Educational Factors, Self-Efficacy and Mathematical Proficiency of Students: A Mediation Analysis

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ABSTRACT

In fact, students' ability to learn mathematics is still an issue because even when there have been improvements in terms of teaching methods, a number of students continue to perform poorly in the subject area. The present study looked into the association between educational factors and mathematical proficiency of grade seven students, focusing on the mediating effect of self-efficacy. Based on Self-Efficacy Theory (Bandura, 1997), the study identified the effect of instructional techniques, learning materials, and classroom settings on students' mathematics performance. Quantitative methodology was used for this study, with a sample size of 332 Grade 7 students. Survey questionnaires and mathematics proficiency test were utilized in collecting data. Descriptive statistics, Pearson correlation, and mediation analysis were used to analyze data. Findings indicated that students had positive perceptions about education-related variables, especially in terms of instructional techniques. Moreover, students had high self-efficacy levels, but they also experienced mathematics anxiety to some extent. Nonetheless, students performed poorly in mathematics proficiency, specifically in conceptual understanding.

Furthermore, it was found out that there is a statistically significant influence of the educational variables on the math ability with a very low effect size. The self-efficacy was found to be an important mediator variable for the relationship between educational variables and math achievement. It means that enhancing the self-confidence of learners is as influential as optimizing learning conditions.

Keywords: self-efficacy, math competence, educational variables, mediation analysis

INTRODUCTION

Mathematics education plays a crucial role in developing learners’ critical thinking, reasoning, and problem-solving skills. However, despite various educational reforms and improvements in instructional practices, many students continue to struggle in achieving proficiency in mathematics. This issue is particularly evident among junior high school learners, where foundational mathematical skills are expected to be developed.

Educational factors such as instructional strategies, learning resources, and classroom environment significantly influence students’ learning experiences. Effective teaching strategies that promote active engagement and student-centered learning have been shown to improve academic performance (Hattie, 2009; Slavin, 2015). Similarly, access to adequate learning materials and a supportive classroom environment contributes to meaningful learning and increased student participation (Fraser, 2012). These factors shape how students perceive and respond to mathematics instruction.

In addition to external factors, students’ self-efficacy plays a vital role in academic success. Self-efficacy, defined as an individual’s belief in their capability to perform specific tasks (Bandura, 1997), influences motivation, persistence, and performance. Students with high self-efficacy are more likely to engage in challenging tasks and demonstrate resilience in solving mathematical problems (Pajares & Miller, 1994).

Conversely, low self-efficacy is associated with mathematics anxiety and avoidance behaviors, which negatively affect performance (Ashcraft & Krause, 2007).

Mathematical proficiency is a multidimensional construct that includes conceptual understanding, procedural fluency, and problem-solving skills (Kilpatrick, Swafford, & Findell, 2001). Students often exhibit varying levels of competence across these domains, highlighting the need to examine the underlying factors influencing each component. Previous studies indicate that students tend to perform better in procedural tasks than in conceptual understanding, suggesting gaps in deeper mathematical learning (Rittle-Johnson & Schneider, 2015).

While numerous studies have examined the independent effects of educational factors and self-efficacy on academic performance, limited research has explored their combined influence using mediation analysis. Understanding how self-efficacy mediates the relationship between educational factors and mathematical proficiency can provide deeper insights into student learning processes.

Previous research has emphasized the importance of instructional strategies in improving students' academic performance. Student-centered approaches, collaborative learning, and the use of varied instructional materials have been found to enhance engagement and understanding (Hattie, 2009).

Self-efficacy has also been widely studied as a predictor of academic success. Pajares (1996) found that students with higher self-efficacy perform better academically due to increased confidence and motivation. Conversely, mathematics anxiety negatively affects performance by reducing students' ability to concentrate and solve problems effectively (Ashcraft & Krause, 2007).

Furthermore, studies suggest that self-efficacy may act as a mediating variable between instructional factors and academic performance. This implies that effective teaching not only improves learning directly but also enhances students' beliefs in their abilities, which in turn improves performance (Schunk, 1991).

Thus, the purpose of this study is to examine the relationship between educational factors and mathematical proficiency and to determine whether self-efficacy mediates this relationship.

METHODOLOGY

This study employed a quantitative research design to examine the relationships among educational factors, self-efficacy, and mathematical proficiency. The respondents consisted of 332 Grade 7 students selected through appropriate sampling techniques.

Data were collected using structured questionnaires measuring educational factors (instructional strategies, learning resources, and classroom environment) and self-efficacy (confidence in problem solving, interest and motivation, and mathematics anxiety). A mathematics proficiency test was also administered to assess students' performance in computational fluency, conceptual understanding, and problem-solving skills.

Prior to data collection, the research instruments underwent validation by experts in mathematics education and educational research to ensure content validity and relevance to the objectives of the study. Necessary revisions were incorporated based on the recommendations of the validators. Reliability testing was also conducted using Cronbach's alpha to determine the internal consistency of the questionnaire items. The results indicated that the instruments were reliable and appropriate for gathering data related to educational factors and self-efficacy among Grade 7 students.

Descriptive statistics such as mean and standard deviation were used to describe the variables. Pearson Product-Moment Correlation was employed to determine relationships among variables, while mediation analysis was conducted to examine the role of self-efficacy in influencing mathematical proficiency.

RESULTS AND DISCUSSION

Educational Factors of Grade 7 Students in terms of Instructional Strategies, Learning Resources and Classroom Environment

Tables 1 present the Educational factors, these factors were measured in terms of instructional strategies, learning resources, and classroom environment.

Table 1. Summary Table of Educational Factors of Grade 7 Students

INDICATORS	Mean	*SD*	Interpretation
1. Instructional Strategies	3.90	0.85	High
2. Learning Resources	3.57	0.92	High
3. Classroom Environment	3.75	1.01	High
Grand Mean	**3.74**	**0.84**	**High**

The result of the study showed that the total educational factors encountered by the students in Grade 7 were favorable, as evidenced by the high interpretation of the result, 3.74. Among these indicators, instructional strategies recorded the highest mean at 3.90, followed by classroom environment with a recorded mean at 3.75. Both were interpreted as high. This indicated that the strategies used by the teacher and the classroom environment were areas where students were able to learn well in mathematics. On the other hand, learning resources recorded the lowest mean at 3.57, although it was interpreted as high. This suggested that learning resources were adequate, but there was a possibility for improvement in providing students with learning materials for them to learn well in mathematics.

The results suggest that educational factors, including effective teaching methods, a good classroom environment, and adequate learning resources, play a role in the learning experiences of students in mathematics. If these factors are available and effective in a classroom environment, students may develop a good understanding of the subject of mathematics. These factors may be improved in a way that increases the students' involvement in classroom activities and helps them develop their mathematical skills.

This was supported by previous research that emphasized the role of educational factors in improving the academic performance of students. Past research revealed that effective teaching strategies and learning resources, as well as the learning environment, played an important role in improving the engagement and learning of students in mathematics. Past research also revealed that the combined effects of these factors contributed to the creation of an effective learning environment that improved the motivation and learning of students. This was in line with previous research that revealed that effective educational support systems contributed positively to the learning outcomes of students (Anthony & Walshaw, 2009; Ramos & De Guzman, 2021; Liu et al., 2021; Alzahrani & Alghamdi, 2020; Cuevas & Berou, 2025).

Level of Self-Efficacy in Mathematics

Tables 2 present the level of Students' self-efficacy which was measured through confidence in problem solving, interest motivation, and mathematics anxiety.

Table 2. Summary Table of Self-Efficacy among Grade 7 Students

Indicators	Mean	*SD*	Interpretation
1. Confidence in Problem Solving	3.67	1.00	High
2. Interest and Motivation	3.64	1.08	High
3. Mathematics Anxiety	3.22	1.06	Moderate
Grand Mean	**3.51**	**0.96**	**High**

The result showed that the general self-efficacy of the students in mathematics in Grade 7 was positive, with a grand mean of 3.51, which was interpreted as high. Among the indicators, the students showed the highest mean in confidence in solving problems, with a mean of 3.67, interpreted as high. Students also showed a high level of interest and motivation in mathematics, with a mean of 3.64, interpreted as high. This result showed that students in general have the capability to solve mathematical problems and also showed a high level of motivation in learning mathematics. On the other hand, mathematics anxiety showed the lowest mean among the indicators, with a mean of 3.22, interpreted as moderate. This result showed that students in general still experience a certain level of anxiety in dealing with mathematics.

The results suggest that students' confidence and motivation are significant factors that play a crucial role in developing self-efficacy in math. If students have a positive belief in their ability to overcome problems and are motivated enough to learn, they are likely to participate actively in math activities and even attempt hard problems in math. Nevertheless, the results reveal the need for reducing the anxiety associated with math through the implementation of various techniques that help reduce anxiety in students. It may help in developing the students' confidence even more.

These findings were consistent with studies emphasizing the role of self-efficacy in students' academic performance. Research indicated that students who possessed strong confidence in their abilities and maintained positive motivation were more likely to perform better in mathematics. At the same time, mathematics anxiety was identified as a factor that could negatively influence students' engagement and performance. Previous studies highlighted that strengthening students' confidence and reducing anxiety could contribute to improved learning outcomes and mathematical proficiency (Liu et al., 2021; Alzahrani & Alghamdi, 2020; Cuevas & Berou, 2025).

Level of Mathematical Proficiency

Tables 3–5 present the level of mathematical proficiency of Grade 7 students. Mathematical proficiency was measured in terms of computational fluency, problem-solving skills, and conceptual understanding.

Table 3. Level of Mathematical Proficiency of Grade 7 Students in terms of Computational Fluency

Table. Level of Proficiency of Respondents

Score Range	Frequency	Interpretation
11–15	26	Very High Proficiency
6–10	160	High Proficiency
0–5	146	Low Proficiency
Total	**332**	

Statistical Measure	Value
Mean	5.97
Standard Deviation (SD)	3.34

The figures presented in Table 3 below reflect the mathematical skills of the Grade 7 learners with regard to their fluency in computations. From the results, it can be seen that many of the respondents, having a frequency of 160 among the total of 332 respondents, are within the high proficiency category (scores from 6-10). This implies that a great number of learners have the necessary mathematical skills to compute problems involving numbers. Nevertheless, there is an evident number of respondents who belong to the category of low proficiency (scores from 0-5), which implies that many learners are unable to perform basic computations. Moreover, there are merely 26 respondents who fall under the very high proficiency category (scores from 11-15).

Moreover, from the calculated mean value of 5.97, it can be stated that, generally, the learners are functioning within the lower range of the high proficiency level, hence, having moderate computational proficiency among Grade 7 learners. In terms of the standard deviation of 3.34, it can be noted that it is moderately dispersed, showing differences in the learners' abilities to compute correctly. This shows that while some learners excel in computations, there are still other learners who lack even the basic understanding of math.

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The result also supports the assertion made by Kilpatrick et al. (2001) on how mathematics proficiency entails computational fluency marked by proficiency in terms of accuracy, efficiency, and flexibility. Moreover, according to the National Research Council (2001), learners have varying levels when developing mathematical proficiency.

Table 4. Level of Mathematical Proficiency of Grade 7 Students in terms of Poblem Solving

Score Range	Frequency	Interpretation
16–20	18	Very High Proficiency
11–15	122	High Proficiency
0–10	192	Low Proficiency
Total	**332**	

Statistical Measure	Value
Mean	6.88
Standard Deviation (SD)	3.72

According to the data presented in Table 4, the proficiency of the Grade 7 students in mathematical problem solving was evaluated. In accordance with the results, most of the participants, who total 192 among 332 students, have a low level of proficiency with scores from 0 to 10. The above statement implies that the majority of the learners have difficulties in comprehending, analyzing, and solving the mathematical problems. In addition, 122 students are identified to have a high level of proficiency in problem solving (11 to 15 scores), which means that quite a significant number of the learners can apply basic strategies for problem solving. Very high problem-solving proficiency is observed in 18 students only.

Furthermore, from the mean score obtained (6.88), learners are said to be in the low boundary of the high proficiency category, thus possessing a moderate degree of problem solving. The obtained standard deviation (3.72) indicates that there is a large variance of the learner's score, hence signifying that there is significant difference in the problem solving skills of the learner. It can therefore be noted that although learners possess sufficient problem solving, most of them are having difficulties when undertaking mathematical problems. As such, there is a need to adopt instructional approaches that focus on nurturing problem solving and critical thinking abilities systematically.

It is important to note that the above observation conforms to the problem solving theory advanced by George Pólya (1945). According to George, problem solving is systematic in nature and comprises four stages which include understanding the problem, devising a plan, executing the plan, and checking the solution. In the same line of thought, Kilpatrick et al. (2001) opined that problem solving was an important aspect of mathematics literacy.

Table 5. Level of Mathematical Proficiency of Grade 7 Students in terms of Conceptual Understanding

Score Range	Frequency	Interpretation
11–15	18	Very High Proficiency
6–10	65	High Proficiency
0–5	249	Low Proficiency
Total	**332**	

Statistical Measure	Value
Mean	4.34
Standard Deviation (SD)	3.01

Based on Table 5 above, there is a measure of the proficiency level among Grade 7 students in terms of conceptual understanding. In relation to the result, it can be observed that the vast majority of respondents, totaling 249, are under the category of low proficiency level, wherein their scores ranged from 0–5. From this, it can be concluded that most of the learners are having difficulties in comprehending mathematical concepts and applying them in real-life situations. Additionally, there are 65 respondents who fall under the category of

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high proficiency level (scores from 6–10), implying that only a portion of the learners demonstrate adequate understanding of mathematical concepts. Lastly, only 18 respondents fall under the very high proficiency level (scores from 11–15). The obtained mean score of 4.34 reflects that, on average, the students are at the low proficiency level, indicating weak conceptual understanding among Grade 7 students. Meanwhile, the standard deviation of 3.01 shows variability in scores, suggesting that while some students demonstrate better understanding, many still struggle significantly.

As a result, this calls for instructional approaches that prioritize conceptual understanding rather than mere memorization of procedures. This is further supported by Kilpatrick et al. (2001), who emphasized that conceptual understanding is a key component of mathematical proficiency that allows learners to make meaningful connections between mathematical ideas.

However, an important observation emerges when comparing students' self-efficacy with their actual performance in conceptual understanding. The findings also imply that despite students demonstrating high levels of self-efficacy, many still experienced difficulties in conceptual understanding and problem-solving tasks. This discrepancy suggests that confidence alone may not always translate into strong mathematical performance. Some students may feel motivated and confident but still lack deeper conceptual mastery of mathematical principles. Hence, instructional practices should not only focus on encouraging students' confidence but also on strengthening conceptual understanding through interactive activities, contextualized lessons, collaborative learning, and problem-based approaches.

The above conclusion is based on the conceptualization of mathematical proficiency posited by Kilpatrick et al. (2001), who emphasized conceptual understanding as one of the essential strands of mathematical proficiency that enables learners to connect and integrate mathematical ideas effectively. Similarly, the National Research Council (2001) stressed that meaningful mathematical learning requires strong conceptual foundations, not just procedural knowledge.

Table 6. Level of Mathematical Proficiency of Grade 7 Students

Table. Level of Proficiency of Respondents

Score Range	Frequency	Interpretation
41–50	12	Very High Proficiency
31–40	25	High Proficiency
21–30	78	Moderate Proficiency
11–20	150	Low Proficiency
0–10	67	Very Low Proficiency
Total	**332**	

Statistical Measure	Value
Mean	17.02
Standard Deviation (SD)	7.63

Based on the data presented in Table 6, the overall mathematical proficiency of the respondents, specifically of Grade 7 students, is based on their respective performance in terms of their ability to solve problems and apply concepts in computing mathematical problems. In relation to the results, most of the respondents, with a total frequency of 150 out of 332, belong to the low level proficiency category (scored between 11-20). It means that most of the learners have poor mathematical proficiency in relation to their capability in understanding, solving mathematical problems, and computations. However, there are 78 students who belong to the moderate level proficiency category (scored between 21-30). Furthermore, only 25 and 12 students belong to the high and very high mathematical proficiency categories.

Additionally, the mean score of 17.02 further implies that, on average, the learners fall under the low proficiency level. As such, Grade 7 students have not yet attained the required level of mathematical proficiency in the three strands. The standard deviation of 7.63 shows a considerable difference in the performance of the students; although some learners performed well in mathematics, most were unable to do so. In other words, although some learners have mastered their mathematical skills, most others are still developing their knowledge in math. Therefore, there is a need for instructional strategies that integrate fluency in computation, concept learning, and problem-solving skills.

The finding aligns with the theory of mathematical proficiency posited by Kilpatrick et al. (2001). They emphasize that mathematical proficiency entails the mastery of the concepts, procedures, and strategies. Additionally, the National Research Council (2001) reiterates that learners need continuous instructional activities to attain complete mathematical development.

In general, it may be observed that the outcome of this study is indicative of low mathematical proficiency levels among students at the Grade 7 level, thus highlighting the need for intervention to improve their mathematics skills.

Regression Analysis Showing the Relationship between Educational Factors and Mathematical Proficiency of Grade 7 Students

Table 7 present the Regression Analysis Showing the Relationship between Educational Factors and Mathematical Proficiency of Grade 7 Students

Table 7. Regression Analysis Showing the Relationship betwee Educational Factors and Mathematical Proficiency of Grade 7 Students

	Predictor	**B**	**S.E**	**Β**	**t**	**p-value**
1	(Constant)	9.776	1.928		5.070	.000
	Educational Factors Scale	1.856	.503	.199	3.688	.000

Note: F (1,329) = 13.603, p = .000^{b,} R = .199, R^2 = .040, ΔR^2 = .037

The table presents the results of a simple linear regression analysis conducted to determine whether educational factors significantly influenced the mathematical proficiency of Grade 7 students.

The findings showed that the Educational Factors Scale significantly influence mathematical proficiency. The regression coefficient for educational factors was B = 1.856 with a standard error of 0.503. The standardized beta coefficient (β) was 0.199, indicating a positive relationship between educational factors and mathematical proficiency. The t-value of 3.688 and p-value of .000 ($p < .001$) indicated that the relationship was statistically significant. This implies that as the level or quality of educational factors increases, the mathematical proficiency of Grade 7 students also increases. Specifically, a one-unit increase in the educational factors scale is associated with an increase of approximately 1.856 points in mathematical proficiency scores, holding other factors constant.

The overall regression model was statistically significant, as shown by F(1,329) = 13.603, $p < .001$, indicating that the educational factors variable significantly contributed to influence mathematical proficiency. The correlation coefficient (R = .199) suggests a positive but weak relationship between educational factors and mathematical proficiency.

Furthermore, the coefficient of determination (R^2 = .040) indicates that only 4% of the variance in mathematical proficiency was explained by educational factors. Although the effect size was relatively small, the findings remain educationally significant because they suggest that educational factors still contribute to students' mathematical performance. The low effect size further implies that mathematical proficiency is influenced by multiple interconnected variables beyond instructional strategies, learning resources, and classroom environment. Factors such as students' socio-economic background, prior academic achievement, study habits, parental support, and motivation may also play important roles in shaping mathematical proficiency. Thus, improving mathematics performance requires a more holistic approach that addresses both school-related and learner-related factors.

Overall, the results indicated that educational factors had a statistically significant but modest influence on the mathematical proficiency of Grade 7 students. This suggests that while educational factors play an important role in improving students' mathematical skills, other variables such as students' self-efficacy, motivation, prior knowledge, teaching strategies, and the learning environment may also contribute significantly to students' mathematical performance. A positive and supportive classroom environment encourages students to participate actively in discussions, express their ideas, and develop confidence in solving mathematical problems. According to Fraser (2012), a well-structured and supportive classroom climate promotes student engagement and improves academic outcomes. Similarly, Santos and Reyes (2021) emphasized that classrooms characterized by respect, collaboration, and positive teacher–student interactions enhance students' motivation and persistence in learning mathematics. These findings suggest that when students perceive their learning environment as safe and supportive, they are more likely to develop stronger mathematical understanding and improved academic performance.

Structural Model Results Showing the Mediating Roles of Students' Self-Efficacy in the Relationship between Educational Factors and Mathematical Proficiency

Table 8 show the Structural Model Results Showing the Mediating Roles of Students' Self-Efficacy in the Relationship between Educational Factors and Mathematical Proficiency.

Table 8. Structural Model Results Showing the Mediating Roles of Students' Self-Efficacy in the Relationship between Educational Factors and Mathematical Proficiency

Path	B	p-value	Effect Size (f^2)	R^2
Educational Factors → Self-Efficacy	0.303	< .001	0.101 (Small–Moderate)	0.092
Self-Efficacy → Mathematical Proficiency	0.161	.004	0.025 (Small)	0.063
Educational Factors → Mathematical Proficiency (Direct Effect)	0.150	.008	0.022 (Small)	0.063
Educational Factors → Self-Efficacy → Mathematical Proficiency (Indirect Effect)	0.049	< .001	—	—
Educational Factors × Self-Efficacy → Mathematical Proficiency	0.074	.048	0.012 (Small)	0.074

Notes:

β = standardized path coefficient; $p < .05$ indicates statistical significance.
Effect size interpretation follows Cohen (1988): 0.02 = small, 0.15 = medium, 0.35 = large.
R^2 indicates the proportion of variance explained in the endogenous variable.

Table 8 presents the structural model results to examine the mediating and moderating roles of students' self-efficacy in the relationship between educational factors and mathematical proficiency. The findings revealed that educational factors had a significant positive effect on students' self-efficacy ($\beta = 0.303$, $p < .001$), indicating that improvements in educational support and instructional practices contributed to stronger beliefs among students regarding their capability to perform mathematical tasks.

Further analysis showed that self-efficacy significantly influenced mathematical proficiency even when educational factors were controlled ($\beta = 0.161$, $p = .004$). At the same time, the direct effect of educational factors on mathematical proficiency remained significant ($\beta = 0.150$, $p = .008$). The computed indirect effect ($\beta = 0.049$, $p < .001$) confirmed that self-efficacy partially mediated the relationship between educational factors and mathematical proficiency. This means that part of the influence of educational factors on students' proficiency operates through enhancing students' confidence, motivation, and belief in their mathematical abilities.

In addition, the results demonstrated that self-efficacy also functioned as a moderating variable. The interaction between educational factors and self-efficacy significantly predicted mathematical proficiency ($\beta = 0.074$, $p = .048$). This indicates that the positive impact of educational factors on students' mathematical proficiency becomes stronger when students possess higher levels of self-efficacy. In other words, educational improvements tend to produce greater gains in mathematical proficiency among students who exhibit stronger confidence, greater interest, and lower anxiety toward mathematics.

Overall, these findings highlight the dual role of self-efficacy as both a mediator and moderator in the relationship between educational factors and mathematical proficiency. This suggests that enhancing students' self-beliefs in mathematics is a critical mechanism through which educational practices influence learning outcomes, and that fostering high self-efficacy can amplify the effectiveness of educational interventions in improving students' mathematical performance.

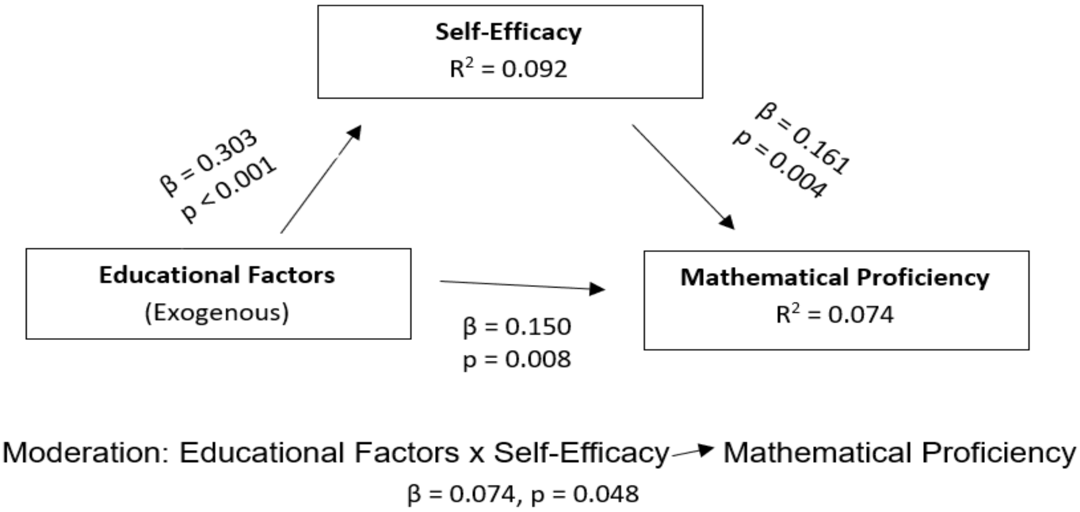

Figure 1. Mediation Model Diagram

The figure presents the structural equation model showing the relationships among educational factors, students' self-efficacy, and mathematical proficiency of Grade 7 students. Educational factors significantly predicted self-efficacy ($\beta = 0.303$, $p < .001$), indicating that improvements in educational support and instructional practices enhanced students' confidence in their mathematical abilities. Self-efficacy, in turn, significantly predicted mathematical proficiency ($\beta = 0.161$, $p = .004$). The direct effect of educational factors on mathematical proficiency remained significant ($\beta = 0.150$, $p = .008$), confirming partial mediation. Additionally, the interaction between educational factors and self-efficacy significantly influenced mathematical proficiency ($\beta = 0.074$, $p = .048$), demonstrating the moderating role of self-efficacy. The model explains 9.2% of the variance in self-efficacy and 7.4% of the variance in mathematical proficiency, indicating that educational factors and self-efficacy contribute to students' mathematical outcomes.

CONCLUSION

The study concludes that while educational factors are positively perceived by students, these alone are not sufficient to ensure high levels of mathematical proficiency. Self-efficacy plays a critical role in bridging the gap between learning conditions and academic performance.

Therefore, improving mathematics education requires not only enhancing instructional strategies and learning environments but also strengthening students' confidence, motivation, and resilience in learning mathematics.

RECOMMENDATIONS

Based on the findings, teachers are encouraged to implement instructional strategies that promote conceptual understanding, critical thinking, and active student engagement in mathematics classes. Schools may also strengthen support systems by providing sufficient learning resources and creating classroom environments that enhance students' confidence and motivation in learning mathematics. Since the study revealed relatively small effect sizes, future researchers may consider including additional variables such as socio-economic status, parental support, study habits, prior academic achievement, and learning strategies to further explain students' mathematical proficiency. Future studies may also employ longitudinal and qualitative research designs to provide a deeper understanding of how self-efficacy influences mathematical performance over time.

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