

A review of the Influence of Self-Efficacy Beliefs on Students Mathematics Achievement

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Abstract: To engage in mathematics with confidence, interest, and ease, it is essential to possess mathematics self-efficacy alongside other crucial elements for successful learning. Many studies have investigated the importance of mathematics task self-efficacy along with the elements that influence it. "Self-efficacy beliefs or confidence in our capabilities dictates how we manage emotions, motivate ourselves, think systematically and ultimately act (Bandura, 1994)." Individuals' self-efficacy beliefs can vary from low to high. Weak self-efficacy beliefs prevent people from maximizing their natural talents, whereas strong self-confidence belief accelerates performance gains. This study aims to deliver an in-depth and thorough examination of the connection between mathematics task self-efficacy and learning, along with factors influencing the improvement and decline of students' beliefs in mathematics self-efficacy. A purposive sampling technique was employed to select 20 research investigations from around the world. Teachers and parents can play a major role in enhancing students' beliefs in their capabilities in doing mathematics through diverse resources to help them gain confidence and develop their ability to handle mathematics.

Keywords: Mathematics, Self-Efficacy, Achievement, School students

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I. Introduction

Perceived mathematics self-efficacy is a vital component for a person's success in learning and acquiring knowledge of the subject. Self-efficacy in mathematics pertains to one's ability to successfully handle tasks related to mathematics. Students' self-regulation of their proficiency in mathematical tasks is known as their mathematics self-efficacy. Given that mathematics self-efficacy dictates the level of consistent effort and motivation a student applies to, it acts as a key determinant of academic success.

Mathematics is considered to be one of the most complex and difficult subjects throughout compulsory schooling. Students proficient in mathematics are better able to think critically, analyze accurately, generalize, and organize ideas. Thus, mathematical training disciplines the mind and cultivates reasoning and critical and analytical reasoning, which have a significant impact on students' accomplishments in mathematics.

"Self-efficacy is an essential element emphasized in Social Learning Theory by the remarkable psychologist Albert Bandura (Bandura, 1977)." An individual's trust in their capability to handle life circumstances stems from four primary factors: direct mastery experiences, modeling, persuasion, and emotional states. Direct mastery experiences have the greatest impact on building self-efficacy beliefs, as they originate from real-life encounters (Yildiz, 2019). Continuous successful outcomes enhance beliefs in self-efficacy, whereas constant errors diminish them (Bandura, 1982). When individuals perceive their efforts as successful, they tend to excel in subsequent

related tasks. The level of performance declines in future endeavors if they lack confidence in their own abilities. Vicarious experiences are another significant source that contributes to self-efficacy beliefs. The external environment's knowledge about a person is also useful for assessing their behavior.

If an individual lacks experience in the relevant field, they are significantly influenced by the experiences of others in developing self-efficacy. The experiences of others are more impactful when the individual serving as a model has traits common to the person. Conversely, the model's failure might lead to uncertainties regarding the individual's ability to succeed (Pajares, 2002). If the model significantly differs from the person, they are unlikely to be greatly influenced by the model or the outcomes generated by them (Bandura, 1994). Verbal encouragement and positive feedback, known as social persuasion, serve as vital tools in shaping self-efficacy. People are influenced by the responses of others as they form their self-efficacy beliefs (Yildiz, P., 2019). This primarily encompasses verbal feedback from others regarding specific abilities that the person has. "It is acknowledged that external feedback concerning the completion of tasks has a beneficial effect on an individual's efforts associated with their beliefs in self-efficacy. On the contrary, negative comments or reactions reduce the individual's self-efficacy (Pajares, 2002).

According to Bandura (1994), it is more straightforward to diminish people's self-efficacy beliefs through social influence than building strong self-efficacy beliefs in them. This situation leads to

people who perceive themselves as lacking the required skills, causing them to avoid challenging tasks and to give up swiftly when they encounter obstacles (Bandura, 1994). People can evaluate their beliefs about task accomplishment by looking at the emotional and physical responses they exhibit while performing the activity. In other words, the assessment of how well one performs is shaped by the individual's awareness of their physiological and emotional states during performance. During any activity, an individual's strong emotional reactions— such as enthusiasm, anxiety, fear, and dread—offer insights into the likelihood of a successful outcome. In addition, positive emotions enhance a person's beliefs in their own efficacy, whereas negative emotions weaken these beliefs (Bandura, 1994, 1977).

Previous research has provided a comprehensive understanding of the connection between students' self-efficacy beliefs and achievement in mathematics. These investigations highlight the significant role of attitudes towards mathematics self-efficacy as students interact with the subject. A thorough investigation was conducted to gauge how beliefs about mathematics impact students' performance in the subject and to identify areas for future investigations.

II. Aim of the Study

Research consistently demonstrates that self-efficacy beliefs are critical factors in mathematics learning and engagement. The present study was designed as part of a review of previous research. This research seeks to explore how mathematics self-efficacy influences learners' performance in mathematics to enhance their likelihood of studying mathematics, improve their cognitive performance, empower them to turn obstacles into stepping stones, and reduce their mathematics anxiety.

III. Research Questions

To achieve this study's aim, the following questions were formulated to guide the investigation:

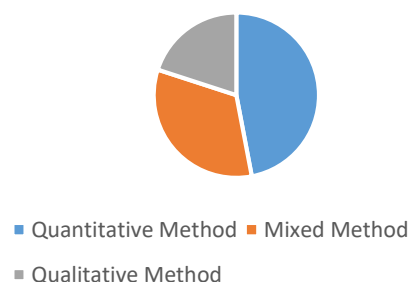
Q1. Which research method is most commonly used in studies involving self-efficacy and performance in mathematics?

Q2. What are the effects of determinants of mathematics self-efficacy on students' mathematics performance?

IV. Analysis of Impact of Self-Efficacy Beliefs on Mathematics Performance of School Students

Q1. Which research method is most commonly used in studies involving self-efficacy and performance in mathematics?

Figure 1: Research Methods of the studies



As shown in Figure 1, most studies used quantitative methods as a research method (47%), including normative surveys using correlational and longitudinal research designs, experimental designs, and mixed methods (33%); qualitative methods using case studies, semi-structured interviews, and exploratory methods followed. Thus, it is essential to employ a quantitative approach as the most suitable method for examining the influence of self-efficacy beliefs on mathematics performance in school students.

Q2. What are the effects of determinants of mathematics self-efficacy on students' mathematics performance?

Determinants of mathematics self-efficacy shape students' mathematical performance through experiences, emotions, and teaching. In social cognitive theory, an individual's beliefs about their own abilities are of paramount importance (Bandura, 2001). Self-efficacy beliefs originate from four main sources: direct mastery experiences, vicarious experiences (modeling), social persuasion, and emotional conditions (Bandura, 1995, 1997, 2012). (Bandura, 1995, 1997, 2012). Among these sources, mastery experience stands out as the most influential driver of self-efficacy (Bandura, 1995; J. A. Chen & Usher, 2013; Usher, E. L., & Pajares, F., 2008; Usher & Pajares, 2009). The second source for improving and strengthening self-efficacy is when a person gains indirect experience by observing others and comparing themselves socially (Phan, 2012). This factor has a weaker impact on shaping students' self-efficacy than mastery and vicarious experiences (Zimmerman, 2000). Support from parents, teachers, and peers, on whom students depend, can bolster their confidence in academic abilities (Usher & Pajares, 2009). Support from parents, teachers, and peers, on whom students depend, can bolster their confidence in academic abilities (Usher & Pajares, 2009). This encompasses boosting overall physical well-being, calming emotional turmoil, and rectifying misinterpretations of physiological cues (Bandura, 1995). In the field of elementary education, social persuasion or verbal encouragement from others is recognized as a leading driver of self-efficacy in mathematics (Lau, C., Kitsantas, A., Miller, A. D., & Drogin Rodgers, E. B., 2018). In the field of elementary education, social persuasion or verbal encouragement from others is

recognized as a leading driver of self-efficacy in mathematics (Lau, C., Kitsantas, A., Miller, A. D., & Drogin Rodgers, E. B., 2018). In contrast, contemporary studies have explored the possible correlation between self-efficacy and academic achievement. Research emphasizes that prior academic achievement has a more significant impact on self-efficacy than self-efficacy does in driving academic achievement (Hwang, M. H., Choi, H. C., Lee, A., Culver, J. D., & Hutchison, B., 2016; Talsma, K., Schütz, B., & Norris, K., 2019).

A notable gap exists in the current understanding of the relationship between factors influencing self-efficacy and academic achievement. "Several investigations have shown positive associations between sources of mathematics self-efficacy and academic achievement (Arslan, 2013; Kaya & Bozdağ, 2016; Keşan & Kaya, 2018; Loo & Choy, 2013; Özcan & Konaş, 2020)." Furthermore, mastery experiences have been found to be the most significant determinants of academic achievement (Kaya & Bozdağ, 2016; Loo & Choy, 2013). Furthermore, Özcan and Konaş (2017) in their investigation of interplay between sources of mathematics self-efficacy and performance on mathematics assessments highlighted the various factors associated with mathematics self-efficacy that were found to predict academic success and outcomes on standardized tests. This result concluded that the sources of mathematics self-efficacy might influence performance in mathematics evaluations and broad academic performance.

V. Conclusion

A review of 20 studies on the relationship between students' self-efficacy beliefs and their performance in mathematics revealed that, among the four main sources of self-efficacy, direct mastery experiences are paramount to students' self-efficacy in mathematics. Prior mathematical accomplishments indirectly impacted mathematics self-efficacy and directly impacted grades. Furthermore, both home and school play a critical role in nurturing a positive perspective towards mathematics with educators supporting pupils' self-efficacy and confidence. Additionally, mathematics self-efficacy is a key driver of achievement in mathematics.

It is recommended to foster students' self-efficacy beliefs by providing various positive experiences, making mathematics accessible by connecting it to daily life, and employing a variety of instructional methods and teaching techniques.

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