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Self-Efficacy in Indonesian Mathematics Pedagogy: A Systematic Literature Review

Andi Mariani Ramlan[1*], Sri Muliana Ramlan[2], Fitri Ramdani[3]
[1] Department of Mathematics Education, Universitas Sembilanbelas November Kolaka, Kolaka, Indonesia
[2] Madrasah Aliyah Negeri 1 Kolaka, Kolaka, Indonesia
[3] Sekolah Menengah Atas Negeri 1 Latambaga, Kolaka, Indonesia

Abstract

Purpose: This study presents a systematic literature review examining mathematics self-efficacy research within the Indonesian educational context from 2019 to 2024. **Methodology:** Guided by the PRISMA 2020 protocol, fifty-seven peer-reviewed journal articles were identified through the GARUDA database, meeting strict inclusion and exclusion criteria. Data were analyzed to determine frequently used keywords, primary research themes, and temporal trends. Keyword analysis revealed a predominant focus on constructs such as learning outcomes, problem-solving ability, motivation, and academic achievement, indicating a learner-centered orientation. **Findings:** Thematic synthesis demonstrated that most studies investigated the impact of self-efficacy on mathematics achievement, with fewer addressing affective factors, conceptual understanding, or higher-order thinking skills. Temporal analysis indicated a publication peak in 2021, followed by a decline, potentially linked to shifts in theoretical frameworks and pandemic-related disruptions. **Significance:** Findings underscore the critical role of self-efficacy in shaping students' cognitive, affective, and behavioral engagement in mathematics, and call for more diverse methodological approaches and participant demographics in future research.

Keywords: Achievement; Education; Learning-outcomes; Mathematics; Motivation; Problem-solving; Self-efficacy.

* Corresponding author : *Andi Mariani Ramlan, marianiramlan@usn.ac.id*

Introduction

Self-efficacy refers to an individual's belief in their capacity to successfully execute a specific task, such as reading or writing in a given language, solving mathematical problems, and related activities (Puozzo & Audrin, 2021; Wang et al., 2024). Self-efficacy enables individuals to recognize and interpret the outcomes of their actions, thereby informing students' self-assessments regarding their capability to succeed in a specific academic subject, course, or level (Atinuke et al., 2022). Extensive theoretical and empirical research underscores that self-efficacy constitutes a critical motivational construct, exerting a significant influence on individuals' choices, effort, persistence, and overall achievement (Schunk & DiBenedetto, 2020).

Within the context of mathematics learning, mathematics self-efficacy, conceptualized as an individual's belief in their capacity to successfully engage in mathematical tasks, constitutes a critical determinant of academic performance and influences the pursuit of careers within science, technology, engineering, and mathematics (STEM) disciplines (Clemente et al., 2024). Mathematics self-efficacy is closely linked to students' mathematical achievement and is recognized as a significant predictor of their academic performance in the subject (Yang et al., 2024). Mathematics self-efficacy encompasses students' interpretations of their prior achievements, self-assessments of their abilities, and personal estimations of their prospective performance on assigned mathematical tasks (Zakariya, 2022).

Students' mathematics self-efficacy is a measure of their confidence in their capacity to complete a given mathematics task successfully (Arthur et al., 2025). Students' mathematics self-efficacy is a critical construct, as it is closely associated with their motivation to learn and engage with mathematics, the effort and persistence they demonstrate, their academic performance, and their future career aspirations and decisions (Street et al., 2024). Therefore, students with high mathematics self-efficacy exhibit strong motivation for learning, heightened self-confidence, and enhanced capacity to plan and successfully complete mathematical tasks, thereby facilitating optimal performance.

Rooted in Social Cognitive Theory, the construct of self-efficacy was introduced by Albert Bandura, a distinguished American psychologist whose theoretical and empirical contributions have had a lasting impact on educational research and psychological science. His influential studies, including the Bobo Doll experiment, laid the foundation for understanding learning as a socially mediated process (Bhati & Sethy, 2022). The self-efficacy construct within Albert Bandura's Social Cognitive Theory is widely regarded by scholars as a pivotal theoretical contribution to the understanding of academic achievement, motivation, and learning (Pajares, 1996; Schunk, 1991). Self-efficacy has been consistently identified as a critical determinant of educational success, influencing not only students but also teachers. Moreover, its impact extends beyond the individual level to encompass group or collective dimensions of efficacy within educational settings (Klassen & Usher, 2010).

In the context of mathematics education, several scholars have conducted systematic reviews on the construct of self-efficacy. Clemente et al. (2024) performed a systematic review synthesizing intervention study aimed at improving students' mathematics self-efficacy. Similarly, Street et al. (2024) carried out a scoping review that examined the substantive foci addressed in recent studies (2018–2022), including the conceptualization, directionality, and role of mathematics self-efficacy (MSE), changes in MSE, and its situational specificity, along with the methodological approaches employed—such as participant characteristics, analytical methods, data sources, and measurement congruence. However, systematic reviews focusing on self-efficacy within the context of Indonesian mathematics pedagogy have not yet been published. This study focuses on the analytical methods employed in systematic reviews to identify research on self-efficacy within Indonesian mathematics education published in scientific journals. Specifically, this paper seeks to address three research questions: (1) What are the keywords commonly used in self-efficacy-related research papers? (2) What are the primary topics addressed in these studies? and (3) How has research on mathematics self-efficacy evolved over time? By conducting a systematic

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literature review (SLR), this study aims to contribute to the existing body of knowledge on self-efficacy, particularly in the context of Indonesian mathematics pedagogy, and to assess the extent to which each research focus has been explored.

Methods

A systematic literature review (SLR) was conducted to methodically identify relevant data, determine commonly used keywords, examine primary topics of focus, and trace the evolution of research over time within the domain of mathematics pedagogy and self-efficacy. To ensure objectivity and accuracy, multiple search strategies were employed in accordance with the PRISMA 2020 guidelines for systematic reviews and meta-analyses (Page et al., 2021). Clear inclusion and exclusion criteria were established to guide the selection of articles for analysis. The PRISMA approach was selected for its rigorous and transparent methodology, which facilitates accurate evaluation and analysis of evidence, ensures a comprehensive and reproducible synthesis of the literature, and thereby enhances the reliability and validity of the review findings while minimizing bias and error (Su et al., 2023; Li et al., 2024).

Inclusion and Exclusion Criteria

This study exclusively focuses on mathematics self-efficacy within the Indonesian context. Therefore, studies related to other educational domains—such as physics, chemistry, biology, and others—or conducted outside Indonesia were excluded. Furthermore, only peer-reviewed journal articles published between 2019 and 2024 were considered for review. The five-year publication window was deliberately selected to ensure a manageable volume of literature and to capture significant developments in the field during this period. This timeframe also serves to guarantee the reliability, quality, accessibility, and timeliness of the studies included. Consequently, undergraduate theses, master's theses, doctoral dissertations, and conference or seminar proceedings were excluded. A summary of the inclusion and exclusion criteria applied in the article selection process is presented in Table 1.

Table 1
Inclusion and Exclusion Criteria

Inclusion	Exclusion
Only articles published in peer-reviewed journals	Articles published in repositories (e.g., undergraduate theses, master's theses, dissertations), and conference proceedings
Published in Indonesia	Published outside Indonesia
Published in the field of mathematics education	From other educational fields such as physics, chemistry, biology, etc.
Empirical research studies	Literature reviews, community service reports, and similar non-empirical works
Focused on self-efficacy in the context of mathematics education	Focused on self-efficacy in other domains
Published between 2019 and 2024	Published prior to 2019

Article Selection Procedure

The literature exploration, conducted in accordance with the inclusion and exclusion criteria described above, was carried out using the *Garba Rujukan Digital* (GARUDA) database, accessible at https://garuda.kemdikbud.go.id/. GARUDA, established in 2018 by the Ministry of Education, Culture, Research, and Technology, is the largest academic database in Indonesia. The search strategy employed a title-based query using the keywords "efikasi diri" AND matematika (self-efficacy AND mathematics). This search was conducted on 24 September 2024, yielding an initial result of 118 articles.
Subsequently, the articles were screened and evaluated for eligibility. Specifically, the initial 118 records

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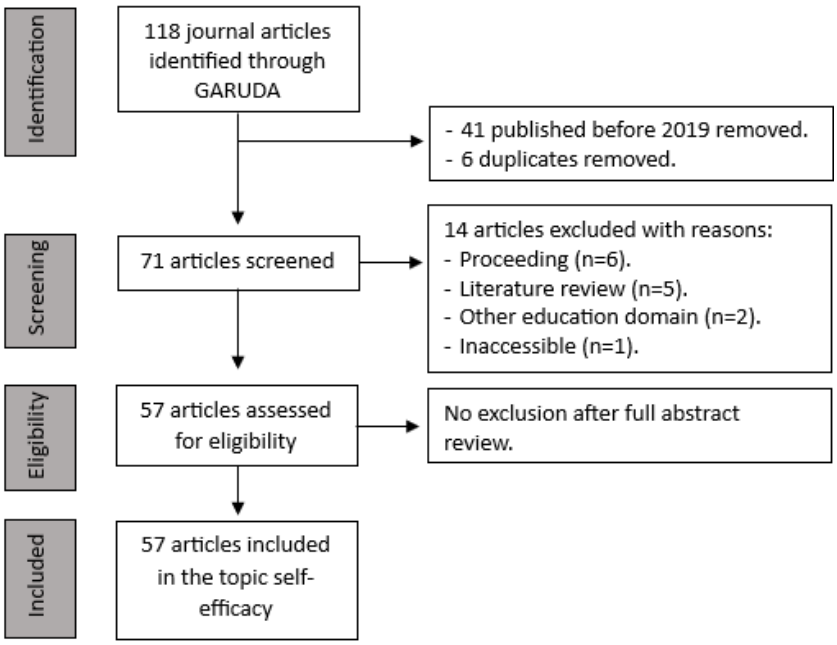
were reduced to 77 after filtering for publication years between 2019 and 2024. The number was further narrowed to 71 following the removal of duplicates. A final sample of 57 articles was obtained after an in-depth review that excluded studies not meeting the predefined criteria. To ensure consistency and reliability in the article selection process, the review was conducted twice over a two-week period. No discrepancies were found between the two rounds of screening, indicating perfect intra-rater reliability. The detailed selection procedure is illustrated in Figure 1, presented in the form of a PRISMA flow diagram.

Figure 1
PRISMA Flowchart for Article Selection.



Data Analysis

The data analysis was conducted in three distinct phases. First, all included articles were thoroughly reviewed, and relevant data pertaining to the scope, methodology, sample size, theoretical frameworks or approaches, and key findings of each study were systematically extracted and organized into a spreadsheet. This process facilitated the classification of articles into various analytical categories. During this phase, a coding scheme was developed and refined to enable efficient categorization of the collected data. Subsequently, several analytical methods were employed:

1. Word Cloud Analysis was used to examine keyword frequency. The initial step involved identifying key terms representing variables within the article titles. These keywords were then extracted using a web-based software tool. The resulting word list was edited to remove conjunctions and prepositions (such as *and*, *on*, *in*, *toward*, *with*, etc.), as well as terms unrelated to the research variables. Additionally, semantically equivalent terms were consolidated. For instance, *parenting style* and *parental upbringing* were treated as identical concepts.
2. Time Series Analysis was applied to track changes in research topics over time.

Finally, the analysis results were presented clearly and concisely using tables, figures, and graphs to effectively communicate the key findings. For each coding step, the first author independently performed the initial coding. This was followed by discussions to evaluate the proposed categorizations, culminating in a consensus on the final categorization scheme.

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Results and Discussions

Keyword Analysis in Self-Efficacy-related Research Papers

Upon scrutinizing the top 20 keywords as a result of keyword analysis, Table 3 reveals several significant findings. Initially, terms such as “effect”, “student”, “learning outcomes”, “relationship”, “university student”, “problem solving ability”, “learning achievement”, “analysis”, “independent learning”, and “learning motivation” are predominant. It is discernible that mathematics education research in Indonesia, concerning self-efficacy, predominantly concentrates on the learner rather than the teacher. Furthermore, the results of the keyword analysis indicate a pronounced focus on the ‘effect’, ‘students’, and ‘learning outcomes’ of self-efficacy across various educational contexts, notably in the students’ mathematical abilities, affective aspect, and mathematics learning lessons. These findings are consistent with those reported by Street et al. (2024), who observed that, although numerous studies have examined students’ mathematics performance, a greater proportion has increasingly emphasized affective and motivational variables, reflecting the broader “affective turn” in mathematics education research. Figure 2 is a word cloud shaped like a question mark, which visually represents the most frequently occurring words in research related to self-efficacy and learning outcomes in mathematics education.

Table 2

Keyword Analysis in Self-Efficacy-related Research Papers

Rank	Word	Translation	Frequency
1	pengaruh	effect	32
2	siswa	students	30
3	hasil belajar	learning outcomes	20
4	hubungan	relationship	9
5	mahasiswa	university student	9
6	kemampuan pemecahan masalah	problem solving ability	8
7	prestasi belajar	learning achievement	7
8	analisis	analysis	6
9	kemandirian belajar	independent learning	6
10	motivasi belajar	learning motivation	6
11	kecemasan matematika	math anxiety	5
12	SMA	high school	4
13	SMP	secondary school	4
14	dasar	primary school	3
15	kemampuan berpikir kreatif	creative thinking ability	3
16	kemampuan berpikir kritis	critical thinking ability	3
17	minat belajar	learning interest	3
18	pembelajaran	learning	3
19	daring	online	2
20	e-learning	e-learning	2

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Figure 2
Word Cloud in Research Related to Self-Efficacy

Figure 2 reveals that frequently occurring terms such as *"siswa"* (students), *"pengaruh"* (influence), *"hubungan"* (relationship), and *"prestasi belajar"* (learning achievement) indicate a predominant research emphasis on the relationship between self-efficacy and students' academic performance. This pattern is consistent with the findings of Shone et al. (2023), who demonstrated that mathematics self-efficacy is a significant predictor of students' mathematics achievement.

Moreover, the prominence of terms such as *"motivasi belajar"* (learning motivation), *"kemandirian belajar"* (learning independence), and *"kemampuan berpikir kritis"* (critical thinking ability) suggests that the literature increasingly positions self-efficacy as a critical factor in fostering students' cognitive and metacognitive development. The occurrence of *"kecemasan matematika"* (mathematics anxiety) and *"minat belajar"* (learning interest) further underscores the importance of affective and psychological dimensions in shaping learning outcomes. In this regard, Shone et al. (2023) conceptualize students' self-efficacy not only in terms of their perceived capability to perform mathematical tasks but also in relation to their levels of anxiety, highlighting the interplay between competence beliefs and emotional states in mathematics learning.

The overall structure of the word cloud, shaped like a question mark, signifies the exploratory nature of self-efficacy research, raising inquiries about the factors that enhance or hinder students' confidence in mathematics learning. Words like "analisis" (analysis) and "penelitian" (research) highlight the focus on empirical studies, while the distinct placement of "hasil belajar" (learning outcomes) and "kemampuan pemecahan masalah" (problem-solving skills) in yellow suggests these are overarching research themes. The image conveys that self-efficacy research is not only concerned with academic

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performance but also with broader cognitive and emotional aspects that contribute to student success in mathematics.

The Primary Topics in Self-Efficacy-related Research Papers

Table 3 presents a structured overview of the major themes explored in self-efficacy research. The analysis reveals several recurring topics that scholars focus on when investigating self-efficacy.

Table 3

Primary Research Topics in Self-Efficacy Studies within Mathematics Education

No.	Themes Found	Study	Frequency(%)
1.	Academic Achievement	Uran et al., 2019; Setyowati et al., 2019; Aswin et al., 2019; Arsyad et al., 2020; Suryani et al., 2020; Umbara & Sudihartinih, 2020; Suryani et al., 2020; Seto et al., 2020; Rangkuti et al., 2021; Sutrisno & Yusri, 2021; Hardimansyah et al., 2021; Farochmah & Leonard, 2021; Nur, 2021; Azizah et al., 2021; Arif et al., 2021; Sriyanti et al., 2021; Salsabila et al., 2021; Nur, 2022; Dwijayanti et al., 2022; Azizah et al., 2022; Ismayati et al., 2022; Ernawati & Ilhamuddin, 2022; Pratiwi, 2022; Ningsih, 2023; Nuraidah et al., 2023; Rahmayanti et al., 2024	26(45.6%)
2.	Problem-Solving Ability	Pratiwi et al., 2019; Kholiva et al., 2020; Alam et al., 2022; Zilfit et al., 2023; Fazriyah & Hadi, 2023; Vernelli, 2023; Euneke & Kaluge, 2024; Luhinar & Nugraheni, 2024; Ahmad & Dewi, 2024	9(15.8%)
3.	Intervention and Instructional Strategy	Wulanningtyas, 2019; Widyastuti et al., 2019; Nurani & Alsa, 2021; Desnatalia, 2022	5(8.8%)
4.	Affective Factors	Fitasari et al., 2019; Safithry, 2021; Paramitha & Ajisuksmo, 2021; Susanto et al., 2023	4(7.0%)
5.	Conceptual understanding ability	Resya, 2019; Akuba et al., 2020; Supriyatin & Masanggeni, 2022	3(5.3%)
6.	creative thinking ability	Nihayah, 2020; Prasetyo, 2023	2(3.5%)
7.	critical thinking ability	Agus, 2021; Fitriyani & Miatun, 2022	2(3.5%)
8.	Learning difficulties	Putri & Apriyanti, 2021; Susanto & Apriyanti, 2022	2(3.5%)
9.	Mathematical knowledge competence	Wulandari & Agustika, 2020	1(1.8%)
10.	Development of Instrument	Abdal et al., 2023	1(1.8%)
11.	Learning motivation	Quraisy & Agus, 2021	1(1.8%)
12.	Innovative behavior	Permana & Rusmana, 2022	1(1.8%)

Table 3 demonstrates that research on self-efficacy within the context of mathematics education in Indonesia predominantly centers on its influence on academic achievement, accounting for 45.6% of the studies (*f* = 26). Other areas of focus include problem-solving ability (*f* = 9, 15.8%), interventions and instructional strategies (f = 5, 8.8%), affective factors such as mathematics anxiety and parenting style (f = 4, 7.0%), and conceptual understanding (f = 3, 5.3%). In contrast, considerably less attention has been devoted to creative thinking, critical thinking, and learning difficulties, each comprising only 3.5% of the research. Furthermore, studies addressing mathematical knowledge competence, instrument

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development, learning motivation, and innovative behavior are notably limited, with each representing only 1.8% of the total.

A substantial body of empirical evidence supports the pivotal role of self-efficacy in promoting mathematics achievement. For instance, Uran et al. (2019) found that self-efficacy, in conjunction with teacher-provided social support, exerted a significant influence on students' mathematical performance. Similarly, Farochmah and Leonard (2021), utilizing a correlational research design, reported a positive and statistically significant relationship between students' mathematics self-efficacy and their academic outcomes. These findings are consistent with theoretical propositions that individuals with high self-efficacy are more inclined to engage with mathematical tasks confidently, implement effective problem-solving strategies, and demonstrate persistence in overcoming challenges—factors that collectively contribute to enhanced academic achievement.

Moreover, in the context of the COVID-19 pandemic, Nur (2022) examined the role of mathematics self-efficacy in supporting academic achievement during remote learning. Her findings revealed that self-efficacy remained a robust predictor of students' mathematics performance, even amid the challenges of online education. This reinforces the notion that self-efficacy is a stable and influential factor across varied instructional settings and learning modalities.

Several studies highlight the role of self-efficacy in enhancing students' mathematics performance, often in relation to external factors such as teacher support and instructional strategies. For example, Additionally, research by Wulanningtyas (2019) explored how different teaching methodologies, such as problem-posing approaches, could enhance students' self-efficacy, suggesting that active learning strategies contribute positively to students' confidence in solving mathematical problems. This indicates that fostering self-efficacy through effective pedagogical techniques can lead to improved learning outcomes.

Another key area of research examines the relationship between self-efficacy and learning motivation, independence, or attitudes. Studies such as Widyastuti et al. (2019) have shown that students with higher self-efficacy tend to exhibit greater interest and engagement in mathematics learning. This aligns with findings from other research indicating that self-efficacy influences not only academic performance but also students' willingness to persist in challenging tasks. Methodologically, most studies employ quantitative approaches, including statistical analyses like multiple regression and quasi-experiments, to assess the effects of self-efficacy on learning outcomes. Moreover, the predominant research sample consists of junior high school students (Grades 7 and 8), reflecting a focus on early adolescent learners. These studies collectively emphasize the importance of integrating self-efficacy-enhancing strategies into mathematics education to promote both academic success and student engagement.

Primary Topics Evolution Over Time in Math Self-Efficacy

The number of articles published over time indicates how frequently research on this topic was conducted within each period. To further analyze these trends, the study used a time series analysis to track changes in research focus on mathematics self-efficacy. Beginning with an overview of the evolution of research on mathematics education self-efficacy in Indonesia, Figure 3 shows the initial appearance of such studies in 2019, marked by eight publications. Subsequently, the number of studies rose to 10 in 2020 and then surged to 16 by 2021. After a slight decline following 2021—likely due to the disruptions caused by COVID-19—the number of publications dropped significantly, reaching just four by 2024.

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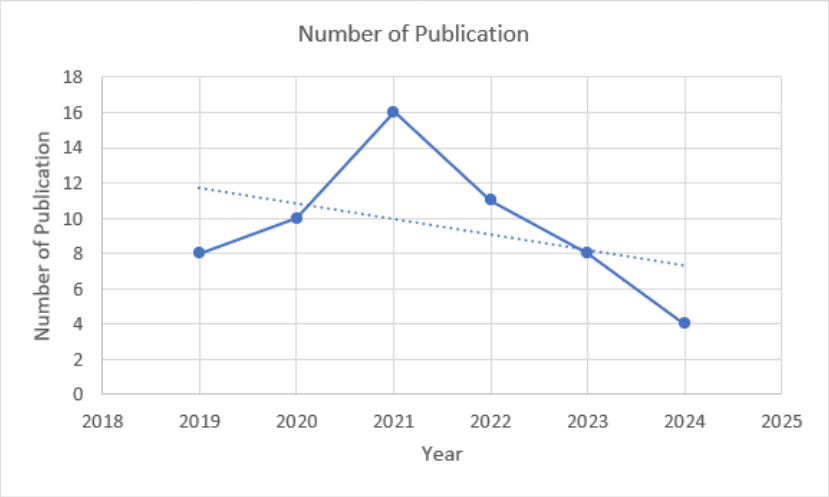
Figure 3

Number of Papers Published from 2019 to 2024 within Indonesia's Mathematics Education Milieu.



This decline can be partly attributed to the introduction of an updated self-efficacy model toward the end of 2022, which offered new perspectives and a refinement over earlier self-efficacy frameworks. This shift may have resulted in decreased interest among mathematics education scholars in previous self-efficacy models, redirecting their focus within the field. This trend suggests an expected, continued decline in traditional self-efficacy-focused scholarship in this domain.

Moreover, such temporal patterns not only reflect shifts in scholarly interest but also signal broader transformations in the theoretical and methodological landscape of mathematics education research in Indonesia. The emergence of the updated self-efficacy model has likely prompted Indonesian scholars to re-examine existing paradigms, leading to a transitional phase in which prior frameworks are critically reassessed and integrated with new conceptual developments. This transitional period may also correspond with an increased emphasis on interdisciplinary approaches, where mathematics self-efficacy is examined alongside related constructs such as motivation (Amjad et al., 2025), metacognition (Guntur & Purnomo, 2024; Tak et al., 2022), and socio-emotional factors in learning, such as mathematics anxiety (Hiller et al., 2021) and mathematics enjoyment (Živković et al., 2023). Consequently, while the numerical decline in publications might be interpreted as a contraction in the field, it may instead represent a reorientation of research agendas toward more nuanced, integrative, and context-specific explorations of self-efficacy in mathematics education within the Indonesian educational milieu.

Conclusions

This study offers a comprehensive overview of prevailing trends in self-efficacy research within the context of mathematics education in Indonesia. Keyword and thematic analyses reveal that the majority of studies emphasize learner-centered constructs—particularly the influence of self-efficacy on student outcomes such as learning achievement, problem-solving ability, motivation, and cognitive development. The predominance of terms like *effect*, *student*, *learning outcomes*, and *motivation* underscores a research landscape primarily concerned with the impact of self-efficacy on academic performance, while also acknowledging its interplay with emotional factors such as math anxiety and learning interest.

Furthermore, thematic exploration highlights that Indonesian mathematics education research often positions self-efficacy as a mediating variable influenced by instructional strategies and teacher support. Empirical studies largely adopt quantitative methodologies and frequently focus on junior high school students, suggesting a targeted yet somewhat limited scope of inquiry. The reliance on these

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methodological approaches and demographic profiles, while providing consistency, may also constrain the generalizability of findings across broader educational contexts.

Temporal analysis further indicates a peak in publication activity around 2021, followed by a marked decline in subsequent years. This reduction may be attributed to both the global impact of the COVID-19 pandemic and the emergence of revised conceptual models of self-efficacy. The introduction of these updated frameworks appears to have shifted scholarly attention away from earlier paradigms, signalling a potential pivot in research priorities.

However, this study has several limitations that should be acknowledged. First, the review relied exclusively on the GARUDA database, which may have limited the breadth of the literature included. Although GARUDA provides extensive coverage of Indonesian scholarly publications, it does not fully represent studies indexed in major international databases such as Scopus or Web of Science. As a result, the findings of this review may primarily reflect a national perspective and may not fully capture global trends in mathematics self-efficacy research.

Given this limitation, future studies are encouraged to expand their data sources by incorporating multiple international and regional databases to obtain a more comprehensive and balanced overview of the field. Such an approach would allow for cross-contextual comparisons and strengthen the generalizability of findings. In addition, further research could adopt bibliometric or meta-analytic methods to provide deeper insights into research patterns, methodological rigor, and the overall development of mathematics self-efficacy studies.

These findings also suggest that while self-efficacy remains a critical construct in understanding mathematics learning, future research should diversify in terms of methodology, participant demographics, and theoretical perspectives. Broader integration of qualitative and mixed-methods approaches, alongside a focus on underrepresented student populations and evolving self-efficacy models, may offer deeper insight into the multifaceted role self-efficacy plays in mathematical learning and instruction.

Declaration of Conflicting Interests

The authors report no conflicts of interest related to the research, authorship, and/or publication of this article.

About the Authors

Andi Mariani Ramlan is a distinguished lecturer at Universitas Sembilanbelas November Kolaka. She earned her doctoral degree (Ph.D.) in Mathematics Education from the State University of Surabaya. Her scholarly pursuits are predominantly situated within the domain of mathematics education, with a pronounced emphasis on higher-order cognitive processes. These include, but are not limited to, geometric reasoning, proportional reasoning, mathematical communication, creative thinking, and complex problem-solving. Furthermore, her research trajectory extends to critical non-cognitive constructs, encompassing personality typologies, self-efficacy, self-regulated learning, and motivational dynamics, thereby reflecting a comprehensive and integrative academic orientation.

Sri Muliana Ramlan is an accomplished educator at Madrasah Aliyah Negeri 1 Kolaka. She holds a master's degree from Halu Oleo University. Her academic interests are intricately aligned with the pedagogy of mathematics, particularly in the areas of geometric reasoning and problem-solving. Her unwavering commitment to educational excellence is exemplified through her proactive engagement in cultivating students' self-confidence via a diverse array of extracurricular endeavors that synergistically reinforce her pedagogical role, including the Youth Red Cross (PMR), scouting, and mathematics olympiads.

Fitri Ramdani is a dedicated teacher at Sekolah Menengah Atas Negeri 1 Latambaga. She obtained her master's degree from Halu Oleo University. Her intellectual engagement is centered on the theory and practice of mathematics teaching and learning. Her professional dedication is manifested in her sustained efforts to enhance students' self-confidence through active participation in extracurricular activities that complement her instructional responsibilities, such as basketball, creative decoration, and photography, thereby fostering holistic student development.

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The asterisk (*) indicates that the paper is included in the systematic review.

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