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## A SYSTEMATIC LITERATURE REVIEW: MATHEMATICAL CONNECTION ABILITY REVIEWED FROM SELF-EFFICACY

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### Abstract

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The primary purpose of mathematics education is to prepare students to address real-life problems by applying mathematical knowledge and skills. A key competency in this regard is the ability to establish mathematical connections, since mathematics itself is a coherent discipline with interrelated concepts. Confidence in one's own ability to complete tasks and achieve outcomes—commonly referred to as self-efficacy—is a psychological aspect that strongly influences learning success, particularly in linking mathematical ideas. This research aims to conduct a systematic literature review (SLR) focusing on students' mathematical connection skills from the perspective of self-efficacy. The SLR method involves identifying, analyzing, and synthesizing relevant academic works. In this study, 12 articles published between 2020 and 2025 were selected from the Google Scholar database using the Publish or Perish application with the keywords "mathematical connection abilities" and "student self-efficacy." The findings reveal that: (1) self-efficacy significantly influences students' mathematical connection skills; (2) differences in connection ability are evident depending on students' levels of self-efficacy; and (3) most studies during this period applied either qualitative or quantitative approaches, with the majority conducted at the junior high school level.

**Keywords:** Mathematical Connections; Self-efficacy; SLR

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## INTRODUCTION

The rapid advancement of science and technology demands that students go beyond mastering individual concepts, requiring them to integrate multiple ideas into practical solutions for complex challenges, both in academic settings and daily life. Within mathematics education, this competency is referred to as mathematical connection skills, which involve linking concepts across mathematical topics, associating mathematics with other fields of study, and applying mathematical principles to real-world problems (Sopian & Sabandar, 2018). Nevertheless, international data reveal that Indonesian students still have weak mathematical connection skills. Evidence from the 2018 Programme for International Student Assessment (PISA) shows Indonesia ranked 74th out of 79 participating countries, with a mathematics literacy score of 379—considerably lower than the OECD average of 487 (Mulyana et al., 2021). These results highlight a substantial gap in students' mathematical proficiency, particularly in their ability to make mathematical connections.

Mathematical connection skills are not developed in isolation but are shaped by both internal and external factors, with one key influence being the psychological aspect

known as self-efficacy. Self-efficacy refers to an individual's confidence in their ability to accomplish tasks or overcome specific challenges (Bandura, 1997). This belief drives students to take initiative, remain persistent, and apply strategies in problem-solving, which in turn enhances cognitive abilities such as mathematical connection skills (Munawaroh et al., 2018). Within the scope of mathematics learning, self-efficacy is essential in determining how consistently students confront problems, select effective learning strategies, and actively investigate the interrelations among mathematical concepts (Maulida et al., 2019). Learners with higher self-efficacy generally exhibit stronger participation, independence in learning, and confidence in linking complex mathematical ideas, all of which contribute to strengthening their mathematical connection abilities (Mukhtari et al.).

From an applied standpoint, both mathematical connection skills and self-efficacy play an important role in helping students develop into independent and reflective problem solvers. Students who have confidence in their abilities are more inclined to examine multiple solution paths, experiment with alternative methods, and relate their learning to real-life contexts. Thus, incorporating both cognitive and affective dimensions becomes essential in the design of mathematics learning (Indriani & Sritresna, 2022). Based on these conditions, this study aims to (1) describe the influence of self-efficacy on students' mathematical connection abilities according to the findings of previous studies; (2) describe variations in the level of mathematical connection abilities viewed from the level of students' self-efficacy; (3) describe research trends during 2020-2025 related to self-efficacy on mathematical connections.

## **METHODS**

This research employs the Systematic Literature Review (SLR) method, which is designed to identify, analyze, and integrate findings from previous studies concerning mathematical connection skills within the framework of self-efficacy. The SLR approach is recognized as systematic, transparent, and replicable, making it appropriate for establishing a solid theoretical basis and mapping research trends in a given field (Synder, 2019). According to Triandini et al. (2019), the SLR process consists of several stages: (1) formulating research questions, (2) conducting the search process, (3) applying inclusion and exclusion criteria, (4) evaluating the quality of studies, and (5) extracting and analyzing data.

The process of implementing this study begins with the first stage, namely formulating research questions (Research Questions/RQ) as a basis for the search. The RQs in this study include: (RQ1) Does self-efficacy influence the improvement of students' mathematical connection abilities?; (RQ2) How is the level of mathematical connection abilities viewed from self-efficacy?; (RQ3) How is the presentation of research trends in 2020-2025 regarding mathematical connection abilities viewed from self-efficacy?. Each RQ will be the basis for the direction of this research.

The second stage is the literature search process, which was collected through the Google Scholar database using the Publish or Perish application, using the keywords "mathematical connection ability" and "self-efficacy." The search was limited to articles published between 2020 and 2025 to ensure the relevance of the data used (Triandini et al., 2019).

The third stage involves selecting articles using inclusion and exclusion criteria. Articles considered for inclusion are those published in national or international journals, relevant to the research focus, written in either Indonesian or English, and accessible in

full text. Conversely, studies that are duplicates, unrelated to the main topic, or not available in full form are excluded from the review (Okoli & Schabram, 2010). This selection process is intended to ensure that the data gathered is appropriate and valid for use in the SLR study.

**Table 1.**

Inclusion Criteria

<b>Criteria</b>	<b>Type</b>
National or international journals that are relevant to mathematical connection skills reviewed from the perspective of self-efficacy	Inclusion
Journals published in the period 2020-2025	Inclusion
Journals that have been published and included in Google Scholar	Inclusion
The language used is Indonesian or English	Inclusion

*Source: Researcher*

The fourth stage is assessing the quality of the selected articles (Quality Assessment/QA) by examining several key criteria. In this study, the QA covered: (1) whether the journal was published between 2020 and 2025, (2) whether it specified the type of research conducted, and (3) whether it described how students' mathematical connection skills were analyzed from the perspective of self-efficacy. Each criterion was evaluated with a "yes" or "no" response. The purpose of this quality assessment is to guarantee that only studies with sufficient scientific credibility are included in the review.

The fifth stage is data extraction, which focuses on compiling essential information from each article that has been selected. The data gathered covers aspects such as the study background, research methodology, key findings, and the educational level of the participants. Afterward, the information is analyzed to reveal trends, similarities, differences, and unresolved gaps in the research. This step aligns with the framework outlined by Kitchenham & Charters (2007), emphasizing the importance of a systematic process to preserve the accuracy and credibility of the literature review.

By applying this approach, the study not only synthesizes prior research outcomes but also offers conceptual insights that can be used as a basis for future investigations in mathematics education. In particular, it highlights the role of affective factors such as self-efficacy in enhancing students' mathematical connection skills (Wahyuni & Hidayat, 2023).

## **RESULTS & DISCUSSION**

### ***Results***

A literature search was carried out using Publish or Perish with the Google Scholar database for the 2020–2025 period, applying the keywords "mathematical connection skills and self-efficacy." This process initially identified 840 articles. After applying the inclusion criteria, 12 journal articles were deemed relevant and selected for review. The extracted literature data are summarized in Table 2.

**Tabel 2.**  
 Classification of Selected Literature

<b>Writer</b>	<b>Publication</b>	<b>Educational Level</b>	<b>Types of Research</b>	<b>Indexation</b>
(Emmanuel et al, 2023)	JPR (Journal of Pedagogical Reasearch)	SMA	Quantitative	Scopus
(Fitrania & Fajar, 2022)	UJME : Unnes Journal of Mathematics Education	SMP	Mix Method	Sinta 3
(Asmara et al., 2021)	JNPM: Jurnal Nasional Pendidikan Matematika	SMA	Quantitative	Sinta 3
(Lestari et al., 2022)	J-KIP: Jurnal Keguruan dan Ilmu Pendidikan	SMA	Qualitative	Sinta 4
(Yanuar & Badu, 2020)	MEJ : Mathematics Education Journals	SMP	Quantitative	Sinta 4
(Fahira & Zaenuri, 2023)	UJME : Unnes Journal of Mathematics Education	SMP	Mix Method	Sinta 3
(Hamdany et al., 2023)	Indo-MathEdu Intellectuals Journal	SMK	Qualitative	Sinta 5
(Urfa et al.,2023)	Jurnal Lebesgue: Jurnal Ilmiah Pendidikan Matematika, Matematika dan Statistika	SMK	Quantitative	Sinta 4
(Nadiyah et al.,2023)	Jurnal Mathedunesa	SMK	Qualitative	Sinta 4
(Santi Widyawati et al., 2025)	Al Jabar : Jurnal Pendidikan Matematika	SMP	Quantitative	Sinta 2
(Ayu et al.,2022)	Jurnal Pendidikan MIPA	SMP	Qualitative	Sinta 2
(Nabilah & Surahmat, 2024)	JIPMat (Jurnal Ilmiah Pendidikan Matematika)	SMP	Qualitative	Sinta 3

*Source: Researcher*

Researchers obtained 12 relevant articles for review regarding students' mathematical connection skills from a self-efficacy perspective. The research data contained in these articles are collected in Table 3.

**Table 3.**  
 Relevant Source Analysis

<b>Writer</b>	<b>Research Result</b>
(Emmanuel et al, 2023)	The findings indicate that the self-efficacy and mathematical connection skills of general science students have a direct effect on their mathematics performance. These factors also play a mediating role by influencing how students' study interest contributes to their success in mathematics. On the other hand, no significant link was found between students' perceptions of mathematics and their level of interest or achievement. To reach academic success, learners are encouraged to consistently assess the effectiveness of their study strategies, build strong confidence in their mathematical

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	abilities, and recognize connections between mathematics and other STEM fields, as these practices can enhance both their interest and achievement in mathematics. Furthermore, the study advises policymakers, curriculum designers, and STEM educators to strengthen the integration of mathematics into various STEM domains, as this may directly raise student performance and foster greater enthusiasm for mathematics learning.
(Fitrania & Fajar, 2022)	The study produced several key findings: (1) students' mathematical connection skills in the REACT model combined with the RME approach met the standard of learning mastery; (2) on average, students taught with REACT and RME demonstrated higher mathematical connection skills compared to those taught through expository instruction; (3) students' levels of self-efficacy created variations in their mathematical connection abilities under REACT with RME; and (4) learners with strong self-efficacy were able to achieve all three indicators of mathematical connection skills, those with moderate self-efficacy managed to meet the indicators but required additional practice, while those with low self-efficacy could only reach the second indicator.
(Asmara et al., 2021)	This research examines the enhancement of students' mathematical connection skills and self-efficacy through the implementation of the 7E learning cycle model. The findings show that learners taught with the 7E cycle demonstrated greater improvement in mathematical connection skills compared to those taught with traditional methods. Additionally, the 7E learning cycle was found to strengthen students' self-efficacy, as it emphasizes student-centered learning and is grounded in constructivist approaches.
(Lestari et al., 2022)	The findings reveal that students' mathematical connection skills develop more effectively when supported by higher levels of self-efficacy. Learners with strong self-efficacy were able to meet all three indicators of mathematical connection: (1) linking concepts within mathematics, (2) relating mathematics to other scientific disciplines, and (3) applying mathematics to real-life situations. Those with moderate self-efficacy could only achieve one of these indicators, while students with low self-efficacy generally failed to demonstrate any of the mathematical connection indicators.
(Yanuar & Badu, 2020)	Students' mathematical connection skills showed improvement, as reflected by the rising average scores on mathematical connection tests across cycles. Similarly, the mean score for each indicator of the mathematical connection test also demonstrated growth. In terms of self-efficacy, progress was evident through the increased average scores of the self-efficacy questionnaires in each cycle, with each indicator within the questionnaire also exhibiting higher values.
(Fahira & Zaenuri, 2023)	The findings of the study indicate that: (1) the percentage of students achieving mathematical connection skills at or above the minimum mastery criteria in the CONINCON model with ethnomathematics elements exceeded the 75% completeness threshold; (2) students taught using the CONINCON approach with ethnomathematics displayed stronger mathematical connection skills compared to those taught with a Problem-Based Learning model; (3) self-efficacy contributed significantly to mathematical connection skills, accounting for 68.7% of the variance;

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(Hamdany et al., 2023)	<p>and (4) the description of students' mathematical connection abilities varied according to their self-efficacy level: (a) those with high self-efficacy were able to meet all indicators, (b) those with moderate self-efficacy achieved two indicators but struggled with the others, and (c) students with low self-efficacy only managed to fulfill one indicator.</p> <p>This research examines the self-efficacy of vocational high school students in relation to their mathematical connection skills. The results reveal that students' attainment of mathematical connection indicators remains relatively low, with only 31% achieving the indicator related to connections with other disciplines and merely 0.69% reaching the indicator linked to everyday life. Such low performance is attributed to students' self-efficacy, which was classified as weak in terms of strength and poor in both magnitude and generality.</p>
(Urfa et al.,2023)	<p>This research aimed to enhance vocational high school students' mathematical connection skills and self-efficacy through video-assisted learning with Edpuzzle. The findings showed that the experimental group experienced greater improvement in both mathematical connection skills and self-efficacy compared to the control group. Edpuzzle functioned as an engaging learning medium in the classroom, which was reflected in the higher level of student responses in the experimental class (26.31%) compared to the control class (17.78%).</p>
(Nadiyah et al.,2023)	<p>This research analyzes vocational high school students' mathematical connection skills from the perspective of self-efficacy. The findings indicate that learners with high self-efficacy successfully achieved all three indicators of mathematical connection ability. Among students with moderate self-efficacy, one was able to fulfill two indicators while another managed to meet all three. Similarly, within the low self-efficacy group, one student only accomplished two indicators, whereas the other reached all three indicators of mathematical connection ability.</p>
(Widyawati et al., 2025)	<p>The study concludes that the Connected Mathematics Project (CMP) model provides a significant improvement in students' mathematical connection abilities compared to traditional instructional methods. This approach effectively supports students in relating mathematical concepts to real-world contexts and to other disciplines. Self-efficacy also plays a positive role, with students who possess higher confidence demonstrating stronger mathematical connections. Nonetheless, the impact of the CMP model appears consistent regardless of students' self-efficacy levels, indicating its applicability to a wide range of learners. Overall, these results emphasize the value of contextual and problem-based learning strategies, while also acknowledging the influence of psychological aspects such as self-efficacy in fostering academic achievement.</p>
(Ayu et al.,2022)	<p>This study concludes that learners with strong self-efficacy can successfully meet all three indicators of mathematical connection skills, indicating a high level of connection ability. Those with moderate self-efficacy managed to achieve two indicators, as they often struggled to fully grasp the concepts presented. Meanwhile, students with low self-efficacy were only able to fulfill one indicator, reflecting limited ability in linking mathematical concepts. Overall, students' self-efficacy was still categorized as low, as many appeared uncertain or hesitant when solving problems.</p>

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(Nabilah & Surahmat, 2024)	The findings revealed that undergraduate students with strong self-efficacy displayed high confidence in problem-solving, engaged actively, and communicated effectively, even when making conceptual mistakes. They showed persistence and confidence in correcting errors. Graduate students at the master's level, who demonstrated moderate self-efficacy, were able to begin solving problems with confidence and apply fundamental formulas appropriately, yet they often hesitated in subsequent steps and sought external validation, although their communication remained good. In contrast, doctoral students with low self-efficacy struggled to comprehend problems, tended to be passive, gave up quickly, relied more frequently on external help, and had weaker communication skills.
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*Source: Researcher*

### **Discussion**

#### **(RQ1) Does self-efficacy influence the improvement of students' mathematical connection abilities?**

Self-efficacy is an individual's belief in their ability to organize and execute the actions necessary to achieve specific outcomes. In the context of mathematics learning, self-efficacy plays a crucial role in encouraging students to think reflectively, actively participate in the learning process, and bravely face complex cognitive challenges. Based on the literature review presented in Table 3, it can be concluded that self-efficacy significantly influences students' mathematical connection skills. Students with high levels of self-efficacy tend to be better at connecting mathematical concepts, linking them to other disciplines, and applying them in everyday life (Ardiani et al., 2021).

Research using constructivist-based learning models such as CONINCON and the 7E learning cycle shows that learning that emphasizes active student involvement, conceptual understanding, and interconnectedness can simultaneously improve self-efficacy and mathematical connection skills (Ayu & Sari, 2021). Furthermore, the use of technology-based media such as Edpuzzle has also been shown to positively contribute to both aspects (Urfa et al., 2023), demonstrating that interactive media can increase student participation and confidence in understanding and connecting mathematical concepts. Furthermore, findings from (Hamdany et al, 2023) indicate that low achievement in mathematical connection indicators in vocational high school students correlates with low levels of self-efficacy, particularly in the aspects of magnitude, strength, and generality. This strengthens the assumption that developing self-confidence is a crucial component in meaningful and applicable mathematics learning.

Based on these findings, it can be concluded that self-efficacy plays a key role not only as a supporting factor but also as a key determinant in improving students' mathematical connection skills. Students who are confident in their abilities will be more motivated to construct meaning, explore relationships between concepts, and transfer knowledge across contexts. Therefore, learning interventions designed to enhance self-efficacy should be a primary focus in mathematics learning development strategies at all levels of education.

#### **(RQ2) How is the level of mathematical connection ability viewed from the perspective of self-efficacy?**

Mathematical connection skills are a crucial aspect of mathematics learning, reflecting students' ability to connect mathematical concepts, integrate mathematics with

other disciplines, and apply them in everyday life. Assessment of these skills is not solely based on cognitive aspects but is also influenced by affective factors, one of which is self-efficacy.

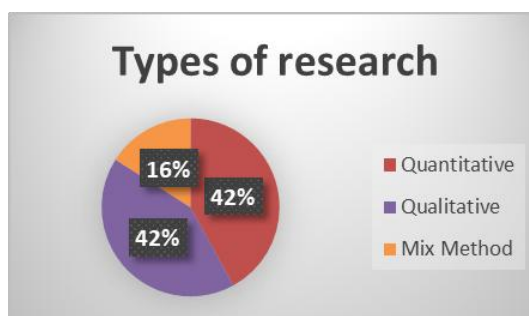
Based on the results of the literature review listed in Table 3, it was found that students' self-efficacy levels were directly proportional to their mathematical connection skills. Students with high self-efficacy generally demonstrated more comprehensive and in-depth mathematical connection indicators. For example, research by Lestari et al. (2022) showed that students with excellent self-efficacy were able to fully fulfill all three mathematical connection indicators: connections between concepts in mathematics, connections with other fields of study, and connections with everyday life. Meanwhile, students with moderate self-efficacy were only able to fulfill one indicator, and those with low self-efficacy tended to be unable to fulfill any of these indicators.

Similar findings were also revealed by Faizah et al. (2024), who stated that students with high self-efficacy met five indicators of mathematical connections, while students with moderate self-efficacy only met four indicators, and students with low self-efficacy only achieved two indicators. Research by (Nadiyah et al, 2023) also supports these findings by showing that the higher the self-efficacy category of students, the greater the likelihood of them meeting all indicators of mathematical connections.

A qualitative study by Nabilah & Surahmat (2024) illustrates in depth how differences in self-efficacy levels influence students' ability to understand and solve mathematical problems requiring conceptual connections. Subjects with high self-efficacy demonstrate courage in exploring ideas, are able to communicate their thoughts clearly, and persist in facing mistakes. Conversely, subjects with low self-efficacy tend to be passive, give up easily, and require a lot of external assistance. Even in the context of vocational high school students, research by (Hamdany et al, 2023) shows that mathematical connection achievement, particularly in terms of connections with other disciplines (31%) and daily life (0.69%), is very low. This is directly linked to suboptimal levels of self-efficacy, particularly in the aspects of magnitude and generality.

Thus, students' mathematical connection skills are significantly influenced by their self-efficacy. Students with high self-efficacy are not only more confident in solving problems but also better able to connect concepts broadly and relevantly. Conversely, students with low self-efficacy tend to be limited in their conceptual connections and practical applications. Therefore, improving self-efficacy needs to be a primary focus in efforts to strengthen students' mathematical connection skills at various levels of education.

**(RQ3) How is the presentation of research trends in 2020-2025 regarding mathematical connection abilities viewed from the perspective of self-efficacy?**



**Figure 1**  
Type of Research

The types of research used to examine students' mathematical connection skills, from a self-efficacy perspective, include qualitative, quantitative, and mixed methods. Based on Figure 1, during the 2020-2025 period, research related to students' mathematical connection skills, from a self-efficacy perspective, predominantly used qualitative and quantitative methods, accounting for 42%. Meanwhile, 16% of research used mixed methods.



**Figure 2.**  
Research Levels

Figure 2 shows that research conducted at the junior high school level has the largest percentage, at 50%. Then at the senior high school level, the percentage is 25%, and the percentage of research at the vocational high school level is 25%. Based on Figure 2, it can be concluded that students' mathematical connection skills, viewed from a self-efficacy perspective, are more frequently conducted at the junior high school level.

## CONCLUSION

Based on the results and discussions that have been presented, it can be concluded that self-efficacy influences students' mathematical connection abilities with the indicators of mathematical connection abilities recommended by researchers are the mathematical connection indicators recommended by Mumcu & Aktas (2018) namely connections between concepts in mathematics, connections between mathematics and other fields of science, and connections between mathematics in everyday life. In addition, appropriate learning models can be added so that students can have varied experiences and learn actively during the learning process. There are differences in the level of mathematical connection abilities based on self-efficacy. Students with high self-efficacy have high mathematical connection abilities, meaning that students can fulfill all indicators of mathematical connection abilities. Students with moderate self-efficacy have good mathematical connection abilities but are not optimal, meaning that students are only able to fulfill several indicators of mathematical connection skills and students with low self-efficacy have low mathematical connection skills, meaning that students tend to make more errors in the three indicators of mathematical connection. Research related to mathematical connection skills from the perspective of self-efficacy is mostly conducted through qualitative and quantitative research methods and is predominantly conducted at the junior high school level.

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