



Relationship between Mathematics Self Efficacy and Mathematics Achievement

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DOI: <https://doi.org/10.70333/ijeks-03-10-011>

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Article Info: - Received : 04 October 2024

Accepted : 25 October 2024

Published : 30 October 2024

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Mathematics self efficacy has been described as the belief a student holds in regard to her or his ability to enact mathematical tasks. Mathematics self efficacy, or the belief inside oneself about their capability to succeed in completing mathematics tasks-a psychological construct-was found to be a powerful contributor to mathematics achievement. The relationship between self efficacy and achievement is not only direct but significantly reciprocal and interdependent. Compared to students with lower perceived self efficacy in mathematics, students with high maths self efficacy are likely to exhibit positive learning behaviors and use effective problem-solving strategies with perseverance in tackling challenging tasks, which by extension further enhances performance. Conversely, success in mathematics reinforces self efficacy, creating a feedback loop that continually enhances achievement. Research has consistently shown that mathematics self efficacy is positively correlated with mathematics achievement. This study explores the relationship between mathematics self efficacy and achievement reviewing relevant literature and theoretical models.

Keywords: *Mathematics, Self Efficacy, Achievement, Performance, Experiences.*



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1. INTRODUCTION

Mathematics self efficacy has been described as the belief a student holds in regard to her or his ability to enact mathematical tasks. The self efficacy of mathematics has been assessed as an individual judgment of their ability to perform tasks related to mathematics, solve specific mathematical problems, or pass mathematics-related courses (Betz & Kennett, 1983). It has recognized a critical predictor of mathematics achievement. Bandura (1986) argued that the self efficacy of mathematics was

more predictive of future performance than of aggregate indicators such as confidence in learning mathematics. Mathematics self efficacy, or the belief inside oneself about their capability to succeed in completing mathematics tasks-a psychological construct-was found to be a powerful contributor to mathematics achievement. The relationship between self efficacy and achievement is not only direct but significantly reciprocal and interdependent. Compared to students with lower perceived self efficacy in mathematics, students with high maths

self efficacy are likely to exhibit positive learning behaviors and use effective problem-solving strategies with perseverance in tackling challenging tasks, which by extension further enhances performance. Conversely, success in mathematics reinforces self efficacy, creating a feedback loop that continually enhances achievement. Research has consistently shown that mathematics self efficacy is positively correlated with mathematics achievement. Students with high self efficacy are more likely to use deeper learning strategies, problem-solving, and critical thinking than low self efficacy counterparts, who are probably going to memorize through rote learning. This enhances their understanding of mathematical concepts and contributes to better academic performance.

2. DEFINITION AND THEORETICAL FRAMEWORK

Albert Bandura (1977) introduced self efficacy as a key component of Social Cognitive Theory. Self Efficacy is the extent or strength of one's belief in one's own ability to complete tasks and reach goals (**Ormrod, 2006**). According to **Albert Bandura (1977)**, self efficacy is "the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations." In other words, self efficacy refers to what an individual believes about his or her capacity to successfully execute tasks in a given domain. Self-efficacy impacts learning approach, resilience toward challenges, and an ultimate outcome such as achievement in mathematics. The Social Cognitive theory states that experiences in self efficacy result from mastery experiences, vicarious experiences, verbal persuasion, and physical & emotional states.

- 1) **Mastery Experiences:** Mastery experiences are the source of self efficacy, but having a first-hand mastery experience is the best means to enhance self efficacy. Failure will weaken the efficacy belief while success, such as mastery of an environment or task, would strengthen self-confidence in that area. A robust sense of self efficacy requires that one has had previous experiences in pushing over challenges with determination and hard work.
- 2) **Vicarious Experiences:** The other source of self efficacy is related to what an individual observe happening around him or her and

people that one considers role models. Observing other people, similar to them, accomplishing their objectives due to sustained efforts enhances one's beliefs that they too have the capabilities to master activities necessary for succeeding in that area.

- 3) **Verbal Persuasion:** Parents, teachers, coaches, supervisors, and other significant figures in one's lives might reinforce the conviction that they possess the necessary skills to succeed. Persuaded themselves that one can become experts at anything makes them more inclined to work hard and stick with it when things go tough.
- 4) **Physical & Emotional states:** The emotional and personal reactions to events can have a significant impact on one's sense of self efficacy. A person's perception of their own talents in a given circumstance can be influenced by a variety of factors, including stress levels, bodily reactions, emotional states, and moods. "How they are perceived and interpreted is more important than the sheer intensity of emotional and physical reactions," according to Bandura's theory of self efficacy. People can increase their sense of self efficacy by learning techniques for reducing stress and improving mood when confronted with demanding or tough circumstances.

Self efficacy is influenced by a combination of personal, social, and environmental factors. Mastery experiences, encouragement, and the elimination of anxiety are critically needed to develop self efficacy of an individual.

3. INFLUENCE OF SELF EFFICACY IN ACADEMIC PERFORMANCE

Self efficacy is the belief in one's capability to succeed with specific tasks. It has major implications for how someone thinks about school work, the ways in which learners manage difficulties encountered along the way, and his or her perseverance when confronted by obstacles. The documented evidence about self efficacy and academic performance has shown that high self efficacy has often been positively correlated with better performance. The mechanism through which this happens is however intricate. Self efficacy refers to a person's confidence in their ability to adopt the behaviours necessary to

achieve the desired result. Educators have long ago recognized that students' beliefs about their academic capabilities are significant sources of motivation to achieve. Research studies have shown that self efficacy beliefs converge with the actual influences on choice, persistence, effort, or emotional reactions in academic motivation. Self Efficacy have also shown greater impact in influencing the choice of activities, intrinsic motivation to engage in a task, level of effort, persistence and emotional dispositions. Below is a comprehensive discussion on how it affects the academic results.

- 1) Students who have more self efficacy are more motivated to get things done and able to set good academic goals. The more certain students are that they can succeed at a task, the more likely they are to persist in their efforts, and the more ambitious their goals will be.
- 2) Self efficacy directly impacts the use of effective learning strategies and promotes cognitive engagement, which contributes to good academic performance. Students with high self efficacy would more likely implement deep learning strategies such as critical thinking, problem-solving, and self-reflection.
- 3) Self efficacy strengthens a student's resilience and persistence when confronted with academic challenges. Students with high self efficacy tend to view setbacks as learning opportunities instead of insurmountable hurdles.
- 4) Self efficacy reduces academic anxiety, which is an obstacle to academic progress. Students with high self efficacy tend to experience less stress when facing academic tasks, which allows them to focus more effectively and perform better.
- 5) Positive academic behaviours, such showing up to class on time, finishing assignments on time, asking for assistance when necessary, and actively participating in class discussions, are shaped by self efficacy.
- 6) Students' long-term academic performance and career aspirations are influenced by the development of a good academic identity, which is influenced by their level of self efficacy.
- 7) Teacher expectations and perceptions, as well as classroom environments, help

shape self efficacy. Oftentimes, teachers who provide a more supportive, motivational climate foster student self efficacy, which in turn positively influences student performance.

4. MATHEMATICS SELF EFFICACY AND MATHEMATICS ACHIEVEMENT

Anexpanding volume of research reveals that there is a strong connection between students' Mathematics Self Efficacy beliefs and their academic success in Mathematics. Students with low self efficacy are more tend to sidestep challenging mathematical tasks and those with high self efficacy more inclined to tackle the difficult mathematical task and also put in more effort and persevere longer when faced with challenges.

4.1. Mathematics Self Efficacy as a predictor of Mathematics Achievement

Most individuals may list objectives they would like to reach, changes they would like to make, and ambitions they would like to complete. Most people are aware that executing these goals is more difficult than they initially thought, though. According to research by [Bandura et al. \(1977\)](#), a person's level of self efficacy greatly influences how they approach tasks, objectives, and obstacles. Strong self efficacy is said to be associated with certain traits in people, such as:

- Perceive difficult situations as tasks to be completed
- Take a deeper interest in the activities they engage in
- Develop a stronger feeling of dedication to their interests and activities
- Get over failures and disappointments fast. Furthermore, those who have a low perception of their own competence
- Tend to avoid difficult assignments
- Believe that challenging tasks and contexts are outside of their capacities.
- Concentrate on own shortcomings and poor outcomes.
- Rapidly lose faith in one's own skills.

Mathematical self-efficacy is the judgement or assessment of one's own mathematical performance. Rather, self-efficacy is an idea that refers to "I can" or "I cannot" beliefs of the learners. Self-efficacy is a measure

of confidence that students have in their ability to perform particular tasks. Self-efficacy, however, refers specifically to one's belief in the ability to carry out tasks, whereas self-esteem refers to the judgement of one's worth. It is also possible that strong self-efficacy in one domain does not always equal strong self-efficacy in another. Self-efficacy is situation-specific, and it does not always mean that pupils believe that they will succeed. Even whilst self-efficacy indicates how strongly they believe in their ability to achieve something, the students may still think that other things may get in their way. The self-efficacy of mathematicians is simply the ability to believe that they can cover the important problems in mathematics or that they can successfully solve a problem. In educational research, this construct has drawn a lot of interest since it is a strong predictor of mathematics achievement, impacting not only academic results but also long-term career paths in STEM professions. In contrast to intrinsic intelligence or past knowledge, students' attitudes towards learning, perseverance, and problem-solving are shaped by their self efficacy, which functions as a dynamic psychological factor. This investigation offers a distinctive viewpoint on the interplay between mathematical achievement and mathematics self efficacy, as well as the underlying mechanisms that underlie this link.

4.2 Factors influencing Self Efficacy in mathematics

Self efficacy in mathematics refers to the level of confidence a student has in accomplishing those tasks. This confidence level plays a crucial role in shaping the motivation, learning strategies, and academic performance of the student. Also, there are several aspects that might shape such a belief, which can be divided into three categories: personal, social, and situational qualities. These factors are discussed briefly as under:

- 1) **Mastery Experiences (Past Performance):** The most significant source is an individual's own experience of success and/or failure in mathematics. The sense that successful problem-solving and success in mathematics reinforces confidence, and conversely, repeated failure erodes it, undergirds the theory behind self-efficacy."

- 2) **Vicarious Experiences (Modeling):** When students watch others who are like them, or who are successful in mathematics, they are more likely to believe that they can also be successful.
- 3) **Verbal Persuasion (Feedback and Encouragement):** Positive feedback, encouragement, and verbal persuasion by teachers, parents, or peers serves as a means of improving students' self-confidence in their mathematics abilities. Constructive feedback making students believe that they can improve.
- 4) **Physiological and Emotional States:** Emotional reactions of students toward the subject of mathematics, like anxiety, stress, or confidence, are influential to their self-efficacy. Extreme mathematics anxiety can attack a student's belief about his or her chances of success.
- 5) **Teacher Expectations and Classroom Environment:** Teachers play a crucial role in shaping students' self-efficacy. High expectations, belief in student abilities, and a positive classroom environment contribute to higher self-efficacy.
- 6) **Social and Cultural Influences:** Cultural attitudes toward mathematics, stereotypes about gender, and societal beliefs about future mathematics ability pervaded self-efficacy determination in students. In some cultures, mathematics concepts are seen as innate talent rather than a skill one can develop with hard work.
- 7) **Peer Influence:** Peer group influences can boost one's self efficacy in mathematics. Supportive peers who are confident in their mathematics abilities can inspire others, while negative peer comparisons or ridicule may harm self-efficacy.
- 8) **Availability of Resources and Support:** Students who receive adequate support in terms of access to learning resources, tutors, extra help, technology, and supportive family environments feel more capable of tackling challenges in mathematics.
- 9) **Personal Goals and Aspirations:** Students with clear personal goals related to mathematics tend to have higher self-efficacy because they perceive mathematics as relevant to their future success.

5. EDUCATIONAL INTERVENTIONS TO IMPROVE MATHEMATICS SELF EFFICACY

Improving self-efficacy in mathematics is essential for boosting students' confidence, motivation, and achievement in the subject. Educational interventions targeting students to increase their self-efficacy direct attention toward mastery experiences, vicarious learning, verbal assurance, and emotional regulation. The following are some workable interventions that have been suggested to increase mathematics self-efficacy.

- 1) Build self-efficacy by offering pupils opportunity to succeed in progressively more demanding assignments.

Strategies:

- Mathematics can be made simple and easy by breaking it down into smaller, manageable bits. When students learn any step, please increase the complexity of the task gradually to build a sense of accomplishment.
 - Give out maths problems that are just right—not too simple, not too complicated. By gradually moving from simple to more difficult assignments, pupils can succeed and develop self-confidence.
 - Provide timely and specific feedback that highlights what students are doing right, as well as areas for improvement. Celebrate small wins and progress to enhance self-belief.
- 2) Motivate students to take charge of their education, track their progress, and set realistic goals.

Strategies:

- Assist students create attainable, realistic, and short-term arithmetic goals. Urge them to put more emphasis on improvement and work than on natural aptitude.
 - Students can track their progress by keeping a mathematics journal where they record goals, strategies, successes, and reflections on what they've learned.
- 3) Increase self-efficacy through observation and collaboration with peers.

Strategies:

- Assign pupils who are struggling with mathematics to peers who have shown proficiency in the subject. Through vicarious

learning, students can boost their own self-efficacy by watching others succeed at tasks they find challenging.

- Collaborative group work can be encouraged, where students work together on the same mathematics problems. Peer discussions and collaborative problem-solving will help students learn with one another, reinforcing confidence in themselves.
- Invite older students or guest speakers who excelled in mathematics to share their own stories, particularly those who struggled with mathematics at first. Real-life examples of perseverance can inspire students.

- 4) Boost confidence by providing positive, specific, and constructive verbal feedback.

Strategies:

- Adopt wording that suggests hard work, taking errors as learning opportunities when formatting comments, such as, "You're doing better than before," or "You will solve these problems with practice."
 - Avoid identifying as weak in mathematics. Instead, focus on ways to help them improve. Turn "You did that wrong" to "Let's see if we can find another way to tackle that."
 - Encourage parents to provide positive reinforcement at home. Teachers can guide parents on how to encourage effort and celebrate maths-related successes.
- 5) Address and alleviate emotional barriers to improve confidence and performance in mathematics.

Strategies:

- Train pupils in deep breathing exercises and mindfulness practices to help them cope with anxiety before difficult assignments or maths tests.
 - Establish a classroom community in which making errors is viewed as something that is natural and conducive to learning and growth, rather than a sign of failure.
 - Assist pupils in reframing unfavourable ideas about their mathematics skills. Show students how to swap negative self-talk, like "I'm terrible at maths," for positive ones, like "I can improve with effort."
- 6) Use technology to personalise learning experiences and maximise engagement.

Strategies:

- Make use of mathematics apps or software that adapt to the skill level of the learner, offering personalised challenges and real-time feedback. Self-efficacy is increased by these technologies, which frequently include rewards and visual progress tracking.
- Use game-based learning platforms that incorporate elements like levels, points, and rewards to make learning mathematics fun and motivating. Games provide an interactive way for students to practice mathematics without fear of failure.

7) Equip teachers with strategies to effectively improve student self-efficacy in mathematics.

Strategies:

- Educate professionals on how to give feedback that increases self-efficacy and cultivate a growth mentality in pupils.
- To accommodate students with diverse levels of maths proficiency and guarantee that every student succeeds in the classroom, teachers should receive training in differentiated instruction methods.

8) Illustrate to children the practical applications of mathematics to improve their self-efficacy and motivation.

Strategies:

- Use real-world examples to demonstrate how mathematics is used in daily life, such as budgeting, cooking, or shopping. This makes mathematics more relatable and meaningful, increasing students' engagement and confidence.
- Introduce students to careers in STEM (Science, Technology, Engineering, and Mathematics) to help them understand how mathematics is crucial in various professions.

Many effective educational interventions meant to enhance mathematics self-efficacy must be multifaceted in their orientation, including inducing competency experiences; furnishing positive feedback; promoting emotional regulation; and ensuring that mathematics is relevant to students' lives. By implementing such methodologies in a classroom context, teachers can cultivate a group of learners of mathematics who will be more confident, engaged, and motivated to learn mathematics. Improvement in

self-efficacy would translate positively to performance, thus setting a foundation for sustained and positive attitudes towards mathematics as a lifetime competency.

7. CONCLUSION

Self Efficacy is an important determinant of student's motivation and learning. Those students who have confidence in their capabilities usually becomes successful in the task they perform. Educators, parents, and peers have opportunities to play a role in the development of a supportive environment which encourages belief in mathematics. Self-efficacy influences motivation, learning strategies, perseverance, stress management, and academic behaviours, making it a potent predictor of academic success. High self-efficacy students are more able to overcome academic obstacles, make meaningful goals, and connect fully with the topic being studied. Teachers can greatly improve students' academic performance and long-term goals by promoting self-efficacy through goal-setting, resilience building, and supportive teaching approaches.

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Cite this article as: Ms.Ishrat Yousuf and Dr.G.Rajeswari., (2024). Relationship between Mathematics Self Efficacy and Mathematics Achievement, International Journal of Emerging Knowledge Studies. 3(10), pp.797-802.
<https://doi.org/10.70333/ijeks-03-10-011>