RELATIONSHIP BETWEEN SELF-EFFICACY AND MATHEMATICS ACHIEVEMENT AMONG GRADE FIVE LEARNERS WITH DYSCALCULIA IN NAIROBI COUNTY, KENYA

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International Academic Journal of Social Sciences and Education (IAJSSE) | ISSN 2518-2412

Received: 5th March 2026

Published: 13th March 2026

Full Length Research

Available Online at: https://iajournals.org/articles/iajsse_v2_i4_292_302.pdf

Citation: Kulenya, K. F., Muthee, J. J. M., Ouko, H. (2026). Relationship between self-efficacy and mathematics achievement among grade five learners with dyscalculia in Nairobi County, Kenya. *International Academic Journal of Social Sciences and Education (IAJSSE), 2*(4), 292-302.

ABSTRACT

This research intended to explore the relationships between self-efficacy, and mathematics achievement among grade five learners with dyscalculia in international schools in Nairobi County, Kenya. The study was directed by Social Cognitive Theory. The correlation research design was utilized. The study targeted 10 school administrators, 30 grade five teachers and 200 grade five learners. The sample size comprised of 125 respondents which include 100 grade five learners, 20 grade five and 5 school administrators. The study utilized questionnaires, standardized tests and assessments, observations, interviews, focus group discussion and academic records to gather data. The questionnaires were utilized to gather the main data on self-efficacy as well as mathematics achievement among grade 5 learners with dyscalculia. The dyscalculia identification tool for grade 5 learners was adopted to help in identifying learners with dyscalculia in international schools Nairobi County. The aim of pilot study was to improve the validity and reliability of the research tools. The consistency and reliability of the data acquired was also evaluated using the split half reliability approach at a 0.7 coefficient. Mixed method techniques to data analysis that incorporate both qualitative and quantitative data were used. Themes and patterns were used to analyze qualitative data, while statistical distribution metrics like percentiles, frequencies, averages, and variance were utilized to analyze numerical data. To draw conclusions from the data, multivariate analysis was also employ inferential statistics. The findings show that there was strong relationship between learners' self-efficacy and their performance in mathematics. The outcomes indicated that there are a number of techniques that positively affected the learning of individuals with dyscalculia. The study suggested that governmental agencies should make a greater effort to support inclusive education through financial support of schools through grants to provide schools with tools and technologies specifically designed to help students with math-related difficulties.

Key words; Dyscalculia, Self-Efficacy, Mathematics Achievement, Grade-five learners.

INTRODUCTION

Dyscalculia is characterized as a particular learning disability that is associated with mathematical abilities, and its prevalence is estimated to be around 4-6% in the general population (Yahya et al., 2020). Students who have dyscalculia have problems in grasping

very basic mathematical ideas like number sense, usage of number lines, and comparing amounts. They usually find it hard to perform both simple arithmetic calculations and also work with abstract math concepts, and therefore they have a problem in getting the math knowledge. The limitations that these individuals face relate to the inability of the brain to process numbers correctly, thus impacting their mathematical reasoning, memorization, and academic performance in general (Onyisi & Sefotho, 2021).

Mathematics, contrarily, is a fundamental life skill that is not limited to calculations performed on paper and with a pencil. It is a prerequisite for success in the fields of science, technology, and economics, and a low level of math skills can pose a barrier to an individual's gaining full acceptance and being able to perform in the modern office (Jeya & Albina, 2019). On the other hand, the importance of mathematics has not made the public aware of the unique learning disability dyscalculia to the same extent as the more well-known ones, e.g., dyslexia, especially in the areas of education and policy making. As a result, in many cases, students with dyscalculia cannot get proper help in classrooms, they are often misperceived as "lazy" or "not having the ability" which lowers their motivation and self-esteem even more (Yoong & Ahmad, 2020).

One key factor influencing learners' academic achievement in mathematics is self-efficacy. According to Bandura (1997), self-efficacy is the conviction that one can accomplish the actions necessary to reach particular objectives. Mastery experiences, vicarious experiences, verbal persuasion, and emotional states are the four main ways that self-efficacy is reinforced (Lewis et al., 2022). Students having low self-belief, strong math self-efficacy ones are more likely to attempt difficult tasks, persist, and even do better. Thus, the support of math self-efficacy among dyscalculic students is necessary for the enhancement of their motivation and academic performance.

Internationally, the poor results in mathematics present a common problem. In South Africa, Spaull (2018) pointed out very low levels of mathematics proficiency. Similar things were witnessed in the case of Cameroon by Sari and Karyati (2020), where the difficulties of primary level learning often led to general learning disabilities like dyscalculia. Jeya and Albina (2019) reported that 9% of primary school children in Karaikudi, India were at risk of dyscalculia, whereas Zhang, Wen, and Dube (2022) urged the application of specially designed pedagogical ways for Chinese numerically challenged learners. Onyisi and Sefotho (2021) showed that the effect of individualized instruction on self-efficacy was significantly positive for children with dyscalculia in inclusive classrooms.

In Kenya, Kahenya, Muthee, and Kaaria (2022) explored the impact of teacher traits on the math grades of dyscalculic students in public primary schools at Starehe sub-county. Their research indicated shortcomings in good teaching methods because most of the teachers, who were experienced, were not trained professionally in special needs education. Moreover, it was discovered that differentiated assessments, which were seen as being pivotal to enhancing performance, were very few due to the inadequacy of identification

and support which in turn, strengthened negative perceptions of the learners and poor self-esteem in mathematics.

The impact of dyscalculia and related factors on mathematical performance have been subjects of research in many countries around the globe, however, the majority of them dealt with young students in such countries as India, China, and South Africa (Jeya & Albina, 2019; Zhang, Wen & Dube, 2022; Spaull, 2018). Also, in Kenya, the research that is available has predominantly been focused on the teacher's qualifications and instructional methodologies in the primary sector (Kahenya, Muthee, & Kaaria, 2022). There are very few studies that have quantitatively examined the role of therapeutic self-efficacy enhancement methods in secondary school students with dyscalculia and their math performance. This shortfall of research calls for additional studies to help in the development of precise interventions that tackle both the cognitive and affective aspects of math learning.

Problem Statement

Dyscalculia learners face huge struggles in their quest for math mastery. These hurdles not just slow down their academic development but also take away their self-esteem and willingness to deal with the topic. The problems become more serious as traditional ways of teaching are used, which very often do not support the special learning needs of these students. As a result, a lot of dyscalculia students go through continuous difficulties and perceive themselves as being less able in math, thus making their negative self-image and disengagement from the subject even stronger.

Research has pointed out self-efficacy's great importance, as a factor that influences mathematics achievement the most, but still there has been no research done in Kenya to find out how self-efficacy could be intentionally developed in school dyscalculia. Consequently, the aim of the present research is to analyze the connection between self-efficacy, and math performance to the case of dyscalculic children in the foreign schools of Nairobi County. The findings are likely to provide the basis for recommendations on better instructional methods and the creation of supportive learning settings which will help the mentioned group of students in their math education.

Theoretical Framework

This study is based on Albert Bandura's Social Cognitive Theory (SCT), which focuses on how an individual's unique profile interacts with their behavior in relation to the surrounding environment to determine how they learn. The SCT revolves around a person's self-efficacy, which is defined as the conviction that an individual can determine and implement the right actions in order to accomplish particular objectives. In the academic setting, the students' self-efficacy directly influences their motivation, persistence, and performance. Students who have self-confidence are less likely to shy away from challenging tasks, make use of effective techniques, and endure during hard times.

Bandura goes one step further and claims that learning is possible by the method of observation, where people take over new behaviors and skills just by seeing others. This theory is completely in sync with the instructional techniques like modeling, demonstration, peer tutoring, and collaborative learning which are used in this study for the benefit of learners with dyscalculia.

The theory was practically used in the study through assessing educational math self-efficacy via structured questionnaires and surveys where students rated their confidence in solving math problems. Teachers were prepared to increase the self-efficacy of the students by using scaffolding, setting small and practicable goals, and giving feedback that is positive and constructive. The feedback was provided not just relying on the outcomes but also considering the input and the plan applied, hence the students believed in their power to become better. Therefore, Bandura's Social Cognitive Theory was the theoretical backbone of the study and it helped in self-efficacy measurement in improving performance of learners with dyscalculia.

REVIEW OF LITERATURE

Self-Efficacy and Academic Achievement

The study of academic success has linked the concept of self-efficacy by Bandura (1997) closely with its most visible manifestation in mathematics. Learners with high self-efficacy are more likely to accept the challenge of hard tasks and remain committed even when they encounter difficulties (Bandura, 1986). In a study conducted by Fuchs et al. (2015), it was concluded that self-efficacy is a strong predictor of mathematics performance for students with learning disabilities, even when initial performance is taken into account.

In their studies, Van der Beek et al. (2017) from the Netherlands and Karimi and Dowson (2019) from Iran both indicated that self-efficacy beliefs of a higher level result in better performance in mathematics which later recognized the universality of the issue. In East Africa, Njiru and Wambugu (2018) in Nyeri, Kenya, pointed out, among other factors, that self-efficacy was the strongest determinant of mathematics achievement, and Mwaniki and Njagi (2019) in Kirinyaga presented that measures like setting goals and providing positive feedback improved confidence and performance. In a research report, Mutua, Mwangi, and Kamau (2020) discussed the situation in Nairobi and classified teacher support as the most critical factor in enhancing the self-efficacy of students.

RESEARCH METHODOLOGY

The present study adopted a correlational research design. Such a design was indeed justified because it avoids the manipulation of variables thereby examining their relations, which is especially fitting for the educational realm where it might be impractical or even unethical to change important factors like teaching styles or students' self-efficacy (Creswell & Creswell, 2019). The study was done in Nairobi County, which is one of the 47 counties that make up Kenya. For this study, the target population included the Grade Five students

with dyscalculia, their math teachers, and school principals in international schools in Nairobi County.

Specifically, the study focused on 200 dyscalculic Grade Five learners who have received formal diagnosis and are studying in international schools. Around 30 math teachers who have the responsibility of teaching Grade Five dyscalculic students in the selected schools. Nearly 10 Special Needs Coordinators or support personnel, including those responsible for policy development, curriculum adaptation, and implementation of support measures for dyscalculic students, are involved in government activities.

The research embraced a stratified random sampling technique to guarantee adequate representation of the different subgroups within the target population. Stratification was done based on school categories and learner characteristics (e.g., self-efficacy levels), after which participants were randomly selected proportionally from each stratum.

Table 1: Study Population and Sample Size

	Population	**Sample size**	**Sampling Method**
Schools administrators	10	5	Random sampling
Teachers	30	20	Random sampling
Grade 5 learners	200	100	Random sampling
Total	**230**	**125**	

To gather thorough information on the connection between self-efficacy and mathematical achievement among students with dyscalculia, the study used a mix of quantitative and qualitative tools. Through triangulation, the use of several instruments improved the validity of the results. The instruments included questionnaires, standardized tests and assessments, observation checklists, interview schedules, focus group discussions, and academic records. Data were analyzed using both quantitative and qualitative techniques to ensure a comprehensive understanding of the research problem. The analysis, the quantitative data gathered from the surveys were processed with the help of the SPSS version 27 software. To give a general picture of the answers and to characterize the population of the participants, descriptive statistics such as frequencies, percentages, and means were used.

Inferential statistics were used to explore the relationships among the primary research variables, self-efficacy, and mathematics achievement of dyscalculic learners in Grade Five. The correlation analysis was performed to indicate the direction and strength of the relationships between the variables. The multiple regression analysis was used to measure how much teaching methods and self-efficacy could predict mathematics performance.

RESULTS AND DISCUSSION

The analysis, interpretation, and discussion of the data gathered in accordance with the study's goals are presented in this chapter.

Self-Efficacy and Achievement in Mathematics Among Learners with Dyscalculia

Self-efficacy is a major determinant of the students' motivation, learning, persistence, and success in school, particularly in mathematics, which is a subject that is often linked with anxiety and difficulty perceived. Among individuals suffering from dyscalculia, which is a learning disability that specifically affects the understanding of numbers, self-efficacy becomes even more important. The research employed a 5-likert scale ranging from SD-strongly disagree to SA=strongly agree. The analysis of the teachers' responses correlating self-efficacy with mathematics achievement is shown in Table 2.

Table 2: Relationship Between Self-Efficacy and Mathematics Achievement Among Grade Five Learners with Dyscalculia

Statements	SD	D	U	A	SA	Mean
Learners with higher levels of self-efficacy tend to perform better in mathematics assessments.	-	2 (10%)	3 (15%)	9 (45%)	6 (30%)	3.95
Low self-confidence in handling numerical tasks contributes to poor mathematics outcomes in learners with dyscalculia.	2 (10%)	1 (5%)	2 (10%)	5 (25%)	10 (50%)	4.00
Learners with strong beliefs in their math capabilities show greater persistence in solving challenging math tasks.	-	2 (10%)	2 (10%)	5 (25%)	11 (55%)	4.25
Encouragement and feedback from teachers enhance learners' self-efficacy and academic outcomes.	-	-	1 (5%)	4 (20%)	15 (75%)	4.70
Learners who frequently set math-related goals and monitor their progress tend to demonstrate higher self-efficacy and achievement.	-	2 (10%)	3 (15%)	6 (30%)	9 (45%)	4.10
Self-efficacy significantly influences the effort learners invest in solving mathematics problems.	-	-	3 (15%)	8 (40%)	9 (45%)	4.30

The outcomes in Table 2 indicated that most responders agreed (45%) or strongly agreed (30%) that higher levels of self-efficacy correlate with better performance in mathematics (mean = 3.95). The learners' beliefs in their math talents and their real school performance are linked directly by the perception. This conclusion is backed by the work of Carbonneau, Marley, and Selig (2020), who showed that self-efficacious students are less likely to give up and more likely to win in the academic arena as a result of their persistence and hard work directed by their positive self-image. Mwangi and Ndichu (2020) have found that high self-efficacy learners are more likely to be engaged and perform well in challenging subjects like mathematics.

The results show that 75% of participants agreed with this statement, indicating a strong consensus that low self-confidence negatively impacts mathematics achievement (mean = 4.00). The result suggests that the psychological obstacle of low self-confidence might be

one of the reasons for the underachievement of the dyscalculic learners. According to Geary (2021), self-confidence is frequently the first step to academic performance, and less confident students are more likely to give up or not even try at all in the subject of mathematics. The observation is reinforced by the recent study conducted by Kariuki and Omollo (2021) who reported that Kenyan students with learning disabilities such as dyscalculia are often the ones who shy away from exercises they think are very hard for them because of their negative self-image and the fear of failure.

The findings reveal that 80% of respondents agreed or strongly agreed, inferring that learners' belief in their own abilities enhances their persistence in problem-solving (mean = 4.25). It is evident from this that self-efficacy is a factor that not only influences the results but also determines the way the learners deal with tasks, particularly the difficult ones. Butterworth et al. (2019) stated that students with high self-efficacy are likely to apply deeper cognitive methods and stay longer on hard tasks. This discovery is in line with Wanjiru and Gathungu (2019), who contended that in case of Kenyan students with numeracy difficulties, persistence is an immediate outcome of confidence that is created through continuing successful learning sessions.

A substantial 95% of the responders agreed or strongly agreed with this statement, indicating near-universal consensus. The high mean of 4.70 underscores the central role of teacher encouragement and constructive feedback in enhancing learner self-efficacy. The present discovery indicates that social persuasion, for example, teacher support, strongly influences the process of learners' self-perceptions. Wekesa and Chebet (2022) also referred to social persuasion as one of the four sources of self-efficacy which is why they backed up as well. According to the study conducted by Emerson and Babtie (2020) in Kenyan international schools, it was also the case that the teacher feedback that was focusing on the effort rather than the results led to increased confidence, and in the end, getting better academic outcomes in mathematics as well.

The results uncovered that 75%, were in favor of this idea, thus inferring that the combination of setting a goal and self-monitoring will lead to greater self-efficacy and better results (mean = 4.10). This suggests that the application of metacognitive methods like goal setting and progress monitoring do not only enable the students to assess their learning but also build their trust in themselves. Mutinda and Muriuki (2023) back this up by claiming that goal-setting is no less a motivating and instructive technique and is especially very much suitable for students with special needs. This goes hand in hand with Montague and van Garderen (2022), who pointed out the necessity of goal-setting interventions for instilling self-confidence and acquiring numeracy skills among the students of Kenyan private and international schools.

A total of 85% agreed or strongly agreed with the statement, which means that the learners' self-confidence was the main factor that decided their efforts in the subject of mathematics (mean 4.30). This is in direct support of the proposition that students who have a high self-

image are the ones who will most likely give up their time, focus, and energy on operating through a problem. This is the same as what Kimani and Nyaga (2021) found, where students with a high mathematical self-efficacy put in more effort and employed a variety of problem-solving techniques. A similar pattern was observed by Kimani and Nyaga (2021) in international schools in Nairobi, where the motivated students had greater endurance in learning mathematics.

Inferential Statistics

The use of inferential statistical methods enabled the researcher to determine not only the relationships among variables but also the extent to which these relationships were statistically significant and generalizable. Multiple regression analysis, analysis of variance (ANOVA), and correlation analysis were the main inferential statistical techniques used in the study.

Table 3: Correlational Outcomes

Correlations	Mathematics Achievement	Self-Efficacy
Mathematics Achievement	1	.729**
Self-Efficacy	.729**	1

$p < .01$, two-tailed (significant at the 0.01 level)

The correlation analysis shows strong, positive, and statistically significant relationships between mathematics achievement and self-efficacy ($r = .729$, $p < .01$). This suggests that learners' self-efficacy improves hence improvement in mathematics performance.

Table 4: Coefficients Regression Outcomes

Model	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
(Constant)	12.487	2.734	—	4.568	.002
Self-Efficacy	0.528	0.097	.456	5.443	.004

The regression coefficients presented in Table 4 showed that constant (intercept) of 12.487 implies that, even when the influences of self-efficacy are held at zero, the base score for mathematics achievement would be 12.487. While this value alone does not hold explanatory power, it provides a reference point for interpreting the regression equation.

The unstandardized coefficient for self-efficacy is 0.528, meaning that a one-unit improvement in learners' belief in their own mathematical capabilities contributes a 0.528-unit increase in their achievement score. This relationship is slightly stronger as seen from the standardized beta coefficient ($\beta = .456$). The t-value of 5.443 and the p-value of .004 also indicate a statistically significant contribution of self-efficacy to learners' mathematical

performance. The findings indicate the importance of psychological and motivational factors a student's confidence in his/her abilities, particularly in the case of the latter, in contributing to learning outcomes. In dyscalculic students, who may have more persistent difficulties than their classmates, the creation of positive self-perceptions is a prerequisite to the development of academic engagement and success.

Conclusions

The study concluded that self-efficacy, an individual's belief in his or her ability, is an important factor in determining the success of an individual in mathematics; those with higher levels of self-efficacy tend to have a greater level of motivation, persistence, and resiliency than other students.

Recommendations

To the Government of Kenya:

- Creating the national policies for the early identification, diagnosis and the monitoring of children with dyscalculia.

To the Ministry of Education:

- Mandatory continuous professional development for teachers on inclusive pedagogies must be instituted.
- Apply quality assurance measures in the classroom that will guarantee differentiated instruction as a result.

To Parents:

- Establish a supportive home environment that will create a positive attitude towards math.
- Contact the teachers to monitor the progress of the student and help build self-confidence at home.

To Policymakers:

- Create and implement inclusive education policies that obligate IEPs and the application of evidence-based teaching techniques.

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