

Perception of Mathematics Self-Efficacy and Its Role in Academic Achievement: A Systematic Review

Prem Prasad Dahal^{1*} and Laxmi G. C²

^{1,2}Tribhuvan University, Sanothimi Campus, Sanothimi, Bhaktapur, Nepal

*Corresponding Email: dahalprem2000@gmail.com

Abstract

Mathematics self-efficacy (MSE) is an important non-cognitive factor that affects the student's achievement, motivation, and persistence in learning mathematics. It is a systematic review of twelve peer-reviewed journals, which were published between 2019 and 2025 and focus on the association between MSE and student achievement in various settings. Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews (PRISMA-ScR, 2020) framework, the empirical and review studies on mathematics self-efficacy and achievement and their associated mediators or moderators were identified through electronic searches in Scopus, Web of Science, ERIC, SpringerLink, and Google Scholar. The evidence is consistent that higher MSE is correlated with an increase in confidence, persistence and academic success. The synthesis yielded five themes that are interrelated and that summarize the influence of MSE on achievement. First, issues of measurement indicate the importance of task-specific and multidimensional instruments for validity. Second, longitudinal studies imply a two-way street, with previous achievement usually predicting later self-efficacy. Third, efficacy and performance could be reinforced in the targeted interventions, including the mastery-oriented instruction, supportive pedagogy, and visualization tools such as GeoGebra that are dynamic. Fourth, the link between MSE and achievement is influenced by mediating and moderating factors such as cognitive ability, interest, anxiety, gender and socioeconomic background. Lastly, cross-cultural data of such countries as United States, Japan, Oman, Turkey and Nigeria confirm the applicability of MSE across the board and highlight contextual differences. The review concludes that the development of mathematics self-efficacy is a good and equitable way to improve achievement and decrease systemic disparities.

Keywords: Academic Achievement, Equity, Interventions, Mathematics self-efficacy, PRISMA 2020

Introduction

Mathematics has been known to be one of the best predictors of school and work achievement. Not only is it a foundation for higher education and employment, but it is

also a driver of innovation for knowledge-based economies. Beyond advancing individuals, the ability to do math adds directly to the social and economic development of societies, especially in places where the ability to analyze and work with numbers is becoming more valued and important. Despite its importance, there are stubborn gaps in mathematics achievement, between genders, between the rich and the poor, and between members of different cultural communities that are all of worldwide concern. Large-scale assessments always show these gaps and they bring the focus back to non-cognitive and contextual factors that influence the learning experiences of students (Yang et al., 2024). Importantly, such disparities are not fixed but they are influenced by the classroom climate, feedback practices and student's prior experiences of success or failure, which are all involved in the development of mathematics self-efficacy (MSE).

Alongside cognitive ability, mathematics self-efficacy, or belief about one's ability to carry out particular mathematical tasks successfully, has become one of the most consistent psychological predictors of achievement. These self-beliefs have an effect on motivation, strategy use, and perseverance in the face of challenges. Because self-efficacy is task specific, not general, self-efficacy is influenced by the difficulty of a topic, past mastery experiences, and the nature of instructional support. Studies that relate measures of MSE to specific, rather than general, areas of mathematics and science find stronger and clearer relationships with achievement (Zakariya et al., 2019). Students with high levels of self-efficacy approach mathematical problems with confidence and take intellectual risks, and they use deeper learning strategies. However, in contrast, those with low self-efficacy frequently avoid difficult tasks, have a surface approach, and have greater mathematics anxiety which interferes with persistence and performance (Shimizu, 2025).

Longitudinal studies and cross-national studies have supported the centrality of MSE in the prediction of mathematics results. Evidence indicates that the relationship between achievement and self-efficacy is reciprocal whereby achievement in mathematics leads to confidence, and confidence leads to engagement and persistence. However, there are several studies that suggest that previous achievement may have a stronger influence on later self-efficacy than vice versa (Sakellariou, 2022; Liu et al., 2024). The trend indicates that combined interventions that build on competence and confidence are required. Conceptually, one can think of this interaction as a two-lever process, where feedback from successful performance builds self-belief over time and carefully designed mastery experiences help to speed up engagement and therefore lead to earlier gains in achievement. Understanding this two-way dynamic places

understanding of MSE in an important status as a desirable educational outcome, as well as a mediating factor through which achievement disparities may be mitigated.

Research Gap

Though there is strong empirical support which connects mathematics self-efficacy to achievement, a number of gaps in the methodology still limit the consistency and generalizability of the results. The question of measurement is still one of the main issues; some research uses general, global self-efficacy items to give a generalized impression of student confidence, some use task-specific or multidimensional scales to measure the power, size, and generality of efficacy beliefs (Street et al., 2024; Zakariya et al., 2019). No standardized methods of measurement are available to aid a cross-contextual comparison and syntheses of results in a consistent way.

The second limitation has to do with causality and pathways. Although other studies have shown that self-efficacy has a direct impact on achievement, there are studies that have focused on its indirect impact on achievement through mediators such as engagement, cognitive skills and less anxiety (Al Umairi, 2024; Shimizu, 2025). It is important to explain these processes in order to create effective interventions. Another problem related to it is the lack of evidence of intervention effectiveness; systematic reviews and experimental studies indicate such promising interventions as mastery-oriented approaches (Zakariya, 2022) and digital solutions like GeoGebra that allow building interactive visualization (Kohen et al., 2019), but no high-scale assessments have been performed.

Last, equity implications have not been properly studied. There is also cross-cultural evidence to support the idea that a stronger or more empowered self-efficacy may reduce the performance gap by subgroups, with research showing that the gaps in gender, socioeconomic status, and cultural disparities would decrease in case of mathematics self-efficacy (Yang et al., 2024). A study on Turkey and Nigeria also emphasizes another aspect of the self-efficacy that it can make persistence occur even in a situation when a person has limited resources in order to make an impact, which supports the idea of its universal application (Blessing, 2024; Özcan & Kültür, 2021). However, the current evidence is mainly aggregated in high-income nations, thus creating a necessity to conduct more inclusive research on other underrepresented areas.

Objectives

This review addresses these gaps through two focused objectives:

- To synthesize recent empirical evidence (2019–2025) on the relationship between students' perceptions of mathematics self-efficacy and their academic achievement.
- To examine how mathematics self-efficacy is measured, mediated, and enhanced across different contexts, and to identify implications for educational practice, policy, and future research.

Methodology

This systematic review follows Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) statement with the aim of being transparent and rigorous in review. There were four steps: identification, screening, eligibility and inclusion that formed the process.

Review Protocol

A protocol was prepared in advance to define the scope and search strategy, inclusion and exclusion criteria and data extraction framework. This protocol was used to guide all stages of the review in order to reduce bias and improve replicability.

Data Sources and Search Strategy

Electronic searches were conducted from 2019 to 2025 from Scopus, Web of Science, ERIC, SpringerLink and Google Scholar. Keyword strings were used to combine keywords related to self-efficacy and mathematics achievement. For example: (“mathematics self-efficacy”, “math self-belief”, “mathematics confidence”) and (“achievement”, “academic performance” , “mathematics learning outcomes”) and (“school” “secondary” “higher education”) Additionally, reference lists of pertinent empirical articles and systematic reviews were searched manually in order to guarantee completeness.

Inclusion and Exclusion Criteria

Inclusion Criteria

The inclusion criteria ensured that only relevant and rigorous studies were selected for synthesis. Eligible studies were peer-reviewed journal articles published between 2019 and 2025. They explicitly examined the relationship between mathematics self-efficacy (MSE) and mathematics achievement, employed quantitative, qualitative, or mixed-methods research designs, and included participants drawn from school, college, or university populations.

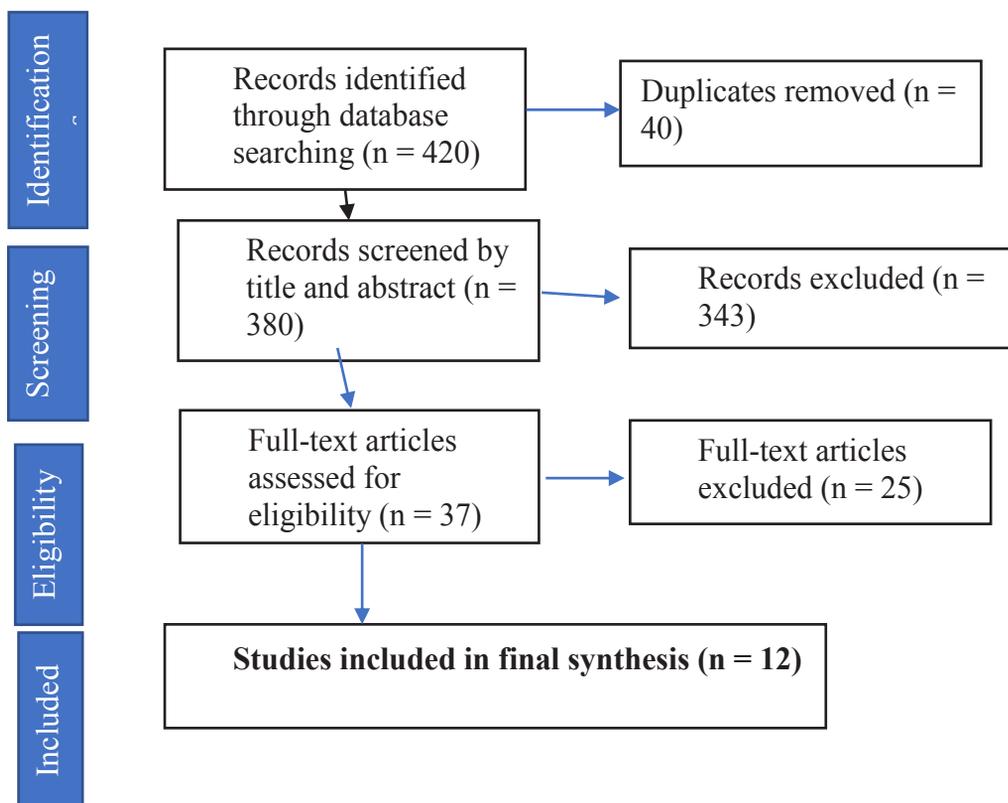
Exclusion Criteria

To maintain focus and quality, several exclusion criteria were applied. Studies were excluded if they did not specifically address mathematics for instance, those limited to general self-efficacy without a mathematics focus. Non-peer-reviewed sources such as dissertations, reports, book chapters, or opinion pieces were also excluded. In addition, articles without empirical data, such as purely conceptual or theoretical works, and grey literature that was unavailable in full text, were not considered.

Study Selection Process

The initial search yielded 420 records. After removing 40 duplicates, 380 records remained for title and abstract screening. Of these, 343 were excluded as irrelevant, leaving 37 articles for full-text review. After assessing methodological fit and relevance, 12 studies met all inclusion criteria and were synthesized in this review.

PRISMA Flow Diagram



Data Extraction and Synthesis

For each study that met the inclusion criteria, detailed information was systematically extracted from the articles in order to ensure consistency and comparability between sources. The data extracted were author(s), year of publication, country, level of education, sample size, and participant characteristics, research design and methodology, and measures used for mathematics self-efficacy and mathematics achievement. In addition, the key findings of the studies and reported limitations for each of the studies were recorded. All information obtained was combined in a large summary table (Table 1) to make comparison between the studies possible.

The synthesis of findings was done thematically-where recurring patterns across the studies were the focus. Themes were identified along five major domains: measuring approaches, the reciprocal direction of causality between self-efficacy and achievement, effects of instructional and intervention strategies, mediating and moderating variables, and cross-cultural knowledge. This thematic approach made it possible to combine the quantitative and qualitative findings in order to capture the multifaceted nature of mathematics self-efficacy effects on academic achievement.

Results

The systematic review synthesized 12 peer-reviewed studies that were published between 2019 and 2025 that focused on the relationship between self-efficacy in mathematics (MSE) and academic achievement. These studies are set in a variety of contexts including the United States, Norway, Japan, Oman, Israel, Turkey, and Nigeria and use methods including longitudinal structural equation modeling, multilevel modeling, quasi-experiments, cross-sectional surveys, mixed methods, and systematic/scoping reviews. A systematic review of research on the topic is presented in two parts: (i) a descriptive synthesis of the included studies and (ii) thematic synthesis of findings.

Descriptive Overview of Studies

The characteristics of the 12 included studies can be summarized in Table 1. They differed considerably with regard to sample size, design, and instruments used to measure MSE and achievement. Three studies were from large-scale international surveys (PISA, NAEP, HSLs), one was on instrument development and validation, one was a classroom-based quasi-experiment, three were systematic or scoping reviews, and the remaining studies were cross-sectional or longitudinal studies in different national contexts.

Table 1
Summary of Included Studies (2019–2025)

Author(s) & Year	Country / Level	Sample	Design	Self-Efficacy Measure	Achievement Measure	Key Findings	Limitations
Al Umairi (2024)	Oman, Grade 8	n=374	Cross-sectional SEM	Mathematics Self-Efficacy Scale	Standardized math test (TIMSS-like)	Cognitive domain partially mediates MSE → Achievement	Cross-sectional; single region
Blessing (2024)	Nigeria, secondary & university	Not specified	Mixed-methods (survey + interviews)	Bandura's four sources	Test scores & reported outcomes	High MSE correlated with performance, persistence, motivation	Self-report; limited sampling details
Kohen et al. (2019)	Israel, Grade 9	n=111	Quasi-experiment (dynamic vs static visualization)	Real-time MSE ratings	Problem-solving tests (immediate & delayed)	Dynamic tools boosted MSE and achievement	Small sample; one topic
Liu et al. (2024)	USA, HSLs panel (high school)	Longitudinal cohort	SEM (multi-group by gender)	HSLs self-efficacy items	Math course grades & standardized scores	Reciprocal effects; stronger Achievement → MSE; gender differences	U.S.-only; observational
Özcan & Kültür (2021)	Turkey, Grade 12	n=257	Correlational regression	Sources of MSE Scale (mastery, vicarious, persuasion, physiological)	Course grades & university entrance test scores	Mastery strongest; multiple sources predicted test scores	Regional sample; self-report
Sakellariou (2022)	USA, HSLs panel (high school)	Longitudinal panel	IV regression	HSLs self-efficacy items	Standardized math test scores	Reciprocal relationship; Achievement → MSE stronger	Validity of IVs; mechanisms unobserved

Shimizu (2025)	Japan, PISA 2022	n≈5,760	SEM, multi-group	PISA MSE scales (applied, reasoning)	PISA math scores	MSE ↓ anxiety, ↑ engagement & achievement; no gender/SES moderation	PISA-only; country-specific
Street et al. (2024)	Global	49 studies	Scoping review	Varied (classroom & survey measures)	Varied	MSE linked to motivation & performance; multidimensional concept	Descriptive only; no effect sizes
Wang et al. (2023)	Global (PISA focus)	156 studies	Systematic review	PISA MSE constructs	PISA math performance	SES, attendance & MSE strong predictors	Mostly correlational
Yang et al. (2024)	USA, NAEP 2019, Grades 4/8/12	Large (national sample)	Multilevel analysis	NAEP math self-efficacy items	NAEP math scores	MSE robust predictor; narrowed subgroup gaps	Cross-sectional; non-causal
Zakariya (2022)	Global	49 studies	Systematic review	Varied	Varied	Identified 3 effective intervention categories (mastery, pedagogy, strategies)	Heterogeneity of studies
Zakariya et al. (2019)	Norway, University STEM	n=234	Instrument development/validation	Calculus Self-Efficacy Inventory	Deep vs surface learning approaches	High MSE → deeper learning; validated reliable tool	Limited to first-year STEM

Thematic Synthesis of Findings

Theme 1: Measurement of Mathematics Self-Efficacy

Two studies highlighted the importance of task specific and multidimensional measures. Zakariya et al. (2019) developed and validated the Calculus Self-Efficacy Inventory, a reliable tool associated with deep learning in context of STEM. Similarly, Street et al. (2024) indicated that most research still underrepresents Bandura's multidimensional framework of self- efficacy and often treats self-efficacy as unidimensional. Together, these studies highlight the critical need for fine-grained measures of efficacy beliefs, and how they can elicit the strength, magnitude, and generalizability of efficacy beliefs. The evidence suggests that if MSE scales are aligned with the curricular content and are assessed for subgroup-invariance, they provide clearer and more interpretable findings and therefore increase the reliability of cross-study comparisons.

Theme 2: Reciprocal Relationship between Self-Efficacy and Achievement

The longitudinal data show that mathematics self-efficacy (MSE) and achievement have a relationship which affects each other through time. The results of Sakellariou (2022) and Liu et al. (2024) showed reciprocal influences, but the achievement appeared to be the better predictor of the following self-efficacy. Building on this trend, Shimizu (2025) found that self-efficacy would help to reduce mathematics anxiety and increase engagement, which leads to indirect achievement improvement. These results indicate that there is a feedback mechanism: when developing a successful change process, confidence is the result, which is then reinforced by perseverance and further learning.

Theme 3: Interventions and Instructional Strategies

Three studies explicitly examined interventions and instructional contexts. Kohen et al. (2022) demonstrated that dynamic visualization tools (e.g., GeoGebra) improved both MSE and problem-solving performance among Grade 9 students. Zakariya (2022) synthesized intervention studies, categorizing effective approaches into mastery experiences, pedagogical integration, and learning strategies. Complementing these findings, Blessing (2024) emphasized the importance of mentoring and supportive environments for fostering MSE, especially in under-resourced contexts. Collectively, these results highlight that multi-pronged interventions, combining cognitive support with emotional and social scaffolds, are most effective in sustaining long-term efficacy gains.

Theme 4: Mediators and Moderators of the MSE–Achievement Link

A number of studies focused on variables that shape or explain the MSE-achievement relationship. Al Umairi (2024) found that cognitive skills partially mediated this link, Shimizu (2025) showed involvement and decreased anxiety had similar roles. In their study, Ozcan and Kultur (2021) emphasized the importance of the sources of efficacy as Bandura highlighted and these are: mastery experiences and social persuasion. The moderating variables were gender (Liu et al., 2024), socioeconomic background, and level of school (Yang et al., 2024). These results show that the intensity of MSE effects is a function of individual and contextual factors. Future research would benefit from integrated models, which would assess multiple mediators and moderators at the same time.

Theme 5: Cross-Cultural Perspective

Studies conducted in different regions of the world including Asia (Shimizu, 2025; and Al Umairi, 2024), Europe (Zakariya et al., 2019), Africa (Blessing, 2024), the Middle East (Ozcan and Kultur, 2021), and North America (Liu et al., 2024; and Yang et al., 2024) have consistently demonstrated a positive relationship between MSE and achievement. However, contextual variables such as availability of resources, instructional practices and system-level structures (Wang et al., 2023) play a role in determining the size of this association. While it would seem that MSE is a universal construct, it is expressed in a local way. Consequently, culturally responsive research and interventions are necessary in the understanding of the role of efficacy in the context of particular educational settings.

Thematic Discussion

The findings of synthesizing twelve studies are consistent with the view that mathematics self-efficacy (MSE) is a significant predictor of academic performance in different educational contexts. Yet, the comprehension of this relationship means that there are a number of conceptual, methodological, and practical nuances that require attention. The results of the review coalesce around five interconnected themes that bring together relationships between MSE and measurement practices, patterns of achievement, instructional interventions, mediating variables, and cultural contexts.

Measurement of Mathematics Self-Efficacy

Accurate measurement is the key to continuing the study of self-efficacy. Evidence seems to exist that task-specific and multidimensional instruments are more faithful in

their capture of the construct than are global scales. Zakariya et al. (2019), for instance, found that the Calculus Self-Efficacy Inventory is suitable for measuring differences in approaches to learning among STEM undergraduates. In contrast, Street et al. (2024) noted that much of the existing research continues to address MSE as a global, unitary construct, without taking into account the original dimensions of strength, magnitude and generality of Bandura's construct. This inconsistency raises questions of comparability of findings from one context to another. Developing standardized but flexible instruments, particularly those that are tested for measurement invariance by gender, socioeconomic status (SES), and cultural groups, would help increase validity, as well as equity, in cross-study analyses.

Reciprocal Relationship between Self-Efficacy and Achievement

Longitudinal studies have always found that mathematics achievement and self-efficacy support each other. Sakellariou (2022) and Liu et al. (2024) found that previous academic achievement tends to predict self-efficacy in future more than the reverse, which means that achievement breeds confidence. Similarly, Shimizu (2025) showed that self-efficacy decreases anxiety and increases engagement which in turn leads to increased achievement. These findings highlight a mutual cycle whereby beliefs and performance are constantly affecting and influencing each other. Accordingly, interventions should address both the development of cognitive skills and confidence building in order to create a self-sustaining pattern of improvement. This dynamic is well encapsulated by the "two-lever model" in which efficacy is boosted through the feedback mechanisms of the academic success and persistence is accelerated by mastery-oriented experiences combined with amplified performance gains.

Interventions and Instructional Strategies

A growing body of research exists about how instructional design can be explicitly used to build students' self-efficacy. Kohen et al. (2022) reported that dynamic visualization tools like GeoGebra increased the confidence and problem-solving ability of the students considerably, and the benefits were maintained even after a long period. Zakariya (2022) categorized successful interventions into three categories; mastery experiences, pedagogical integration of self-efficacy principles and strategy-based learning. Blessing (2024) further emphasized on the importance of mentoring and social support, especially in the low-resource environment, where the opportunities for mastery experiences are limited. These findings are consistent with Bandura's four sources of

efficacy (mastery experience, vicarious experience, verbal persuasion, and affective states) and indicate that interventions that have a combination of cognitive, social, and emotional components are likely to result in the most sustainable improvements. Practically, the efficacy can be facilitated through designing sequenced tasks, providing process-focused feedback, and providing a chance to peer-model.

Mediators and Moderators of the MSE–Achievement Relationship

The analyzed publications also indicate a collection of mediating and moderating variables that determines the way MSE is converted into performance. Al Umairi (2024) discovered cognitive skills to mediate the relationship partially, which suggests that confidence can be used to acquire additional skills, which, in its turn, contribute to performance. Engagement, reduction of anxiety, and experiences of mastery were found to be such major psychological pathways by Shimizu (2025) and Özcan and Kültür (2021). Moderating factors such as gender (Liu et al., 2024), socioeconomic status and school level (Yang et al., 2024) also influence the magnitude of these effects. A combination of these findings leads to the conclusion that MSE acts in many ways and its effects depend on factual characteristics of individuals and the circumstances they are in. Further studies must then use integrative models which study the mediating and moderating factors together to help understand when, how and who self-efficacy has the most impact.

Cross-Cultural Insights and Equity Implications

The studies that have been reviewed include a wide range of cultural and national backgrounds, and they are the United States, Japan, Norway, Oman, Israel, Turkey, and Nigeria. In these situations MSE is a predictor of mathematics achievement consistently. Nevertheless, the intensity of this relationship is different under diverse contextual circumstances including the quality of instruction, availability of resources, and system level relative to context (Wang et al., 2023). For example, in a study by Yang et al. (2024), the results indicated that self-efficacy helped alleviate the differences in subgroup achievement due to gender, SES, and ethnicity in the U.S. and in Blessing's study of motivation in Nigeria, the findings indicated that MSE helped foster persistence and motivation, despite the lack of resources. These results indicate that even though MSE is a universal construct, its manifestation and influence are influenced by local realities. Further studies into multilingual and low-resource experiences would

contribute to finding whether the efficacy mechanisms in a multicultural setting can be applied without any adjustment or they need to be contextualized.

Summary of Thematic Findings

Overall, mathematics self-efficacy has been found not only to be a good predictor of achievement but also to be a malleable construct which can be improved by focused intervention. Its influence works through cognitive, emotional and social channels and makes it a versatile tool in enhancing learning results. However, inconsistencies in measurement, uncertainty regarding causal direction and poor cross-cultural representation continue to be major challenges. Addressing these problems will require the development of standardized instruments, more use of causal research designs, and the inclusion of a variety of cultural contexts in order to capture the full complexity of MSE in mathematics learning.

Implications

The result of this review show that mathematics self-efficacy (MSE) is a core influencer on academic achievement across situations and there are several implications for practice, policy, and research. For educators, the evidence indicates that mastery experiences consistently represent the strongest source of MSE (Özcan & Kültür, 2021), and suggests instructional design should be a carefully considered and determined priority to incorporate as many tasks as possible in which students can experience success at levels of increasing difficulty. It is also worth noting that the combination of dynamic visualization tools such as GeoGebra with supportive feedback, mentoring and collaborative learning opportunities has shown to increase both self-efficacy and performance (Kohen et al., 2022) in the classroom. As a part of everyday planning, teachers may develop in concise confidence checks-ins, framework works with worked-example to independent problem development, and erring as the standard, as learning chances. Besides causing the teacher to consider their teaching, these tasks are relevant in confirming the effort and encouraging risk-taking, and eliminate the mathematics anxiety that tends to undermine the performance of students (Shimizu, 2025).

At policy level, improving the self-efficacy of students is a major trigger of equity in education. The inter-group differences based on the gender, socioeconomic status, and language background decrease when self-efficacy is taken into consideration (Yang et al., 2024). This indicates that policies are not only important in the context of

curriculum reform and standardized testing but also the context of the targeted investment in the confidence of learners and their persistence. The practical programs can involve the incorporation of self-efficacy-based approaches within the national curriculum, teacher training aimed at emphasizing psychological and cognitive aspects of learning and resource allocation to digital infrastructures facilitating the application of mastery-oriented learning in underserved schools. The self-efficacy indicators, along with the performance metrics, should also be tracked by the monitoring system because often, the change in confidence is usually the antecedent to the performance (whether positive or negative).

For researchers, three things are of great importance. First, practices related to measurement need to be more standardized. Current studies range in form from unidimensional global scales to task-specific and multidimensional inventories (Zakariya et al., 2019), which creates problems in comparison. The development of validated instruments that prove measurement invariance across gender, SES and cultural groups will enhance comparability as well as equity arguments. Second, additional longitudinal and experimental research are required in order to clarify causality. While previous research evidences that prior achievement is a stronger predictor of later self-efficacy than vice versa (Sakellariou, 2022; Liu et al., 2024), interventions specifically targeting MSE can alter this and proper tests of such effects need to be performed. Third is the uneven distribution of evidence around the world with the majority of studies being concentrated in high-income countries. Although contributions from Turkey (Özcan & Kültür, 2021) and Nigeria (Blessing, 2024) demonstrate the universal relevance of MSE, a better evidence base from underrepresented and low-resource contexts is needed to enhance generalizability and to provide evidence for context-sensitive policies.

Collectively, these implications suggest that MSE constitutes a psychological asset as well as a policy lever. For example, interventions that develop both confidence and competence in teachers, support teachers to incorporate efficacy-building practices and building MSE within broader education policy frameworks are all promising ways to develop interventions that enhance achievement outcomes and mitigate systemic inequities. However, researchers need to further develop methodology and expand the investigation to other settings in order to capture the complex and changeable role of self-efficacy in mathematics learning.

Limitations

While this review provides useful information about the relationship between MSE and achievement, there are a few limitations that need to be recognized.

Furthermore, the review excluded peer-reviewed articles published prior to 2019 and after 2025, limiting the relevance of the review to peer-reviewed studies published in English, thus potentially excluding relevant studies from other languages or in the grey literature. This is a possible publication and language bias.

Second, the measurement tools are so heterogeneous that it is difficult to make direct comparisons. Some of the studies utilized global measures, whereas others utilized task-specific or multidimensional measures. Much heterogeneity means that quantitative synthesis or meta-analysis is not possible.

Third, most included studies were cross-sectional or correlational, making it difficult to establish definitive causal relationships. Although several longitudinal and experimental studies were included (e.g., Sakellariou, 2022; Kohen et al., 2019; Liu et al., 2024), further robust designs are needed to clarify pathways between MSE and achievement.

Finally, the geographical distribution of studies remains uneven, with a concentration in high-income countries. While contributions from Nigeria (Blessing, 2024) and Turkey (Özcan & Kültür, 2021) add diversity, more evidence from underrepresented regions is needed to strengthen cross-cultural generalizability.

These limitations suggest that the results should be interpreted with caution, though they do not undermine the overall conclusion that MSE is a significant and modifiable predictor of mathematics achievement.

Conclusion

This systematic review summarized the results of 12 recent studies (2019-2025) on mathematics self-efficacy role in academic achievement. In various countries, with different levels of education and methodologies, the same pattern was observed: the perception of the students as having a certain level of abilities in mathematics has a great impact on their learning performance.

The evidence indicates a number of important insights. To begin with, MSE is a predictor as well as a result of achievement. Longitudinal designs also indicate the existing reciprocal relationship, yet achievement is likely to have a more critical effect on subsequent self-efficacy (Sakellariou, 2022; Liu et al., 2024). Second, interventions

that focus on self-efficacy and especially those that focus on mastery experiences, supportive pedagogies, and dynamic digital tools can increase both confidence and performance (Kohen et al., 2019; Zakariya, 2022). Third, the mediators include engagement, anxiety, and cognitive skills as well, and the moderators are gender, socioeconomic status, and school-level factors. Such processes define the role of MSE in contributing to individual as well as subgroup achievement gaps (Yang et al., 2024).

Notably, the cross-cultural data show MSE is an innate psychological resource but its influence depends on the contingencies of situations. The Turkish (Özcan and Kültür, 2021) and Nigerian (Blessing, 2024) research indicate that self-efficacy promotes persistence despite the stressful resource-limited conditions, which validates its applicability on the global level.

Collectively, the findings of this study support the claim that mathematic self-efficacy should be aggrieved as an effective and fair way to enhance performance. In the case of educators, this implies creating the classroom environment that integrates mastery-based tasks with affirmative feedback. To policymakers, this highlights the need to consider the self-efficacy constructs when designing educational programs and the teacher professional development programs. This type of integration requires the use of standardized measurements, the application of high-fidelity causal research designs, and cross-cultural studies by researchers.

The belief that learners have strong mathematical competence should come first to be able to attain high performance and also to develop resilience and long-term interest in the subject, which may result in a lifelong dedication to mathematics.

References

- Al Umairi, K. S. (2024). Mediating effect of mathematics cognitive domain in the relationship between mathematics self-efficacy and mathematics achievement. *EURASIA Journal of Mathematics, Science and Technology Education*, 20(9), em2500. <https://doi.org/10.29333/ejmste/14990>
- Blessing, M. (2024, October 10). The impact of self-efficacy on mathematics achievement. *ResearchGate*. <https://www.researchgate.net/publication/384802122>
- Kohen, Z., Amram, M., Dagan, M., & Miranda, T. (2019). Self-efficacy and problem-solving skills in mathematics: The effect of instruction-based dynamic versus static visualization. *Interactive Learning Environments*, 27(5–6), 759–778. <https://doi.org/10.1080/10494820.2019.1683588>

- Liu, R., Jong, C., & Fan, M. (2024). Reciprocal relationship between self-efficacy and achievement in mathematics among high school students. *Large-scale Assessments in Education*, 12(14). <https://doi.org/10.1186/s40536-024-00201-2>
- Özcan, B., & Kültür, Y. Z. (2021). The relationship between sources of mathematics self-efficacy and mathematics test and course achievement in high school seniors. *SAGE Open*, 11(3), 21582440211040124. <https://doi.org/10.1177/21582440211040124>
- Sakellariou, C. (2022). The reciprocal relationship between mathematics self-efficacy and mathematics performance in US high school students: Instrumental variables estimates and gender differences. *Frontiers in Psychology*, 13, 941253. <https://doi.org/10.3389/fpsyg.2022.941253>
- Shimizu, Y. (2025). Relation between mathematics self-efficacy, mathematics anxiety, behavioural engagement, and mathematics achievement in Japan. *Psychology International*, 7(2), 36. <https://doi.org/10.3390/psycholint7020036>
- Street, K. E. S., Malmberg, L.-E., & Schukajlow, S. (2024). Students' mathematics self-efficacy: A scoping review. *ZDM – Mathematics Education*, 56, 265–280. <https://doi.org/10.1007/s11858-024-01548-0>
- Wang, X. S., Perry, L. B., Malpique, A., & Ide, T. (2023). Factors predicting mathematics achievement in PISA: A systematic review. *Large-scale Assessments in Education*, 11, 24. <https://doi.org/10.1186/s40536-023-00174-8>
- Yang, Y., Maeda, Y., & Gentry, M. (2024). The relationship between mathematics self-efficacy and mathematics achievement: Multilevel analysis with NAEP 2019. *Large-scale Assessments in Education*, 12(16). <https://doi.org/10.1186/s40536-024-00204-z>
- Zakariya, Y. F. (2022). Improving students' mathematics self-efficacy: A systematic review of intervention studies. *Frontiers in Psychology*, 13, 986622. <https://doi.org/10.3389/fpsyg.2022.986622>
- Zakariya, Y. F., Goodchild, S., Bjørkestøl, K., & Nilsen, H. K. (2019). Calculus self-efficacy inventory: Its development and relationship with approaches to learning. *Education Sciences*, 9(3), 170. <https://doi.org/10.3390/educsci9030170>

To cite this article:

Dahal, P. P. & G. C., L. (2025). Perception of mathematics self-efficacy and its role in academic achievement: a systematic review. *Mathematics Education Forum Chitwan*, 10 (1), 52-68. <https://doi.org/10.3126/mefc.v10i1.90995>