with the justification of his/her ability or skill (Bandura, 1997; Pajares, 1996). In a mathematics learning context, it could be interpreted as students' beliefs to think and reason mathematically in solving mathematics problems with their mathematical ability. The motivation and behavior of students could be affected by self-efficacy (Bandura, 1997). The low or high motivation of students in finishing mathematics tasks depended on their belief level to conduct it. Also, students' belief level to be able to face obstacles in solving mathematics tasks will determine their positive or negative behavior based on his/her abilities (Usher & Pajares, 2008).

Bandura (1997) revealed that self-efficacy was constructed by four primary sources – vicarious experience, psychological and emotional states, enactive mastery experience, verbal persuasion. Enactive mastery experience related to an individual's previous experiences that would provide a negative or positive effect on an individual's self-efficacy belief (Bandura, 1997). Previously successful experience in solving mathematics problems rose students' self-efficacy beliefs to finish further mathematics tasks while failed experience decreased it. Vicarious experience also influenced one's self-efficacy. It referred to an individual's experience in conducting the same task that they could observe and compare themselves with another high-achieving individual (Bandura, 1997). It means that in a mathematics learning context, the student who has a high mathematical ability enables to teach observers and transmit knowledge effective strategies and skills to solve mathematics problems.

In addition, verbal persuasion had an important role in the cultivation of an individual's self-efficacy belief (Bandura, 1997). Students' self-efficacy belief in the mathematics learning process could be strengthened by reinforcement and positive feedback from mathematics teachers while their self-efficacy beliefs in understanding mathematical content were able to be weakened by punishment or negative feedback from mathematics teachers. The cultivation of an individual's self-efficacy was also constructed by an individual's psychological and emotional states such as anxiety, fatigue, and mood (Bandura,

1997; Usher & Pajares, 2008). For example, students' low math anxiety could enhance their self-efficacy beliefs in solving mathematics problems while students' self-efficacy beliefs could decrease because of their high math anxiety (Suparman et al., 2021). So, the enhancement of psychological and positive emotional states and the reduction of psychological and negative emotional states strengthened an individual's self-efficacy beliefs.

Mathematical Ability

Mathematical ability was the capability to solve mathematical problems using mathematical content effectively (Koshy et al., 2009). Koshy et al. (2009) also revealed that mathematical ability, a future potential skill, was the capacity to mastery mathematical ideas in solving non-routine mathematical problems. Meanwhile, Vilkomir and O'Donoghue (2009) defined mathematical ability as an ability to retain, process, and obtain mathematical information. In general, the mathematical ability could be interpreted as a potential future skill to solve routine or non-routine mathematical problems employing mathematical information or knowledge effectively.

NCTM (2000) mentioned that there were five mathematics process standards – mathematical abilities that students should know and had through mathematics learning. These mathematical abilities were connection, communication, problem-solving, representation, and reasoning, and proof. On the other hand, there were several 21st century skills that students must have by learning mathematics, namely collaboration, creativity, problem-solving, innovation, communication, and critical thinking (Sanabria & Arámburo-Lizárraga, 2017; Silber-Varod et al., 2019). In addition, Kilpatrick et al. (2001) proposed five strands of mathematical proficiency – mathematical ability supporting students to achieve mathematics learning goals successfully. These mathematical proficiencies were strategic competence, productive disposition, conceptual understanding, adaptive reasoning, and procedural fluency (Groth, 2017; Groves, 2012). So, there were many mathematical abilities that had to be enhanced in the mathematics learning process that were connection, communication, problem-solving, representation, reasoning and proof, collaboration, creativity, innovation, critical thinking, strategic competence, productive disposition, conceptual understanding, adaptive reasoning, and procedural fluency.

For this recent study, there are only six mathematical abilities involved that are problem-solving, reasoning, communication, creative thinking, critical thinking, and conceptual understanding. Groves (2012) interpreted conceptual understanding as a functional and integrated grasp of mathematical thinking while reasoning as a capacity to think logically regarding the relationship between situation and concept. In addition, Chaffee (2017) revealed that there were two thinking processes – creative thinking and critical thinking. Critical thinking referred to the thinking process carefully to clarify every individual's understanding and make smart decisions while creative thinking referred to the thinking process to develop unique, useful, and eligible ideas. Furthermore,

NCTM (2000) mentioned that communication was an ability to share ideas to be objects of reflection, refinement, discussion, and amendment, and clarify understanding. On the other hand, Mamona-Downs and Downs (2013) defined problem-solving as an ability to solve non-routine mathematical tasks in which students did not have an initial-overall idea to process these tasks.

Self-Efficacy and Mathematical Ability

Self-efficacy belief was one of the significant predictors of students' achievement in mathematics (Ayotola & Adedeji, 2009; Chiu, 2017; Komalavalli, 2014). Also, it could predict students' mathematical ability such as problem-solving (Amalia et al., 2018; Pratiwi et al., 2019; Zamnah, 2019), reasoning (Aprisal & Arifin, 2020; Hadiat & Karyati, 2019), communication (Hendriana & Kadarisma, 2019; Kurnia et al., 2018; Rahmi et al., 2017), critical thinking (Agus, 2021; Hari et al., 2018; Nurazizah & Nurjaman, 2018), creative thinking (Septiani et al., 2018; Wulansari et al., 2019), and conceptual understanding (Akuba et al., 2020; Hutagalung, 2016; Siregar, 2019). So, students' mathematics achievement related to their mathematical ability from the mathematics learning process was partially determined by the factor of self-efficacy beliefs.

Several meta-analysis studies related to the relationship between academic performance and self-efficacy, achievement goals, outcome expectation, memory performance, or language proficiency had been conducted by some researchers (Beaudoin & Desrichard, 2011; Farid & Ashrafzade, 2020; Huang, 2016; Multon et al., 1991; Sheu et al., 2018; Wang & Sun, 2020). Some studies showed that self-efficacy significantly related to academic performance in which academic performance and self-efficacy had a moderate positive correlation ($r = 0.39$) (Farid & Ashrafzade, 2020; Multon et al., 1991). Huang (2016) also reported that self-efficacy significantly related to performance and mastery goals. Self-efficacy and mastery goal had a weak positive correlation ($r = 0.14$) while self-efficacy and performance goal had a moderate positive correlation ($r = 0.40$). In addition, Wang and Sun (2020) presented that self-efficacy related to language proficiency significantly in which both of them had a strong positive correlation ($r = 0.796$). Furthermore, Beaudoin and Desrichard (2011) showed that although self-efficacy and memory performance had a weak positive correlation ($r = 0.15$); however, both of them related significantly.

Based on these reports that overall, self-efficacy and academic performance, achievement goals, or language proficiency had various relationship levels. Even though, academic performance related positively and significantly with self-efficacy, achievement goals, or language proficiency. Also, based on these reports that it did not seem meta-analysis study focusing on the relation between students' mathematical ability and students' self-efficacy. So, we interested to conduct a meta-analysis study regarding the relationship between both in the Indonesian student context.

Potential Moderating Factors

A heterogeneous effect size tended to be moderated by some factors. Lipsey and Wilson (2001) mentioned that substantial, extrinsic, and methodological factors were the possible factors moderating the heterogeneous effect size between one variable and other variables. Some meta-analysis studies revealed that the heterogeneous relation between self-efficacy and language proficiency, achievement goals, or academic performance was moderated significantly by some potential factors such as participants' country (Beaudoin & Desrichard, 2011; Huang, 2016; Wang & Sun, 2020), educational level (Farid & Ashrafzade, 2020; Multon et al., 1991), gender (Beaudoin & Desrichard, 2011; Farid & Ashrafzade, 2020), and scientific field (Farid & Ashrafzade, 2020; Huang, 2016).

Wang and Sun (2020) revealed that the relation between self-efficacy and language proficiency of East Asian Students was stronger than the Middle East or Western Students. Huang (2016) also revealed that the correlation between achievement goals and self-efficacy of Korean participants was stronger than the participants in United States, Norway, Canada, and Italy. In addition, some studies reported that the relation between self-efficacy and academic performance or language proficiency of college students was stronger than K-12 students (Farid & Ashrafzade, 2020; Wang & Sun, 2020). Multon et al. (1991); however, reported that the relation between self-efficacy and academic performance of high school students was stronger than college or elementary students.

Furthermore, several studies showed that the relation between academic performance and self-efficacy of female samples was stronger than male samples (Beaudoin & Desrichard, 2011; Farid & Ashrafzade, 2020). Farid and Ashrafzade (2020) presented that the relation between self-efficacy and academic performance in the mathematics field was stronger than in other scientific fields. Meanwhile, Huang (2016) presented that the relationship between self-efficacy and achievement goals of participants in the social science field was stronger than in mathematics, language arts, or natural science field. For this study, based on these reports, we predicted educational level and geographical location as the potential factors that enabled moderating the heterogeneous relationship between mathematical ability and self-efficacy. Educational level and geographical location were selected as the potential moderating factors to be examined because these factors were substantial factors in which the factor of educational level was related to the students' cognitive development affecting mathematical ability and students' psychological development affecting self-efficacy. In addition, the factor of geographical location was related to the facilities and infrastructures for students in learning mathematics affecting self-efficacy and mathematical ability.

Indonesian Education System

The system of Indonesian education organized that the children had to start the educational process in the elementary school at seven years old (Suparman et al., 2021). As a consequence, they could finish their study in the senior high school at seventeen

years old and continue their study in the university or college. This indicated that the educational level of Indonesian students was related to the cognitive and psychological development. In addition, Indonesia had many islands in which the geographical location of Indonesian school was different among each other. There were some schools located in the urban area, but there were also many schools located in the rural area (Nugraha and Suparman, 2021). The condition indicated that the facilities and infrastructures supporting the implementation of educational process in Indonesian school were also different. Nugraha and Suparman (2021) revealed that the urban schools had more sophisticated facilities and sufficient infrastructures than the rural schools. Therefore, based on the system and culture of Indonesian education, two potential moderating factors such as geographical location and educational level were involved in this study to be examined.

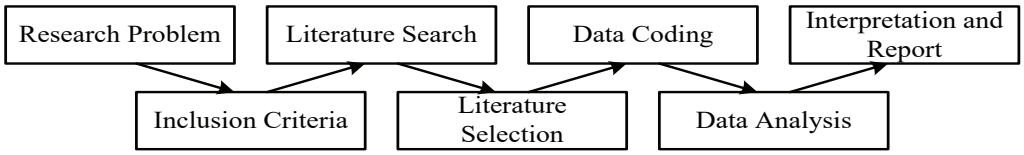
To provide accurate information for mathematics practitioners such as mathematics teachers, these problems such as an inconsistent and heterogeneous relationship between students' mathematical ability and students' self-efficacy had to be cleared. Therefore, this current study examines the relation between self-efficacy and mathematical ability, and investigate a few of potential factors such as geographical location and educational level predicted as moderating factors of the heterogeneous relation between mathematical ability and self-efficacy. We proposed some research questions to achieve these purposes as following:

1. Do mathematical ability and self-efficacy have a significant positive relationship?
2. Do educational level and geographical location significantly affect the strength of relationship between mathematical ability and self-efficacy?

Methods

A meta-analysis by selecting the random effect model was used to carry out this study (Borenstein et al., 2009; Cleophas & Zwinderman, 2017; Cumming, 2012; Mike & Cheung, 2015). Some literatures mentioned that there were seven stages to carry out a meta-analysis study (Cooper et al., 2013; Hunter & Schmidt, 2004). These steps are presented in Figure 1.

Figure 1
Meta-Analysis Stages



Note. Meta-analysis stages for this study: (1) research problem, (2) inclusion criteria, (3) literature search, (4) literature selection, (5) data coding, (6) data analysis, and (7) interpretation and report.

Inclusion Criteria

To limit the problems of this meta-analysis study, we established some inclusion criteria. Our inclusion criteria were included: (1) the study was proceeding articles or journal articles written in English and indexed by Google Scholar and Semantic Scholar; (2) the study was published in 2016–2021; (3) the study was a non-experiment with correlational design; (4) the participant was Indonesian students; and (5) the study reported the complete statistics to calculate effect size such as sample size (N), Pearson's correlation coefficient (r), and p-value. Some inclusion criteria were expected to focus on searching and selecting literature.

Literature Search and Selection

We only used electronic searches to find some literature. Some database such as Semantic Scholar and Google Scholar were chosen to search literature using some combinational keywords such as self-efficacy and mathematical skills or self-efficacy and mathematical abilities. By using these keywords, we found 73 documents from Semantic Scholar and 167 documents from Google Scholar regarding self-efficacy and mathematical ability. To select these documents, we referred to PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) (Fuad et al., 2022; Moher et al., 2009). The steps of the literature selection process are presented in Figure 2.

Data Coding

To transfer statistical data such as Pearson's correlation coefficient, sample size, and Fisher z, and some information such as authors, educational level, document type, geographical location, database, and mathematical ability (See Table 1), we used a coding sheet developed by the lead author.

Table 1

Statistical Data and Some Information of Each Document

Code	Authors	Statistical Data		
		Coefficient r	Sample Size	Fisher z
D1	Amalia et al., 2018	0.4080	31	0.433
D2	Kurnia et al., 2018	0.7140	30	0.895
D3	Hendriana & Kadarisma, 2019	0.7760	30	1.035
D4	Hilmi, 2017	0.0810	35	0.081
D5	Nurseha & Apiati, 2019	0.5700	32	0.648
D6	Hari et al., 2018	0.7510	30	0.975
D7	Wulansari et al., 2019	0.4000	30	0.424
D8	Pratiwi et al., 2019	0.8770	100	1.363
D9	Siregar, 2019	0.3520	63	0.368
D10	Hutagalung, 2016	0.7440	46	0.959
D11	Liberna, 2018	0.9300	39	1.658
D12	Misbahudin, 2019	0.4460	30	0.480
D13	Febrianti et al., 2018	0.7430	36	0.957
D14	Nurazizah & Nurjaman, 2018	0.5560	34	0.627
D15	Jatisunda, 2017	0.6450	30	0.767
D16	Yuliyani et al., 2017	0.9830	60	2.380
D17	Disai et al., 2017	0.2100	467	0.213
D18	Khotimah et al., 2020	0.2760	108	0.283
D19	Hadiat & Karyati, 2019	0.0410	362	0.041
D20	Profitasari et al., 2020	0.3222	30	0.334
D21	Sunarti et al., 2020	0.0980	29	0.098
D22	Umaroh et al., 2020	0.2848	158	0.293
D23	Septiana et al., 2018	0.2310	32	0.235
D24	Zammah, 2019	0.6020	38	0.696
D25	Akuba et al., 2020	0.1750	75	0.177
D26	Aprisal & Arifin, 2020	0.5560	132	0.627
D27	Rahmi et al., 2017	0.4240	70	0.453
D28	Husna et al., 2018	0.0726	55	0.073
D29	Alminingtias et al., 2018	0.5980	30	0.690
D30	Agus, 2021	0.6200	56	0.725

Code	Information				
	Educational Level	Geographical Location	Mathematical Ability	Document Type	Database
D1	Junior High School	Rural Area	Problem-Solving	Journal Article	Semantic Scholar
D2	Senior High School	Rural Area	Communication	Journal Article	Semantic Scholar
D3	Junior High School	Urban Area	Communication	Journal Article	Semantic Scholar
D4	University / College	Urban Area	Reasoning	Journal Article	Semantic Scholar
D5	Junior High School	Urban Area	Problem-Solving	Conference Paper	Google Scholar
D6	Junior High School	Rural Area	Critical Thinking	Journal Article	Semantic Scholar
D7	Junior High School	Urban Area	Creative Thinking	Journal Article	Google Scholar
D8	Senior High School	Rural Area	Problem-Solving	Journal Article	Semantic Scholar
D9	Elementary School	Rural Area	Conceptual Understanding	Journal Article	Google Scholar
D10	Senior High School	Urban Area	Conceptual Understanding	Journal Article	Semantic Scholar
D11	Senior High School	Urban Area	Creative Thinking	Conference Paper	Google Scholar
D12	Senior High School	Urban Area	Critical Thinking	Journal Article	Google Scholar
D13	Senior High School	Urban Area	Critical Thinking	Journal Article	Semantic Scholar
D14	Junior High School	Urban Area	Critical Thinking	Journal Article	Semantic Scholar
D15	Junior High School	Rural Area	Problem-Solving	Journal Article	Semantic Scholar
D16	Senior High School	Urban Area	Problem-Solving	Journal Article	Semantic Scholar
D17	Senior High School	Urban Area	Problem-Solving	Journal Article	Semantic Scholar
D18	Junior High School	Rural Area	Problem-Solving	Journal Article	Google Scholar
D19	Senior High School	Rural Area	Reasoning	Journal Article	Semantic Scholar

D20	Junior High School	Rural Area	Reasoning	Journal Article	Google Scholar
D21	Senior High School	Urban Area	Communication	Journal Article	Google Scholar
D22	Junior High School	Rural Area	Reasoning	Journal Article	Google Scholar
D23	Junior High School	Urban Area	Creative Thinking	Journal Article	Semantic Scholar
D24	Senior High School	Rural Area	Problem-Solving	Journal Article	Semantic Scholar
D25	Elementary School	Urban Area	Conceptual Understanding	Journal Article	Semantic Scholar
D26	Junior High School	Rural Area	Reasoning	Journal Article	Semantic Scholar
D27	Junior High School	Rural Area	Communication	Journal Article	Semantic Scholar
D28	Senior High School	Urban Area	Conceptual Understanding	Journal Article	Google Scholar
D29	Senior High School	Urban Area	Conceptual Understanding	Conference Paper	Google Scholar
D30	Junior High School	Rural Area	Critical Thinking	Journal Article	Semantic Scholar

To verify that the data coding extracted was valid and credible, we involved two coders (Vevea et al., 2019). Data coding that had been extracted by them was measured its consistency using Cohen's Kappa test (Cooper et al., 2013). The calculation of Cohen's Kappa was conducted by using the formula as follows:

$$\kappa = \frac{\Pr(a) - \Pr\,(e)}{1 - \Pr(e)}$$

where Pr(a) is actual observed agreement and Pr(e) is a chance agreement (McHugh, 2012). The results of Cohen's Kappa test are shown in Table 2.

Table 2
The Results of Cohen's Kappa Test

Items	Kappa Value	Agreement Level	Significance Value
Authors	0.867	Strong	0.012
Sample Size (N)	0.934	Almost Perfect	0.007
Pearson's Correlation Coefficient (r)	0.951	Almost Perfect	0.005
Fisher z	0.912	Almost Perfect	0.004
Database	0.822	Strong	0.016
Document Type	0.875	Strong	0.012
Educational Level	0.813	Strong	0.015
Geographical Location	0.892	Strong	0.011
Mathematical Ability	0.832	Strong	0.014

Table 2 shows that the agreement level of these coders in extracting data in every item was categorized as almost perfect and strong (McHugh, 2012). These findings indicate that data coding verified by these coders is valid and credible (Cooper et al., 2013).

Data Analysis

Since the distribution of correlation coefficient especially Pearson's correlation was inclined to become skewed, so every correlation coefficient between mathematical ability and self-efficacy had to be normalized by using the equation of Fisher's transformation (Borenstein et al., 2009). The transformation correlation coefficient r to Fisher's z is given by:

$$z = 0{,}5 \times \ln\left(\frac{1+r}{1-r}\right)$$

Summary effect size, confidence intervals, and so on in Fisher's z were converted back to correlation unit using the equation as follows:

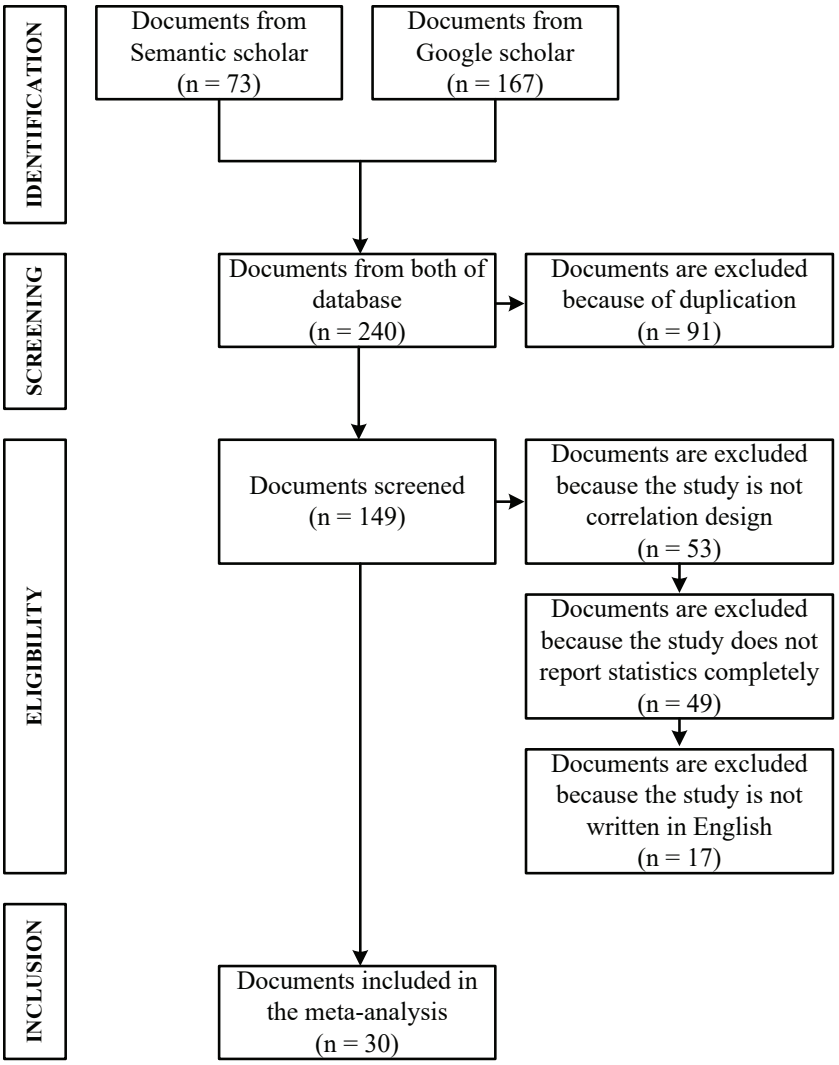
$$r = \frac{e^{2z} - 1}{e^{2z} + 1}.$$

The overall effect size in correlation unit was classified as r = 0.90 – 1.00 (very strong correlation), r = 0.68 – 0.89 (strong correlation), r = 0.36 – 0.67 (moderate correlation), and r = 0.00 – 0.35 (weak correlation) (Taylor, 1990). In addition, to justify the significance of the relation between self-efficacy and mathematical ability of the overall study, we employed the Z test (Borenstein et al., 2009). Also, to justify the significance of potential moderating factors such as educational level and geographical location in moderating

the heterogeneous relation between mathematical ability and self-efficacy, we used the Q Cochrane test (Higgins et al., 2003).

Figure 2

The Document Selection Process



Note. The document selection process in this study: (1) identification, (2) screening, (3) eligibility, and (4) inclusion.

Furthermore, published studies were prone to report significant results statistically and were included in meta-analysis studies that publication bias was able to occur (Suparman et al., 2021b; 2021a). As a consequence, analysis of publication bias had to be carried out. To examine publication bias, we used Rosenthal's fail-safe N (FSN) test (Rothstein et al., 2005). The results revealed that the FSN value was 4.420 and its significance value was also less than 0,05. It interprets that 4.420 additional missing studies are needed to increase the significance value of the relation between mathematical ability and self-efficacy to 0.05. Thus, the test suggests that there is no publication bias in this present meta-analysis study.

To inspect that the outliers of the document collection did not exist, sensitive analysis was performed. Bernard et al. (2014) proposed that the tool of one study removed in the CMA software could be used to ensure that there were no existing outliers of the collection of effect size data. The analysis results using the tool showed that the overall effect size of all documents was r = 0.553. In addition, the lowest and highest effect size of all documents was r = 0.512 and r = 0.574. It shows that the overall effect size of all documents is located in the interval between the lowest effect size and the highest effect size. It interprets that there are no existing outliers of the collection of effect size in this meta-analysis study (Fuadi et al., 2021; Jaya & Suparman, 2021).

Results

Average of Effect Size

The overall relation between students' mathematical ability and students' self-efficacy is shown in Table 3.

Table 3
Effect Size in the Unit of Correlation r

Mathematical Ability	Authors	Statistics for Each Study				
		R-value	Lower Limit	Upper Limit	Z-value	P-value
Communication	Kurnia et al., 2018	0.714	0.476	0.854	4.652	0.000
	Hendriana & Kadarisma, 2019	0.776	0.577	0.888	5.379	0.000
	Sunarti et al., 2020	0.098	-0.279	0.488	0.501	0.616
	Rahmi et al., 2017	0.424	0.210	0.599	3.704	0.000
	Siregar, 2019	0.550	0.076	0.821	2.235	0.025

Mathematical Ability	Authors	Statistics for Each Study				
		R-value	Lower Limit	Upper Limit	Z-value	P-value
Conceptual Understanding		0.352	0.114	0.552	2.848	0.004
	Hutagalung, 2016	0.744	0.579	0.851	6.291	0.000
	Akuba et al., 2020	0.175	-0.054	0.387	1.500	0.134
	Husna et al., 2018	0.073	-0.196	0.332	0.524	0.000
	Alminingtias et al., 2018	0.598	0.303	0.788	3.585	0.000
		0.420	-0.029	0.728	1.842	0.066
Creative Thinking	Wulansari et al., 2019	0.400	0.046	0.665	2.201	0.028
	Liberna, 2018	0.930	0.870	0.963	9.950	0.000
	Septiana et al., 2018	0.231	-0.128	0.536	1.267	0.205
		0.653	0.152	0.887	2.437	0.015
Critical Thinking	Hari et al., 2018	0.751	0.536	0.875	5.068	0.000
	Misbahudin, 2019	0.446	0.102	0.695	2.493	0.013
	Febrianti et al., 2018	0.743	0.548	0.861	5.498	0.000
	Nurazizah & Nurjaman, 2018	0.556	0.268	0.753	3.491	0.000
	Agus, 2021	0.620	0.427	0.759	5.278	0.000
		0.637	0.263	0.845	3.049	0.002
Problem-Solving	Amalia et al., 2018	0.408	0.063	0.666	2.292	0.022
	Nurseha & Apiati, 2019	0.570	0.276	0.766	3.487	0.000
	Pratiwi et al., 2019	0.877	0.822	0.916	13.420	0.000
	Jatisunda, 2017	0.645	0.371	0.816	3.984	0.000
	Yuliyani et al., 2017	0.983	0.972	0.990	17.965	0.000
	Disai et al., 2017	0.210	0.122	0.295	4.592	0.000
	Khotimah et al., 2020	0.276	0.092	0.442	2.903	0.004
	Zammah, 2019	0.602	0.350	0.773	4.119	0.000
		0.690	0.440	0.841	4.417	0.000
Reasoning	Hilmi, 2017	0.081	-0.259	0.403	0.459	0.646
	Hadiat & Karyati, 2019	0.041	-0.062	0.143	0.777	0.437
	Profitasari et al., 2020	0.322	-0.043	0.611	1.736	0.083
	Umaroh et al., 2020	0.285	0.135	0.422	3.647	0.000
	Aprisal & Arifin, 2020	0.556	0.426	0.664	7.122	0.000
		0.270	-0.194	0.634	1.146	0.252

Table 3 shows that the overall coefficient correlation between mathematical ability and self-efficacy was r = 0.553. It indicates that mathematical ability and self-efficacy of Indonesian students have a moderate positive relationship (Taylor, 1990). Moreover, the significance value of the Z statistics was less than 0.05. It interprets that students' mathematical ability significantly relates to students' self-efficacy. So, these findings reveal that there is a significantly moderate positive relation between students' mathematical ability and students' self-efficacy

From eight studies regarding the relationship between mathematical problem-solving ability (MPSA) and self-efficacy, four studies reported that MPSA and self-efficacy had a moderate positive correlation (Amalia et al., 2018; Jatisunda, 2017; Nurseha & Apiati, 2019; Zamnah, 2019). In addition, two studies reported that self-efficacy and MPSA had a strong positive correlation (Pratiwi et al., 2019; Yuliyani et al., 2017). Also, two studies reported that there was a weak positive correlation between MPSA and self-efficacy (Disai et al., 2018; Khotimah et al., 2020). So, overall, these studies revealed that there was a strong positive correlation between students' MPSA and students' self-efficacy. Moreover, the significance value of its Z test was less than 0.05. It indicates that students' MPSA significantly relates to students' self-efficacy.

Other reports regarding the relation between mathematical reasoning ability (MRA) and self-efficacy, four studies revealed that MRA and self-efficacy had a weak positive correlation (Hadiat & Karyati, 2019; Himmi, 2017; Profitasari et al., 2020; Umaroh et al., 2020). Meanwhile, one study revealed that self-efficacy and MRA had a moderate positive correlation (Aprisal & Arifin, 2020). So, overall, the studies provided a report that there was a weak positive correlation between students' MRA and students' self-efficacy. In addition, the results of the Z test revealed that students' MRA did not relate to students' self-efficacy significantly.

There were five studies related to the relation between mathematical critical thinking ability (MCriTA) and self-efficacy. Three studies reported that self-efficacy and MCriTA had a moderate positive correlation (Agus, 2021; Misbahudin, 2019; Nurazizah & Nurjaman, 2018). Two studies, however, reported that MCriTA and self-efficacy had a strong positive correlation (Febrianti et al., 2018; Hari et al., 2018). So, overall, these studies revealed that there was a moderate positive correlation between students' MCriTA and students' self-efficacy. Also, the results of the Z test revealed that students' MCriTA significantly related to students' self-efficacy.

From three studies regarding the relation between mathematical creative thinking ability (MCreTA) and self-efficacy, one study revealed that MCreTA and self-efficacy had a strong positive correlation (Liberna, 2018). Meanwhile, one study showed that MCreTA and self-efficacy had a moderate positive correlation (Wulansari et al., 2019). Moreover, one study revealed that there was a weak positive correlation between MCreTA and self-efficacy (Septiani et al., 2018). So, overall, these studies revealed that students'

MCreTA and students' self-efficacy had a moderate positive correlation. Also, the significance value showed that students' MCreTA significantly related to students' self-efficacy.

There were five studies regarding the relation between mathematical conceptual understanding ability (MCUA) and self-efficacy. Two studies reported that MCUA and self-efficacy had a weak positive correlation (Akuba et al., 2020; Husna & Yani, 2018). Also, two studies reported that self-efficacy and MCUA had a moderate positive correlation (Almininghtias et al., 2018; Siregar, 2019). One study, however, reported that there was a strong positive correlation between MCUA and self-efficacy (Hutagalung, 2016). So, overall, the studies provided a report that students' MCUA and students' self-efficacy had a moderate positive correlation. The results of the Z test, however, revealed that students' MCUA did not relate to students' self-efficacy significantly.

In another report related to the relation between mathematical communication ability (MCA) and self-efficacy, two studies revealed that self-efficacy and MCA had a strong positive correlation (Hendriana & Kadarisma, 2019; Kurnia et al., 2018). Meanwhile, one study revealed that self-efficacy and MCA had a moderate positive correlation (Rahmi et al., 2017). Moreover, one study revealed that there was a weak positive correlation between MCA and self-efficacy (Sunarti, 2020). So, overall, these studies reported that there was a moderate positive correlation between students' MCA and students' self-efficacy. Also, the significance value showed that students' MCA significantly related to students' self-efficacy.

The explanations above regarding the relation between mathematical ability and self-efficacy provided summarization that specifically, not all mathematical ability significantly related to self-efficacy such as MRA and MCUA. Generally, however, self-efficacy significantly related to mathematical ability. Furthermore, Figure 3 shows that the coefficient correlation between MPSA and self-efficacy was higher than the coefficient correlation between self-efficacy and MRA, MCA, MCriTA, MCUA, and MCreTA. It interprets that the relation between students' self-efficacy and students' MPSA is stronger than the relation between other students' mathematical abilities and students' self-efficacy.

Potential Factors Moderating the Effect Size

The different relationship levels between self-efficacy and mathematical ability indicated that there was a heterogeneous relation between students' mathematical ability and students' self-efficacy. For example, students' self-efficacy and students' MPSA had a moderate positive relation while students' MRA and students' self-efficacy had a weak positive relation. The statistical evidence of the Q Cochrane test also revealed that the Q-value was 518.920 and the p-value was less than 0.05. It provided rigorous evidence that there was a heterogeneous relation between both of them (Higgins et al., 2003). In addition, the inconsistency test showed that the value of I-squared was 94.411. Higgins et al. (2003) argued that if the value of I-squared is more than 50%, it indicates that there is a heterogeneity of the collection of effect size data. It interprets that the inconsistency

test strengthens the evidence that there is a heterogeneity of the relationship between self-efficacy and mathematical ability. Therefore, analysis of the potential factors such as educational level and geographical location moderating heterogeneity of the relation between mathematical ability and self-efficacy should be conducted.

Table 4

Descriptive Statistics of Effect Size Based on Educational Level and Geographical Location

Factors	Groups	Number Studies	Effect Size and the Z Test			Q Cochrane Test		
			r	Z-value	P-value	Q-value	df(Q)	P-value
Educational Level	Elementary School	2	0.265	0.706	0.480	3.433	3	0.330
	Junior High School	14	0.507	3.764	0.000			
	Senior High School	13	0.668	5.298	0.000			
	College	1	0.081	0.145	0.885			
Geographical Location	Urban Area	16	0.672	4.050	0.000	0.912	1	0.661
	Rural Area	14	0.585	4.916	0.000			

Educational Level

Table 4 shows that there was a positive moderate relation between mathematical ability and self-efficacy of junior and senior high students. Meanwhile, the mathematical ability and self-efficacy of elementary and college students had a weak positive correlation. In addition, the Z test of the secondary students' group revealed that the significance value was less than 0.05. It indicates that secondary students' mathematical ability significantly relates to secondary students' self-efficacy. Meanwhile, the Z test of the elementary and college students group showed that the significance value was more than 0.05. It indicates that elementary and college students' self-efficacy does not relate to elementary and college students' mathematical ability.

Furthermore, the Q Cochrane test of educational level factor showed that the significance value was more than 0.05. It indicates that educational level is not a significant potential factor in moderating the heterogeneous relation between mathematical ability and self-efficacy. It means that the heterogeneous relation between students' mathematical ability and students' efficacy is not moderated by the educational level factor. In addition, the coefficient correlation between mathematical ability and self-efficacy of senior high students was higher than the coefficient correlation between mathematical ability and self-efficacy of elementary, college, and junior high students. It interprets that descriptively, self-efficacy is more related to senior high students' mathematical ability than elementary, college, and junior high students' mathematical ability.

Geographical Location

Table 4 reveals that there was a strong positive relation between urban students' mathematical ability and urban students' self-efficacy. Meanwhile, rural students' self-efficacy and rural students' mathematical ability had a moderate positive relation. In addition, the Z test of every group in the geographical location factor revealed that the significance value was less than 0.05. It indicates that urban and rural students' self-efficacy significantly relates to mathematical ability.

Furthermore, the Q Cochrane test of geographical location factor showed that the significance value was more than 0.05. It indicates that geographical location is not a significant potential factor in moderating the heterogeneous relation between students' mathematical ability and students' self-efficacy. It interprets that the geographical location factor does not moderate the heterogeneous relation between students' mathematical ability and students' self-efficacy. In addition, the coefficient correlation between urban students' self-efficacy and mathematical ability was higher than the coefficient correlation between rural students' self-efficacy and mathematical ability. It interprets that descriptively self-efficacy is more related to urban students' mathematical ability than rural students' mathematical ability.

Discussion

The Relationship Between Mathematical Ability and Self-Efficacy

The finding revealed that students' mathematical ability positively related to students' self-efficacy. As a consequence, if students had low self-efficacy, it could decrease their mathematical ability. Conversely, when students had a high self-efficacy, it enabled them to enhance their mathematical ability. Some similar studies also revealed that students' self-efficacy positively related to students' academic performance (Farid & Ashrafzade, 2020; Huang, 2016; Multon et al., 1991). Likewise, Wang and Sun (2020) revealed that students' self-efficacy and students' language proficiency had a positive relation. The previous studies strengthened the findings of this study that students' mathematical ability related to students' self-efficacy level. It means that students' mathematics achievement level in learning mathematics also related to students' self-efficacy indirectly.

Specifically, the finding also revealed that students' MPSA positively related to students' self-efficacy in which there was a moderate relationship between self-efficacy belief and MPSA. Moreover, self-efficacy belief was more related to students' MPSA than other students' mathematical abilities. Students' success in finishing mathematics tasks could come from their previous experiences in solving mathematics problems. Bandura (1997) stated that enactive mastery experience was one of the primary sources of self-efficacy

beliefs. Previously successful experiences of students in solving mathematics problems would increase their self-efficacy beliefs. As a consequence, it was able to enhance their ability in solving new mathematics problems. Otherwise, previously failed experience in solving mathematics problems would decrease their self-efficacy beliefs. So, it could reduce students' ability in solving new mathematics problems.

The emotional state was another primary source of self-efficacy beliefs (Bandura, 1997). It also played an important role in students' self-efficacy beliefs. Some achievement emotions such as boredom, anxiety, enjoyment, and hopelessness were often involved in learning mathematics (Pekrun et al., 2011). In an empirical study, Suparman et al. (2021) reported that mathematical problem-solving situations positively related to students' joyful and proud emotions while students' anxious, hopeless, angry, and boring emotions negatively related to mathematical problem-solving situations. It means that the enhancement of pleasant emotions such as enjoyment and pride can strengthen students' self-efficacy beliefs. The reduction of unpleasant emotions such as anger, anxiety, hopelessness, and boredom also can strengthen students' self-efficacy beliefs. As a consequence, these efforts would improve students' mathematical abilities. In the end, it supported them to achieve success in learning mathematics (Hanin & Van Nieuwenhoven, 2016).

Trautwein et al. (2009) revealed that one of the efforts to increase pleasant emotion and decrease unpleasant emotion was giving feedback at the end of learning because it played an important role in learning evaluation. The positive feedbacks from mathematics teachers can strengthen students' self-efficacy beliefs in the mathematics learning process. Otherwise, the negative feedbacks can weaken students' self-efficacy beliefs. Giving feedback in learning mathematics was one of the forms of verbal persuasion. Bandura (1997) mentioned that verbal persuasion was one of the primary sources constructing students' self-efficacy beliefs. Therefore, mathematics teachers should always give positive feedbacks in the mathematics learning process especially in the end as a learning evaluation. So, this effort enabled students to enhance their mathematical ability, specifically in solving mathematics problems.

The Heterogeneous Relation Between Mathematical Ability and Self-Efficacy

Educational Level

Other findings revealed that educational level was not a significant potential factor mode rating the heterogeneous relation between mathematical ability and self-efficacy. Wang and Sun (2020) also reported that the heterogeneous relation between language proficiency and self-efficacy was not moderated by the educational level factor. Some studies, however, reported that the factor of educational level significantly moderated the heterogeneous relationship between self-efficacy and academic performance (Farid & Ashrafzade, 2020; Multon et al., 1991). These findings indicate that educational level is not a consistent factor in moderating the heterogeneous relation between academic performance and

self-efficacy such as mathematical ability. It can be affected by the difference in the scientific field (Huang, 2016). This study only focuses on the correlation between students' self-efficacy and students' academic performance in the mathematics field. Meanwhile, some studies (e.g., Farid & Ashrafzade (2020); Multon et al. (1991)) focuses on the relation between academic performance and self-efficacy in the scientific field generally.

Since educational level did not moderate the heterogeneous relation between mathematical ability and self-efficacy, it interprets that there is no difference in the relation level between both of them across educational levels. It means that students' cognitive development is suitable to students' mastery of mathematical content such as number and operation, algebra, measurement, geometry, and data analysis and probability at every educational level. Based on Piaget's theory, Ojose (2008) revealed that elementary school students (7–11 years old) began to think rationally and structurally in which they could solve mathematics problems logically though they could not think abstractly. In addition, Ojose (2008) revealed that secondary school and college students (more than 11 years old) began to think abstractly such as calculate mathematically, think creatively, and imagine the effect of an action. So, students' mathematical ability to solve mathematics problems at every educational level had adjusted to their cognitive development. As a consequence, it motivated them to complete and work on the mathematics tasks. Cooper (1989) stated that motivation played an important role in increasing pleasant emotion and decreasing unpleasant emotion in which emotion state constructed students' self-efficacy beliefs.

In addition, the finding revealed that students' self-efficacy is more related to secondary students' mathematical ability than college or elementary students' mathematical ability. Multon et al. (1991) also revealed that the relationship between self-efficacy is more related to high school students' academic performance than college or elementary students' academic performance. Farid and Ashrafzade (2020), however, revealed that self-efficacy is more related to college students' academic performance than K-12 students' academic performance. Wang and Sun (2020) also revealed that self-efficacy is more related to college students' language proficiency than K-12 students' language proficiency. It indicates that the scientific field creates the difference of the relation level between academic performance and self-efficacy across educational levels. In the language field, the strength of the relation between academic performance and self-efficacy tends to be dominated by college students. In the mathematics field, however, the strength of the relation between academic performance and self-efficacy tends to be dominated by high school students.

Geographical Location

The finding revealed that a heterogeneous relation between mathematical ability and self-efficacy was not moderated by the geographical location factor. Some studies, however, revealed that geographical location was one of the significant potential factors in moderating the heterogeneous relationship between academic performance and

self-efficacy (Beaudoin & Desrichard, 2011; Huang, 2016; Wang & Sun, 2020). These findings indicate that geographical location is not a consistent factor in moderating the heterogeneous relation between academic performance and self-efficacy, especially mathematical ability. It can be affected by the difference in students' geographical location. This study only focuses on the relation between Indonesian students' mathematical ability and self-efficacy. Meanwhile, these studies (e.g., Huang (2016); Wang and Sun (2020)) focus on the relation between academic performance and self-efficacy of American, European, and Asian students.

Another finding also revealed that self-efficacy is more related to urban students' mathematical ability than rural students' mathematical ability. In an empirical study in the United State of America, Jordan et al. (2011) revealed that urban students' self-efficacy was higher than rural students' self-efficacy. Zhou et al. (2021), an empirical study in China also revealed that self-efficacy and mathematical academic outcomes of students in urban areas were higher than mathematical academic outcomes and self-efficacy of students in a rural area. Moreover, Zhou et al. (2021) reported that self-efficacy is more related to urban students' mathematical academic outcomes than rural students' mathematical academic outcomes. These reports supported the finding of this study that self-efficacy is less related to rural students' mathematical ability than urban students' mathematical ability. Some empirical studies reported that urban students' academic motivation was higher than rural students' academic motivation (Lamb, 2012; Saleh, 2021; Singh et al., 2012). On the other hand, Cooper (1989) revealed that academic motivation was one of the important predictors of constructing emotional states. As a consequence, academic motivation had an important role in the level of students' self-efficacy beliefs because emotional states were one of the primary sources of self-efficacy beliefs (Bandura, 1997). So, one of the causal factors regarding the relation between students' mathematical ability and students' self-efficacy in urban areas was stronger than the relation between students' self-efficacy and students' mathematical ability in a rural area, was students' academic motivation.

Limitation and Suggestion

Based on the perspective of methodological limitations of meta-analysis, this study only involves two scholar databases such as Semantic scholar and Google scholar to search the document. It implies that the scope of document search is a little limited. As a consequence, it causes the limitation of studies got in this study. It suggests that for further research, researchers should involve more scholar database such as DOAJ, ERIC, science direct, Taylor and Francis Journal, SAGE Journal, and so on. In addition, the output of meta-analysis only provides the conclusion based on the secondary data so that the given conclusion is not recent based on the current phenomena. Furthermore, regarding the heterogeneous relation between self-efficacy and mathematical ability of Indonesian students, this study only examines educational level and geographical

location as the potential factor moderating the heterogeneous relationship between mathematical ability and self-efficacy. Moreover, the reports reveal that educational level and geographical location are not significant potential factors. As a consequence, this study has not found the potential factors moderating the heterogeneous relationship between self-efficacy and mathematical ability. Therefore, for further similar studies, researchers should investigate and examine other potential factors such as mathematical content, gender, and age.

Conclusion

The synthesis of 30 documents regarding self-efficacy and mathematical ability provides summarization information that self-efficacy and mathematical ability of Indonesian students have a moderate positive relationship. Moreover, students' self-efficacy significantly relates to students' mathematical ability. In addition, students' self-efficacy more relates to students' MPSA than other students' mathematical abilities such as reasoning, communication, critical thinking, conceptual understanding, and creative thinking. Furthermore, heterogeneity of the relation between students' mathematical ability and students' self-efficacy is not moderated by educational level and geographical location. It means that there is no difference in the relation between both of them across educational level and geographical location.

Information regarding students' self-efficacy positively relates to students' mathematical ability, indicates that students' self-efficacy is one of the predictors of their mathematical ability. As a consequence, students' self-efficacy level can affect students' mathematical ability level, specifically related to students' MPSA. Therefore, mathematics teachers or lecturers should design a mathematics learning that can facilitate students to improve their self-efficacy beliefs. So, students who have a high self-efficacy belief can enhance their mathematical ability especially in solving mathematics problems. In the end, they can get a successful mathematics achievement from learning mathematics.

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References

Agus, I. (2021). Hubungan antara efikasi diri dan kemampuan berpikir kritis matematika siswa [The relationship between self-efficacy and students' mathematical critical thinking skill]. *Delta: Jurnal Ilmiah Pendidikan Matematika*, *9*(1), 1–8. https://doi.org/10.31941/delta.v9i1.1061

Akuba, S. F., Purnamasari, D., & Firdaus, R. (2020). Pengaruh kemampuan penalaran, efikasi diri dan kemampuan memecahkan masalah terhadap penguasaan konsep matematika [The effect of reasoning ability, self-efficacy and problem-solving ability on mastery of mathematical concepts]. *JNPM (Jurnal Nasional Pendidikan Matematika)*, *4*(1), 44–60. https://doi.org/10.33603/jnpm.v4i1.2827

Alminingtias, F. M. N., Soro, S., & Handayani, I. (2018). Hubungan self-efficacy dengan hasil belajar matematika siswa di MAN 7 Jakarta. *Seminar Nasional Pendidikan Matematika*, *1*, 365–371.

Amalia, A., Syafitri, L. F., Sari, V. T. A., & Rohaeti, E. E. (2018). Hubungan antara kemampuan pemecahan masalah matematik dengan self-efficacy dan kemandirian belajar siswa SMP [The relationship between mathematical problem solving ability with self-efficacy and learning independence of junior high school students]. *Jurnal Pembelajaran Matematika Inovatif*, *1*(5), 887–894. http://dx.doi.org/10.22460/jpmi.v1i5.p887-894

Aprisal, & Arifin, S. (2020). Kemampuan penalaran matematika dan self-efficacy siswa SMP [Mathematical reasoning ability and self-efficacy of junior high school students]. *Delta: Jurnal Ilmiah Pendidikan Matematika*, *8*(1), 31–40. https://doi.org/10.31941/delta.v8i1.945

Ayotola, A., & Adedeji, T. (2009). The relationship between mathematics self-efficacy and achievement in mathematics. *World Conference Education Science, 1*, 953–957. https://doi.org/10.1016/j.sbspro.2009.01.169

Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman and Company. https://doi.org/10.1891/0889-8391.13.2.158

Beaudoin, M., & Desrichard, O. (2011). Are memory self-efficacy and memory performance related? A meta-analysis. *Psychological Bulletin*, *137*(2), 211–241. https://doi.org/10.1037/a0022106

Bernard, R. M., Borokhovski, E., Schmid, R. F., Tamim, R. M., & Abrami, P. C. (2014). A meta-analysis of blended learning and technology use in higher education: From the general to the applied. *Journal of Computing in Higher Education*, *26*(1), 87–122. https://doi.org/10.1007/s12528-013-9077-3

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to meta-analysis*. John Willey and Son Ltd. https://doi.org/10.1007/978-3-319-14908-0_2

Chaffee, J. (2017). *Thinking critically* (12th ed.). Cengage Learning.

Chiu, M. M. (2017). Self-concept, self-efficacy, and mathematics achievement: Students in 65 regions including the US and Asia. In *What Matters? Research Trends in International Comparative Studies in Mathematics Education*. Springer International Publishing. https://doi.org/10.1007/978-3-319-51187-0

Cleophas, T. J., & Zwinderman, A. H. (2017). *Modern meta-analysis: Review and update of methodologies*. Springer International Publishing. https://doi.org/10.1007/978-3-319-55895-0

Cooper, H. M., Patall, E. A., & Lindsay, J. J. (2013). Research synthesis and meta-analysis. In L. Bickman & D. J. Rog (Eds.), *The SAGE handbook of applied social research methods,* (pp. 344–370). Sage Publications Inc. https://dx.doi.org/10.4135/9781483348858

Cumming, G. (2012). *Understanding the new statistics: Effect sizes, confidence intervals, and meta-analysis*. Routledge Taylor & Francis Group. https://doi.org/10.1111/j.1751-5823.2012.00187_26.x

Disai, W. I., Dariyo, A., & Basaria, D. (2018). Hubungan antara kecemasan matematika dan self-efficacy dengan hasil belajar matematika siswa SMA X Kota Palangka Raya [The relationship between math anxiety and self-efficacy with mathematics learning outcomes for high school students X Palangka Raya]. *Jurnal Muara Ilmu Sosial, Humaniora, Dan Seni*, *1*(2), 556–568. https://doi.org/10.24912/jmishumsen.v1i2.799

Dori, Y. J., Mevarech, Z. R., & Baker, D. R. (2018). *Cognition, metacognition, and culture in STEM education: Learning, teaching and assessment*. Springer International Publishing.

Farid, A., & Ashrafzade, T. (2020). A meta-analysis of the relationship self-efficacy and academic performance. *Journal of Educational Sciences*, *27*(2), 69–90. https://doi.org/10.22055/edus.2020.35466.3130

Febrianti, F. M. S., Kadarisma, G., & Hendriana, H. (2018). Analisis hubungan kemampuan berpikir kreatif matematis dan self-efficacy siswa SMK [Analysis of the relationship between mathematical creative thinking skills and self-efficacy of SMK students.]. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *1*(4), 793–798. https://doi.org/10.22460/jpmi.v1i4.p793-798

Fuad, M., Suyanto, E., Sumarno, Muhammad, U. A., & Suparman. (2022). A bibliometric analysis of technology-based foreign language learning during the COVID-19 pandemic : Direction for Indonesia language learning. *International Journal of Information and Education Technology*, *12*(10), 983–995. https://doi.org/10.18178/ijiet.2022.12.10.1710

Fuadi, D. S., Suparman, S., Juandi, D., & Avip Priatna Martadiputra, B. (2021). Technology-assisted problem-based learning against common problem-based learning in cultivating mathematical critical thinking skills: A meta-analysis. *ACM International Conference Proceeding Series*, 162–168. https://doi.org/10.1145/3510309.3510335

Groth, R. E. (2017). Classroom data analysis with the five strands of mathematical proficiency. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *90*(3), 103–109. https://doi.org/10.1080/00098655.2017.1301155

Groves, S. (2012). Developing mathematical proficiency. *Journal of Science and Mathematics Education in Southeast Asia*, *35*(2), 119–145.

Hadiat, H. L., & Karyati, K. (2019). Hubungan kemampuan koneksi matematika, rasa ingin tahu dan self-efficacy dengan kemampuan penalaran matematika [Relationship between mathematical connection ability, curiosity and self-efficacy with mathematical reasoning

ability]. *Jurnal Riset Pendidikan Matematika*, *6*(2), 200–210. https://doi.org/10.21831/jrpm.v6i2.26552

Hanin, V., & Van Nieuwenhoven, C. (2016). The influence of motivational and emotional factors in mathematical learning in secondary education. *Revue Europeenne de Psychologie Appliquee*, *66*(3), 127–138. https://doi.org/10.1016/j.erap.2016.04.006

Hari, L. V., Zanthy, L. S., & Hendriana, H. (2018). Pengaruh self-efficacy terhadap kemampuan berpikir kritis matematik siswa SMP. *Jurnal Pembelajaran Matematika Inovatif*, *1*(3), 435–444. https://doi.org/10.22460/jpmi.v1i3.435-444

Hendriana, H., & Kadarisma, G. (2019). Self-efficacy dan kemampuan komunikasi matematis siswa SMP [Self-efficacy and mathematical communication skills of junior high school students]. *JNPM (Jurnal Nasional Pendidikan Matematika)*, *3*(1), 153–164. https://doi.org/10.33603/jnpm.v3i1.2033

Higgins, J. P. T., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analysis. *British Medical Journal*, *327*, 557–560. https://doi.org/10.1007/s10844-006-2974-4

Himmi, N. (2017). Korelasi self-efficacy terhadap kemampuan penalaran matematis mahasiswa semester pendek mata kuliah trigonometri UNRIKA. PYTHAGORAS [Self-efficacy correlation with mathematical reasoning ability of short semester students of UNRIKA trigonometry course. PYTHAGORAS]. *Jurnal Program Studi Pendidikan Matematika*, *6*(2), 143–150. https://doi.org/10.33373/pythagoras.v6i2.941

Huang, C. (2016). Achievement goals and self-efficacy: A meta-analysis. *Educational Research Review*, *19*, 119–137. https://doi.org/10.1016/j.edurev.2016.07.002

Hunter, J. E., & Schmidt, F. L. (2004). *Methods of meta-analysis: Correcting error and bias in research findings* (2nd ed.). Sage Publications Inc.

Husna, R., & Yani, B. (2018). Pengaruh self-efficacy terhadap hasil belajar matematika siswa di kelas X SMK SMTI Banda Aceh [The effect of self-efficacy on students' mathematics learning outcomes in class X SMK SMTI Banda Aceh]. *Jurnal Ilmiah Mahasiswa Pendidikan Matematika*, *3*(2), 43–48.

Hutagalung, D. D. (2016). Hubungan self-efficacy dan motivasi belajar dengan hasil belajar matematika siswa kelas XI IPS SMA Negeri 5 Batam tahun pelajaran 2013/2014. *Jurnal Mercumatika : Jurnal Penelitian Matematika Dan Pendidikan Matematika*, *1*(1), 33–43. https://doi.org/10.26486/mercumatika.v1i1.187

Jatisunda, M. G. (2017). Hubungan self-efficacy siswa SMP dengan kemampuan pemecahan masalah matematis. *Jurnal Theorems (The Original Research of Mathematics)*, *1*(2), 24–30.

Jaya, A., & Suparman, S. (2021). The use of CABRI software in mathematics learning for cultivating geometrical conceptual understanding: A meta-analysis. *ACM International Conference Proceeding Series*, 37–44. https://doi.org/10.1145/3510309.3510316

Jordan, K. L., Sorby, S., Amato-Henderson, S., & Donahue, T. H. (2011). Engineering self-efficacy of women engineering students at urban vs. rural universities. *Proceedings - Frontiers in Education Conference, FIE*, 3–6. https://doi.org/10.1109/FIE.2011.6143014

Khotimah, N. H., Khoirunnisa, A., & Bilda, W. (2020). Pengaruh self efficacy siswa SMP terhadap pemecahan masalah pada materi aritmetika sosial [The influence of junior high school students' self-efficacy on problem solving on social arithmetic material]. *Jurnal Edukasi Dan Sains*, *2*(2), 285–291. https://doi.org/10.36088/edisi.v2i2.913

Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding it up: Helping children learn mathematics*. National Academy Press.

Komalavalli, T. (2014). The relationship between mathematics self-efficacy and achievement in mathematics. *International Journal of Environment, Ecology, Family and Urban Studies*, *9*(3), 1–6.

Koshy, V., Ernest, P., & Casey, R. (2009). Mathematically gifted and talented learners: Theory and practice. *International Journal of Mathematical Education in Science and Technology*, *40*(2), 213–228. https://doi.org/10.1080/00207390802566907

Kurnia, R. D. M., Mulyani, I., Rohaeti, E. E., & Fitrianna, A. Y. (2018). Hubungan antara kemandirian belajar dan self-efficacy terhadap kemampuan komunikasi matematis siswa SMK [The relationship between learning independence and self-efficacy on the mathematical communication skills of SMK students]. *Jurnal Ilmiah Pendidikan Matematika*, *3*(1), 59–64. https://doi.org/10.26877/jipmat.v3i1.2183

Lamb, M. (2012). A self system perspective on young adolescents' motivation to learn english in urban and rural settings. *Language Learning*, *62*(4), 997–1023. https://doi.org/10.1111/j.1467-9922.2012.00719.x

Liberna, H. (2018). Hubungan efikasi diri terhadap pemahaman berpikir kreatif matematika [The relationship of self-efficacy to the understanding of mathematical creative thinking]. *Seminar Nasional Matematika Dan Pendidikan Matematika II*, 132–139.

Lipsey, M. W., & Wilson, D. (2001). *Applied social research methods series*. Sage Publications Inc. https://psycnet.apa.org/record/2000-16602-000

Mamona-Downs, J., & Downs, M. (2013). Problem solving and its elements in forming proof. *The Mathematics Enthusiast*, *10,* 136–162. https://doi.org/10.54870/1551-3440.1263

McHugh, M. L. (2012). Interrater reliability : the kappa statistic. *Biochemica Medica*, *22*(3), 276–282.

Mercader, J., Presentación, M.-J., Siegenthaler, R., Molinero, V., & Miranda, A. (2017). Motivation and mathematics performance: A longitudinal study in early educational stages. *Revista de Psicodidáctica*, *22*(2), 157–163. https://doi.org/10.1016/j.psicoe.2017.05.008

Mike, W., & Cheung, L. (2015). *Meta-analysis: A structural equation modeling approach*. John Willey and Son Ltd. https://doi.org/10.1002/9781118957813

Misbahudin, A. R. (2019). Hubungan self-efficacy terhadap kemampuan berpikir kritis matematis siswa SMK pada materi barisan dan deret matematika [The relationship of self-efficacy to the mathematical critical thinking skills of SMK students on the material of mathematical sequences and series]. *Journal on Education*, *1*(2), 445–450.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *BMJ (Online)*, *339*(7716), 332–336. https://doi.org/10.1136/bmj.b2535

Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology*, *38*(1), 30–38. https://doi.org/10.1037/0022-0167.38.1.30

NCTM. (2000). *Principles and standards for school mathematics*. The National Council of Teachers of Mathematics, Inc.

Ng, B. L. L., Liu, W. C., & Wang, J. C. K. (2016). Student motivation and learning in mathematics and science: A cluster analysis. *International Journal of Science and Mathematics Education*, *14*(7), 1359–1376. https://doi.org/10.1007/s10763-015-9654-1

Nugraha, T., & Suparman. (2021). Does students' demography cause heterogeneity of students' mathematical critical thinking abilities through problem-based learning? A meta-analysis. *Journal of Hunan University (Natural Sciences)*, *48*(8), 47–55.

Nurazizah, S., & Nurjaman, A. (2018). Analisis hubungan self-efficacy terhadap kemampuan berpikir kritis matematis siswa pada materi lingkaran [Analysis of the relationship of self-efficacy on students' mathematical critical thinking skills on circle material]. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *1*(3), 361–370. https://doi.org/10.22460/jpmi.v1i3.p361-370

Nurseha, S. M., & Apiati, V. (2019). Hubungan kemampuan pemecahan masalah dengan self-efficacy siswa melalui pembelajaran pendidikan matematika realistik [The relationship between problem solving abilities and students' self-efficacy through realistic mathematics education learning] *Seminar Nasional Program Studi Magister Pendidikan Matematika Universitas Siliwangi*, 539–546.

Ojose, B. (2008). Applying Piaget's theory of cognitive development to mathematics instruction. *Mathematics Educator*, *18*(1), 26–30.

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research*, *66*(4), 543–578. https://doi.org/10.3102/00346543066004543

Pekrun, R., Goetz, T., Frenzel, A. C., Barchfeld, P., & Perry, R. P. (2011). Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ). *Contemporary Educational Psychology*, *36*(1), 36–48. https://doi.org/10.1016/j.cedpsych.2010.10.002

Pratiwi, D., Suendarti, M., & Hasbullah. (2019). Pengaruh efikasi diri dan kemandirian belajar terhadap kemampuan pemecahan masalah matematika [The effect of self-efficacy and learning independence on mathematical problem-solving abilities]. *JKPM (Jurnal Kajian Pendidikan Matematika)*, *5*(1), 1–14. https://doi.org/10.30998/jkpm.v5i1.5329

Profitasari, A., Darmono, P. B., & Maryam, I. (2020). Hubungan self efficacy terhadap kemampuan penalaran matematis siswa SMP [The relationship of self-efficacy to the mathematical reasoning ability of junior high school students]. *EKUIVALEN-Pendidikan Matematika*, *1*(2), 13–18.

Rahmi, S., Nadia, R., Hasibah, B., & Hidayat, W. (2017). The relation between self-efficacy toward math with the math communication competence. *Infinity Journal*, *6*(2), 177–182. https://doi.org/10.22460/infinity.v6i2.p177-182

Rothstein, H. R., Sutton, A. J., & Borenstein, M. (2005). *Publication bias in meta-analysis: Prevention, assessment and adjustments*. John Willey and Son Ltd. https://doi.org/10.1002/0470870168

Saleh, S. (2021). Malaysian students' motivation towards Physics learning. *European Journal of Science and Mathematics Education*, *2*(4), 223–232. https://doi.org/10.30935/scimath/9414

Sanabria, J. C., & Arámburo-Lizárraga, J. (2017). Enhancing 21st century skills with AR: Using the gradual immersion method to develop collaborative creativity. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(2), 487–501. https://doi.org/10.12973/eurasia.2017.00627a

Septiani, T., Hudanagara, M. A., Hendriana, H., & Anita, I. W. (2018). Pengaruh self-confidence dan self-efficacy terhadap kemampuan berpikir kreatif matematis siswa SMP [The effect of self-confidence and self-efficacy on the mathematical creative thinking ability of junior high school students] *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *1*(2), 185–192. https://doi.org/10.22460/jpmi.v1i4.p667-672

Sheu, H. Bin, Lent, R. W., Miller, M. J., Penn, L. T., Cusick, M. E., & Truong, N. N. (2018). Sources of self-efficacy and outcome expectations in science, technology, engineering, and mathematics domains: A meta-analysis. *Journal of Vocational Behavior*, *109*, 118–136. https://doi.org/10.1016/j.jvb.2018.10.003

Silber-Varod, V., Eshet-Alkalai, Y., & Geri, N. (2019). Tracing research trends of 21st-century learning skills. *British Journal of Educational Technology*, *50*(6), 1–20. https://doi.org/10.1111/bjet.12753

Singh, S., Singh, A., & Singh, K. (2012). Education systems and academic satisfaction: A study on rural and urban students of traditional vs open education system in India. *Turkish Online Journal of Distance Education*, *13*(3), 391–406. https://doi.org/10.17718/tojde.14199

Siregar, N. (2019). Hubungan self-efficacy dengan hasil belajar matematika siswa kelas rendah [The relationship of self-efficacy with low grade students' mathematics learning outcomes]. *Journal of Mathematics Science and Education*, *1*(2), 64–72. https://doi.org/10.31540/jmse.v1i2.459

Sullivan, P., Borcek, C., Walker, N., & Rennie, M. (2016). Exploring a structure for mathematics lessons that initiate learning by activating cognition on challenging tasks. *Journal of Mathematical Behavior*, *41*, 159–170. https://doi.org/10.1016/j.jmathb.2015.12.002

Sunarti. (2020). Hubungan self-efficacy dan kemampuan komunikasi matematis siswa SMA pada materi perbandingan trigonometri [The relationship between self-efficacy and mathematical communication skills of high school students on trigonometric comparison material]. *Jurnal Pendidikan Matematika*, *1*(1), 1–10.

Suparman, Juandi, D., & Tamur, M. (2021a). Review of problem-based learning trends in 2010-2020 : A meta-analysis study of the effect of problem-based learning in enhancing mathematical problem-solving skills of Indonesian students. *Journal of Physics: Conference Series*, *1722*(012103), 1–9. https://doi.org/10.1088/1742-6596/1722/1/012103

Suparman, Juandi, D., & Tamur, M. (2021b). Does problem-based learning enhance students' higher order thinking skills in mathematics learning? A systematic review and

meta-analysis. *The 4th International Conference on Big Data and Education*, 44–51. https://doi.org/10.1145/3451400.3451408

Suparman, S., Juandi, D., & Herman, T. (2021). Achievement emotions of female students in mathematical problem-solving situations. *Journal of Physics: Conference Series*, *1806*(1), 1–7. https://doi.org/10.1088/1742-6596/1806/1/012106

Suparman, Suparman, Juandi, D., & Martadiputra, B. A. P. (2021). Heterogeneity of students' mathematical critical thinking ability re-viewed from education levels: A meta-analysis. *Paedagogia: Jurnal Penelitian Pendidikan*, *24*(2), 126–143. https://doi.org/10.20961/paedagogia.v24i1.53981

Tambunan, H. (2018). Impact of heuristic strategy on students' mathematics ability in higher order thinking. *International Electronic Journal of Mathematics Education*, *13*(3), 321–328. https://doi.org/10.12973/iejme/3928

Taylor, R. (1990). Interpretation of the correlation coefficient: A basic review. *Journal of Diagnostic Medical Sonography*, *6*(1), 35–39. https://doi.org/10.1177/875647939000600106

Thiessen, V., & Blasius, J. (2008). Mathematics achievement and mathematics learning strategies: Cognitive competencies and construct differentiation. *International Journal of Educational Research*, *47*(6), 362–371. https://doi.org/10.1016/j.ijer.2008.12.002

Trautwein, U., Schnyder, I., Niggli, A., Neumann, M., & Lüdtke, O. (2009). Chameleon effects in homework research : The homework – achievement association depends on the measures used and the level of analysis chosen. *Contemporary Educational Psychology*, *34*(1), 77–88. https://doi.org/10.1016/j.cedpsych.2008.09.001

Umaroh, S., Yuhana, Y., & Hendrayana, A. (2020). Pengaruh self-efficacy dan kecemasan matematika terhadap kemampuan penalaran matematis siswa SMP [The effect of self-efficacy and mathematics anxiety on the mathematical reasoning ability of junior high school students]. *Jurnal Inovasi Dan Riset Pendidikan Matematika*, *1*(1), 1–15.

Usher, E. L., & Pajares, F. (2008). Sources of self-efficacy in school: Critical review of the literature and future directions. *Review of Educational Research*, *78*(4), 751–796. https://doi.org/10.3102/0034654308321456

Vevea, J. L., Zelinsky, N. A. M., & Orwin, R. G. (2019). Evaluating coding decisions. In H. Cooper, L. V. Hedges, J. C. Valentine (Eds.), *The handbook of research synthesis and meta-analysis* (3rd ed.) (pp. 174–201). Russel Sage Foundation. https://doi.org/https://doi.org/10.7758/9781610448864

Vilkomir, T., & O'Donoghue, J. (2009). Using components of mathematical ability for initial development and identification of mathematically promising students. *International Journal of Mathematical Education in Science and Technology*, *40*(2), 183–199. https://doi.org/10.1080/00207390802276200

Voogt, J., & Roblin, N. P. (2012). A comparative analysis of international frameworks for 21st century competences: Implications for national curriculum policies. *Journal of Curriculum Studies*, *44*(3), 299–321. https://doi.org/10.1080/00220272.2012.668938

Wang, C., & Sun, T. (2020). Relationship between self-efficacy and language proficiency: A meta-analysis. *System*, *95*(102366), 1–11. https://doi.org/10.1016/j.system.2020.102366

Wulansari, Suganda, A. I., & Fitriana, A. Y. (2019). Hubungan self-efficacy terhadap kemampuan berpikir kreatif matematik siswa SMP pada materi bangun datar segitiga dan segiempat [The relationship of self-efficacy to the mathematical creative thinking ability of junior high school students in the material of triangular and quadrilateral flat shapes]. *Journal on Education*, *1*(3), 422–428.

Yuliyani, R., Handayani, S. D., & Somawati. (2017). Peran efikasi diri dan kemampuan berpikir positif terhadap kemampuan pemecahan masalah matematika [The role of self-efficacy and positive thinking skills on mathematical problem-solving abilities]. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *7*(2), 130–143. https://doi.org/10.30998/formatif.v7i2.2228

Zamnah, L. N. (2019). Hubungan antara kemampuan pemecahan masalah matematis dengan self-efficacy [The relationship between mathematical problem solving ability and self-efficacy]. *Daya Matematis: Jurnal Inovasi Pendidikan Matematika*, *7*(2), 139–145. https://doi.org/10.26858/jds.v7i2.9811

Zhou, D., Liu, J., & Liu, J. (2021). On the different effects of teacher–student rapport on urban and rural students' math learning in China: An empirical study. *Psychology in the Schools*, *58*(2), 268–285. https://doi.org/10.1002/pits.22446

Saviveikmingumas ir matematiniai gebėjimai: Indonezijoje atliktų tyrimų metaanalizė

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Santrauka

Kai kurių empirinių tyrimų sintezė atskleidė, kad ryšys tarp mokinių matematinių gebėjimų ir saviveiksmingumo nėra nuoseklus, todėl šiame naujausiame metaanalizės tyrime nagrinėjamas matematinių gebėjimų ir saviveiksmingumo ryšys bei galimi veiksniai, tokie kaip išsilavinimo lygis ir geografinė vietovė, ribojantys abiejų ryšių heterogeniškumą. Šiame tyrime išanalizuota 30 dokumentų, kuriuos sudarė 27 žurnalų straipsniai ir 3 konferencijų pranešimai, kurie buvo paskelbti 2016–2021 m. ir gauti iš Semantic Scholar ir Google Scholar duomenų bazių. Šiuose dokumentuose rasta 30 reikšmių, įvardijančių dviejų kintamųjų ryšio stiprumą. Tyrimas apėmė ir 2298 dalyvius. Rezultatai atskleidė, kad mokinių matematiniai gebėjimai ir mokinių saviveiksmingumas turėjo vidutinį teigiamą ryšį (r = 0,553). Tai reiškia, kad kiekvienas mokinys gali turėti aukštą saviveiksmingumo lygį, kad pagerintų savo matematinius gebėjimus. Be to,

saviveiksmingumas buvo labai susijęs su matematinių problemų sprendimo gebėjimais. Tai rodo, kad ryšys tarp saviveiksmingumo ir matematinių problemų sprendimo gebėjimų yra stipresnis nei ryšys tarp saviveiksmingumo ir kitų matematinių gebėjimų. Be to, matematinių gebėjimų ir saviveiksmingumo ryšio stiprumo nesumažino išsilavinimo lygis ir geografinė padėtis. Šis tyrimas aiškiai ir tiksliai rodo, kad kai kurie veiksniai, tokie kaip išsilavinimo lygis ir geografinė padėtis, neturi įtakos skirtingo stiprumo ryšiui tarp mokinių matematinių gebėjimų ir mokinių saviveiksmingumo.

Esminiai žodžiai: *matematiniai gebėjimai, metaanalizė, saviveiksmingumas***.**

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