

## A SYSTEMATIC LITERATURE REVIEW: SELF-EFFICACY TOWARD MATHEMATICAL REASONING ABILITY

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**ABSTRACT** This study is a systematic literature review aimed at describing various research findings related to students' mathematical reasoning ability in relation to their self-efficacy levels. The method used is a systematic literature review by applying the keywords self-efficacy and reasoning ability, along with predefined inclusion criteria to select relevant articles. Articles that met the inclusion criteria were then analyzed qualitatively to draw valid and accountable conclusions. The results of the analysis reveal inconsistencies across studies regarding the influence of self-efficacy on students' mathematical reasoning ability. Differences were also found in how varying levels of self-efficacy affect students' performance in solving mathematical reasoning tasks. These discrepancies may stem from several factors, including sample limitations, differences in methodological approaches, the theoretical frameworks adopted, and variations in contextual field conditions. Therefore, further research is needed that involves more diverse variables and employs more comprehensive methodological designs to gain a more consistent and holistic understanding of the relationship between self-efficacy and students' mathematical reasoning ability.

**Keywords:** self-efficacy, mathematical reasoning ability, systematic literature review

**ABSTRAK** Penelitian ini merupakan tinjauan pustaka sistematis yang bertujuan untuk mendeskripsikan berbagai hasil penelitian terkait kemampuan penalaran matematis siswa ditinjau dari tingkat self-efficacy yang dimiliki. Metode yang digunakan adalah systematic literature review dengan kata kunci *self-efficacy* dan *kemampuan penalaran*, serta menetapkan kriteria inklusi untuk memilih artikel yang sesuai. Artikel yang memenuhi kriteria inklusi kemudian dianalisis secara kualitatif untuk memperoleh kesimpulan yang valid dan dapat dipertanggungjawabkan. Hasil analisis menunjukkan bahwa terdapat kesenjangan temuan antarpelitian terkait pengaruh self-efficacy terhadap kemampuan penalaran matematis siswa. Perbedaan juga ditemukan dalam bagaimana tingkat self-efficacy memengaruhi performa siswa dalam menyelesaikan tugas-tugas penalaran

matematis. Kesenjangan ini dapat disebabkan oleh berbagai faktor, seperti keterbatasan populasi, perbedaan pendekatan metodologis, kerangka teori yang digunakan, serta perbedaan kondisi kontekstual di lapangan. Oleh karena itu, diperlukan penelitian lanjutan yang melibatkan variabel yang lebih beragam dan pendekatan metodologi yang lebih komprehensif, guna memperoleh pemahaman yang lebih utuh dan konsisten mengenai hubungan antara self-efficacy dan kemampuan penalaran matematis siswa.

**Kata-kata kunci:** self-efficacy, kemampuan penalaran matematis, tinjauan pustaka sistematis

## INTRODUCTION

Mathematics is a compulsory subject studied by students from elementary school to higher education levels. This is based on the function of mathematics education in equipping students with various essential competencies, such as logical thinking, systematic analysis, and the ability to think critically and creatively. With strong mastery of mathematical competencies, students are expected to develop abilities that help them lead better lives (Kemendikbud, 2016).

According to the Azizah & Wardani (2024), mathematics, as one of the branches of science, has specific learning objectives. One of the objectives outlined in the standard learning process is that students should have the ability to reason about mathematical concepts related to various patterns and properties found in mathematics. Students should also be able to construct mathematical proofs and draw general conclusions based on patterns, properties, and evidence. From these learning objectives, it can be concluded that one of the essential skills students should possess in learning mathematics is mathematical reasoning.

Mathematical reasoning is one of the abilities that students should master after learning mathematics, in which the student is able to understand the information provided in a mathematical problem and use that information to solve the problem (Wulansari et al., 2019). In mathematics learning, mathematical reasoning holds a very important position. When a student has strong mathematical reasoning skills, they are able to critically understand information and make sound decisions (Kurniawati, 2022). As a result, the student's academic performance will also improve. Therefore, it is highly expected that students possess good mathematical reasoning skills.

In fact, students in Indonesia still have relatively low mathematical reasoning abilities. This is evidenced by the results of the 2023 TIMSS, in which Indonesia ranked 45 th out of 58 participating countries (Hamzah & Dahlan, 2023). This data indicates the low quality of education in Indonesia. Indonesia's poor performance in the TIMSS highlights that Indonesian students face serious challenges in their learning. One of these issues lies in the students' low ability to reason through mathematical concepts.

In reasoning through mathematical concepts, students need a strong sense of confidence in their ability to handle the mathematical problems given by the

teacher. This confidence encourages students to be more motivated when solving mathematical problems. This sense of confidence is known as self-efficacy. A psychologist, Bandura (1994), introduced self-efficacy as a psychological condition in which an individual believes in their own ability to complete a specific task or challenge. Self-efficacy influences how a person approaches goals they want to achieve or overcomes obstacles and challenges they encounter.

This is what makes the role of self-efficacy important in mathematics learning. Moreover, a student's level of self-efficacy also has a significant impact on their academic achievement (Indirwan et al., 2021). Typically, students with high academic achievement tend to have high self-efficacy, and conversely, low self-efficacy often leads to low academic performance. Indirwan also added that self-efficacy drives students to strive for success and to persevere through difficulties when completing mathematical tasks. This, in turn, contributes to the improvement of the students' academic performance.

Considering the importance of self-efficacy, students are expected to have high self-efficacy in solving mathematical problems after learning mathematics. According to the Regulation of the Minister of National Education (Kemendikbud, 2016), it is stated that after learning mathematics, students are expected to be able to apply mathematical concepts in their daily lives, have a high curiosity about mathematical matters, be motivated to continue learning mathematics, be diligent in their studies, and be more confident in solving various mathematical problems. From these mathematics learning objectives, it is clear that one of the expected outcomes after learning mathematics is that students will have high self-efficacy (Putri et al., 2024). However, the reality shows that students' self-efficacy is still low. This view was expressed by Siregar (2019) in his research, stating that there is a consistent decline in self-efficacy from the time students are in elementary school until they reach senior high school. This is what gives rise to the stigma that mathematics is a difficult and complicated subject, resulting in most students disliking mathematics.

Many researchers have conducted studies related to self-efficacy and mathematical reasoning making it unclear whether the two variables influence each other. These studies have covered a wide range of themes. However, most of them focused only on specific variables, for example, only related to self-efficacy or mathematical reasoning. There is still little research that discusses self-efficacy and mathematical reasoning simultaneously. From several previous studies, several gaps were still found in either the theory or the results obtained.

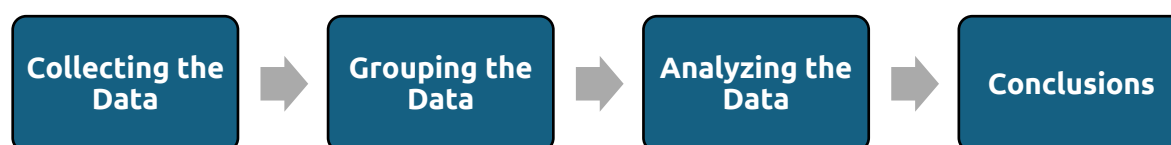
Therefore, this study is expected to fill that gap by providing broader and stronger empirical evidence regarding the relationship or influence of students' self-efficacy on their mathematical reasoning abilities. The novelty in this research is the combination of variables chosen namely self-efficacy and mathematical reasoning. The lack of research involving these two variables directly makes this research have a novelty that can be used for the development of the world education. In addition,

the researcher has formulated two research questions that will serve as the focus of the analysis. These research questions are: (1) Does self-efficacy have an influence on students' mathematical reasoning abilities? (2) What is the level of students' self-efficacy in relation to their mastery of mathematical reasoning abilities?

## METHODS

This study employs a Systematic Literature Review (SLR) approach with the aim of describing the influence of self-efficacy on students' mathematical reasoning abilities, as well as examining how different levels of self-efficacy affect students' mathematical reasoning. This method is used to collect and evaluate previous research findings related to the topic under investigation. The term SLR is often used as a research method or methodology in certain studies. This approach is carried out to classify various types of articles based on predetermined criteria, followed by analyzing the articles and then drawing valid conclusions from the analysis conducted (Sari et al., 2023)

According to Triandini (2019) the steps in this study begin with collecting data, then grouping the data based on inclusion criteria, followed by analyzing the data and drawing conclusions from the analysis conducted. Systematically, the SLR steps used in this research are presented in the following figure :



**Figure 1.** The SLR Systematics

In the data collection process, the researcher used the Publish or Perish software and also conducted direct searches for national journals using Google. The articles collected through the Publish or Perish software were sourced from e-databases indexed by Google Scholar, OpenAlex, and CrossRef.

The inclusion criteria established for this research are as follows: (1) Articles are limited to the field of mathematics education; (2) Articles are limited to studies discussing self-efficacy and mathematical reasoning; (3) Articles are published within the period of 2015–2024; (4) Articles are published in nationally accredited journals indexed by SINTA or in reputable international journals.

Based on inclusion criteria, researchers carried out an analysis of the articles that had been collected. The analyzing process reference to research question that have been determined. Final step, the researcher will draw conclusions from the result of the analysis that has been carried out. The data analysis technique used in this research was carried out by meta-synthesis. With meta-synthesis, researchers combine

several qualitative data from different studies, so that new understanding or deeper explanation regarding certain phenomena can be found..

## FINDING AND DISCUSSION

From the data collection process, A total of 33 articles were obtained from these sources, and all of them were then extracted to identify those that met the predetermined inclusion criteria. From the analysis process conducted, 16 articles were found to meet the inclusion criteria.

From the analysis process conducted, 16 articles were found to meet the inclusion criteria. These articles were subsequently analyzed by the researcher to find answers to the predetermined research questions. Of the 16 articles, 7 addressed Research Question 1 (RQ1), which pertains to the influence of students' self-efficacy on their mathematical reasoning abilities. Meanwhile, 8 articles addressed Research Question 2 (RQ2), which concerns the levels of students' self-efficacy in relation to their mastery of mathematical reasoning. Additionally, 1 article addressed both research questions. This data is presented in the literature review results table, as shown in Table 1 below:

**Table 1.** Summary of Research Findings

No	Researcher(s) and Year of Publication	Research Findings	RQ1	RQ2
1	Nailul Himmi (2017)	The findings of this study reveal that among UNRIKA students who took the trigonometry course, the correlation value between self-efficacy and mathematical reasoning was 0.081. This indicates that self-efficacy does not have a significant relationship with the students' mathematical reasoning abilities.	√	
2	Tatiriah, Edi Cahyono, Kadir, (Tatiriah et al., 2017)	The findings of this study indicate that through problem-posing learning, students with high mathematical reasoning only possess a moderate level of self-efficacy. At other levels, the degree of self-efficacy does not affect the level of mathematical reasoning.		√
3	Melinda Putri Mubarika (2017)	This study found a positive and mutually reinforcing relationship between students' self-efficacy and their mathematical reasoning ability. In other words, students with strong mathematical reasoning skills tend to have high self-efficacy, and vice versa.	√	

No	Researcher(s) and Year of Publication	Research Findings	RQ1	RQ2
4	Siti Zakiyah, Syifa Halawatul Imania, Gustiani Rahayu, Wahyu Hidayat (2018)	The findings of this study indicate that students' levels of self-efficacy do not positively influence their mathematical reasoning abilities. This is evident from students who demonstrate low mathematical reasoning but possess high self-efficacy.		√
5	Hanifah Latifah Hadiat, Karyati Karyati (2019)	This study found that self-efficacy contributes 1.81% to students' mathematical reasoning ability.	√	√
6	D I Jumiarsih, T A Kusmayadi, and L Fitriana (2020)	The results of this study show that students with both high and moderate levels of self-efficacy still experience difficulties in reasoning through mathematical concepts. Meanwhile, students with low levels of self-efficacy consistently perceive mathematical reasoning as difficult.		√
7	Samsul Bahri, Farah Heniati Santosa, Kiki Riska Ayu Kurniawati, Habibi Ratu Perwira Negara (2022)	The research findings reveal that when a student has high self-efficacy, their mathematical reasoning ability also tends to be strong. Conversely, poor mathematical reasoning ability is associated with low levels of self-efficacy.		√
8	Angel Mukuka, Vedaste Mutarutinya, Sudi Balimuttajjo (2021)	The findings of this study indicate a positive effect of students' self-efficacy on their mathematical reasoning skills.	√	
9	Supardi Uki Sujiman, Hasbullah (2021)	This study demonstrates that the self-efficacy of high school students has a significant influence on their ability to reason through mathematical concepts.	√	
10	Zubaidah Amir MZ, Athik Urrohmah, Lies Andriani (2021)	The findings of this study show that students with high self-efficacy also tend to have high mathematical reasoning abilities, and vice versa. Therefore, the level of self-efficacy a		√

No	Researcher(s) and Year of Publication	Research Findings	RQ1	RQ2
		student possesses has a positive influence on their mathematical reasoning skills.		
11	Rezki Amaliyah AR, Sartika Arifin, Aprianti Aprianti (2022)	The researcher found a significant influence of students' self-efficacy on their ability to reason through mathematical concepts.	√	
12	Gustia Putri Lestari, Zamzaili, Saleh Haji (2022)	The findings of this study indicate that self-efficacy accounts for 24.5% of the variance in students' mathematical reasoning ability.	√	
13	Addini Nurussalamah, Rina Marlina (Nurussalamah & Marlina, 2022)	This study revealed several findings: (1) Students with high self-efficacy also demonstrated strong mathematical reasoning abilities; (2) Students with moderate self-efficacy showed mathematical reasoning abilities ranging from fairly good to high; (3) Students with low self-efficacy exhibited mathematical reasoning abilities ranging from low to fairly good.		√
14	Sartika Arifin, Andi Trisno Trisno, Iswandi Iswandi, Sandriwanti Arifin (2024)	The findings of this study indicate that research subjects with high self-efficacy were able to successfully complete all five indicators of mathematical reasoning ability. In contrast, subjects with moderate self-efficacy were only able to complete three indicators, while those with low self-efficacy managed to complete only two.		√
15	Sri Nuraeni, Linda Herawati, Yeni Heryani (2024)	The findings of this research indicate that there is no mutual influence between self-efficacy and mathematical reasoning ability.	√	
16	Habibi Ratu Perwira Negara, Farah Heniati Santosa, Muhammad Daut Siagian (2024)	Based on the results of the study, it was found that the level of self-efficacy has a positive influence on students' ability to reason through mathematical concepts. This means that students with high self-efficacy tend to reason well in mathematics, and vice versa.		√

## The Influence of Self-Efficacy on Students' Mathematical Reasoning Ability

A person with strong mathematical reasoning skills can be identified by their ability to think logically, analyze problems, think systematically, solve problems, and express mathematical ideas when finding solutions—either verbally or in written form. This mathematical reasoning ability is influenced by various factors, both internal and external.

Internally, one of the factors that affects students' ability to reason through mathematical concepts is the emotional intelligence they possess. By definition, emotional intelligence is related to how students are able to manage their emotions, especially when facing math problems they perceive as difficult. One example of the emotional intelligence in question is self-efficacy, which refers to the students' belief in their own ability to solve mathematical problems, face the challenges presented, learn concepts, complete assignments, and communicate during the learning process.

According to Bandura (Baihaki et al., 2022) there are four factors that influence a student's level of self-efficacy. First, mastery experiences, which refer to an individual's past successes or failures. Second, vicarious experiences, which involve learning from the success of others, leading the individual to believe that they too can accomplish the same task. Third, social persuasion, which refers to encouragement from others—such as family, teachers, or peers—that can boost a student's confidence in understanding and completing a task. Fourth, emotional states. These emotional conditions play a role in shaping how individuals perceive their own self-efficacy or belief in their ability to achieve goals. These four factors influence an individual's perception of self-efficacy, or the learner's confidence in their ability to succeed.

From Table 1, there are seven articles that address the first research question (P1): Does students' self-efficacy have a positive influence on their mathematical reasoning ability? Among these seven articles, five of them found similar results, indicating that self-efficacy contributes to or has an influence on students' ability to reason through mathematical concepts. This means that the quality of students' mathematical reasoning ability is strongly influenced by the quality of their self-efficacy. Therefore, if a student experiences difficulties related to mathematical reasoning, teachers can work on improving that student's self-efficacy to help enhance their reasoning skills.

However, different findings were reported in two other studies, namely those by Himmi (2017) and Nuraeni et al. (2024) These researchers found that self-efficacy did not have a significant positive effect on students' mathematical reasoning abilities. In other words, even if a student possesses high self-efficacy, this cannot be considered the main reason for a high level of mathematical reasoning ability.

The discrepancy in research findings can be attributed to several factors, such as the research population not including certain groups, limitations in the application of

theory, gaps between observed phenomena and field evidence, methodological limitations, and inconsistencies between research concepts and actual field data. Therefore, further research is needed to re-examine whether self-efficacy does indeed have a positive influence on students' mathematical reasoning abilities.

### **Levels of Self-Efficacy in Relation to Students' Mathematical Reasoning Ability**

If self-efficacy is proven to have a positive influence on students' mathematical reasoning abilities, the next step is to examine the degree of influence exerted by different levels of self-efficacy. According to Hatta (2021) self-efficacy can be categorized into three levels: high, moderate, and low. By referring to these levels, we can then analyze how each level specifically affects students' ability to reason through mathematical concepts.

From Table 1, there are nine articles that address the second research question (RQ2): What is the level of students' self-efficacy in relation to their mastery of mathematical reasoning ability? Among these nine articles, five of them found similar results, showing that the level of students' self-efficacy has a positive relationship with their mathematical reasoning ability. In other words, it can be stated that the higher a student's level of self-efficacy, the better their ability to reason mathematically.

However, different findings were reported in the other four studies, where the results indicated that the level of self-efficacy is not a definitive indicator of the quality of students' mathematical reasoning ability. This means that a student may possess strong mathematical reasoning skills even if their self-efficacy is only moderate or low.

The differences in these research findings are certainly influenced by several factors, such as the research population not covering certain groups, limitations in the application of theoretical frameworks, discrepancies between observed phenomena and field evidence, methodological constraints, and inconsistencies between research concepts and real-world data. Therefore, to address these research gaps, further studies are necessary in order to obtain more relevant and conclusive findings.

### **CONCLUSIONS AND RECOMMENDATIONS**

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Based on the explanation above, it can be concluded that among the studies reviewed, there are still discrepancies in the research findings. Some studies found that self-efficacy has an influence on students' mathematical reasoning ability. On the other hand, other studies asserted that self-efficacy does not have an effect on students' mathematical reasoning ability. The same applies to the levels of self-efficacy possessed by students. Several studies also revealed discrepancies in their findings. Some studies found that the level of self-efficacy has a positive effect on students' mathematical reasoning ability. However, other studies showed the

opposite — that the level of self-efficacy is not a reliable indicator for determining the quality of students' mathematical reasoning skills.

These discrepancies are, of course, influenced by various factors such as the condition of the research samples, theoretical limitations, or the research methodology used. Therefore, it is necessary to conduct further studies to examine the influence or relationship between self-efficacy and mathematical reasoning ability by incorporating more diverse aspects — such as broader populations, varied methodologies, different mathematical topics, and so on. It is hoped that the emergence of more diverse research will enrich the body of knowledge related to self-efficacy and students' mathematical reasoning abilities.

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