Self-Regulated Learning as a Correlate of Mathematics Achievement among Secondary School Students in Meru South Sub-County, Kenya

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ABSTRACT

This study investigated the relationship between self-regulated learning and mathematics achievement among Form Three students in Meru South Sub-County, Kenya, a region characterized by persistent underperformance in the subject. Grounded in Bandura's Social Cognitive Theory, the study sought to determine the extent to which students' strategic learning behaviors are associated with their academic outcomes. A correlational research design was employed, involving a sample of 276 Form Three students selected from public secondary schools. Data on self-regulated learning were collected using the Academic Self-Regulated Learning Questionnaire (ASRLQ), while mathematics achievement was measured using standardized examination scores. Data were analyzed using the Pearson product-moment correlation coefficient. The results revealed a strong, positive, and statistically significant relationship between self-regulated learning and mathematics achievement ($\rho = .766$, $p < .001$). This finding indicates that students who more frequently employ self-regulatory strategies such as goal setting, self-evaluation, and environmental structuring tend to achieve higher scores in mathematics. The study concludes that self-regulated learning is a critical component of academic success in mathematics and recommends the explicit integration of self-regulated learning strategy instruction into secondary school mathematics pedagogy to better equip students for academic success.

Keywords: Self-Regulated Learning, Mathematics Achievement, Social Cognitive Theory, Secondary School Students, Kenya, Correlational Study

INTRODUCTION

For decades, mathematics achievement has been globally recognized as a cornerstone of academic success and a critical driver of future career opportunities and national economic development. Despite this recognition, persistent low achievement in mathematics remains a significant challenge in educational systems worldwide. In the United States, for instance, students have demonstrated middling performance on international assessments, a trend Richards (2020) attributes to pedagogical approaches that overemphasize formulaic application at the expense of creative problem-solving. Similarly, in South Africa, a confluence of student- and teacher-related factors, including negative attitudes and language barriers, has contributed to poor learning outcomes in mathematics (Mabena et al., 2021). This global pattern of underachievement has spurred extensive research into the complex interplay of factors that influence student success in this critical subject.

The situation in Kenya mirrors these international trends. Persistent poor performance in mathematics at the secondary school level is a matter of grave concern for educators and policymakers. In Meru South Sub-County, the context for the present study, this challenge is particularly acute. The Kenya Certificate of Secondary Education (KCSE) mean scores in mathematics for the sub-county have consistently remained far below average, with mean scores of 2.6 (Grade D) in 2018, 2.4 (Grade D-) in 2019, 2.7 (Grade D) in 2020, and 2.5 (Grade D) in 2021. These outcomes indicate that a vast majority of students are graduating with inadequate problem-solving skills, limiting their access to competitive post-secondary courses and careers in a technology-driven era.

While numerous studies have investigated external factors influencing this performance, less attention has been paid to the internal, psychological processes that students employ to manage their own learning. Scholars have identified self-regulated learning—the process by which students actively manage their cognitions, behaviors, and emotions to achieve academic goals—as a potent factor in academic success (Zimmerman & Labuhn, 2012). However, most research in this area has been conducted in Western or Asian contexts, and findings may not be directly generalizable to the unique educational environment of rural Kenya. A significant gap exists in the local literature regarding the specific relationship between students' use of self-regulated learning strategies and their mathematics achievement in a context like Meru South Sub-County. Therefore, the purpose of this study was to establish the relationship between self-regulated learning and mathematics achievement among Form Three students in Meru South Sub-County, Kenya.

LITERATURE REVIEW

Self-regulated learning is a proactive and cyclical process wherein learners set goals, select and deploy strategies, monitor their progress, and adjust their approaches based on feedback (Zimmerman & Labuhn, 2012). It encompasses a range of cognitive, metacognitive, and behavioral strategies, including memory enhancement, goal setting, self-evaluation, help-seeking, environmental structuring, and organization. Rather than viewing students as passive recipients of information, the concept of self-regulation frames them as active agents in their own learning journey. This perspective is critical in a subject like mathematics, which demands not only content knowledge but also strategic thinking, persistence, and metacognitive awareness.

A substantial body of international research has established a strong, positive link between self-regulated learning and academic achievement across various domains, including mathematics. In a large-scale study in Australia, Harding et al. (2019) found that self-regulated learning was a powerful predictor of mathematics achievement for students in grades five through eight. Their findings highlighted that students who actively managed their learning environment and monitored their progress consistently outperformed their peers. Similarly, in a study conducted in the Philippines, Llagoso (2017) reported that students who utilized self-regulated learning strategies, such as setting personal goals and motivating themselves, achieved higher scores in mathematics. This suggests that equipping students with these strategic skills can directly translate into improved academic outcomes.

This relationship has also been validated in various African contexts. A study in Nigeria by Duru and Okeke (2021) adopted a predictive design and found that self-regulated learning skills significantly predicted the mathematics achievement of both high- and low-achieving secondary school students. The researchers concluded that self-regulation has a direct and measurable influence on performance, suggesting that interventions focused on these skills could be highly effective. In Oman, El-Adl and Alkharusi (2020) investigated the association between self-regulated learning, motivation, and mathematics performance, finding that students who achieved the best results were those who adeptly used cognitive and self-regulated learning strategies.

Within Kenya, research has begun to explore components of this relationship, though often focusing on specific sub-domains of self-regulation. For example, Ong'uti et al. (2019) examined metacognitive monitoring, a key aspect of self-regulation, and established a positive and significant relationship with mathematics performance among secondary school students in Kisii County. Likewise, Ochieng (2015) studied self-efficacy, another crucial component of self-regulation, and found a significant positive correlation with academic performance in Kisumu County. While these studies provide valuable insights, they tend to focus on a single facet of the broader self-regulation construct. A more holistic investigation into the relationship between global self-regulated learning—encompassing its multiple strategic components—and mathematics achievement is needed, particularly within the under-researched context of Meru South Sub-County. This study aims to fill that gap by providing a comprehensive analysis of this relationship.

THEORETICAL FRAMEWORK

This study is anchored in Albert Bandura's (1986) Social Cognitive Theory. This theory provides a robust framework for understanding human learning and functioning, positing that individuals are not merely shaped by their environment but are active agents who influence their own development through a process of triadic reciprocal determinism. According to this model, personal factors (e.g., beliefs, cognitive processes), behavioral patterns, and environmental influences continuously interact and determine one another. Self-regulation is a core concept within this theory, representing the mechanism through which individuals exercise agency over their own actions and learning environments.

Bandura (1986) conceptualizes self-regulation as a process involving three key sub-functions: self-observation, self-judgment, and self-reaction. First, individuals must monitor their own behavior and its outcomes (self-observation). In an academic context, this involves students paying attention to their study habits, their level of understanding, and their performance on assignments. Second, they compare this observed performance against personal or external standards and goals (self-judgment). For a student, this could mean assessing whether their current study methods are effective enough to achieve a desired grade. Finally, based on this judgment, they engage in self-reaction, which involves affective and tangible responses to their own behavior. A positive self-reaction, such as a sense of satisfaction from mastering a difficult concept, can enhance self-efficacy and motivate continued effort. Conversely, a negative self-reaction might prompt a student to change their study strategy.

Social Cognitive Theory directly informs the variables in this study by framing self-regulated learning as a proactive, goal-directed behavior. The strategies measured by the Academic Self-Regulated Learning Questionnaire—such as goal setting, self-evaluation, seeking assistance, and environmental structuring—are all manifestations of this agentic process. For example, a student who sets specific academic goals (goal strategy), assesses their progress towards those goals (self-evaluation), and adjusts their physical environment to minimize distractions (environmental structuring) is actively engaging in the self-regulation cycle described by Bandura. The theory posits that students who are more adept at these processes will be more effective learners. Therefore, it provides a powerful theoretical rationale for the hypothesized positive relationship between self-regulated learning and mathematics achievement. The study tests this proposition by examining whether higher levels of these self-regulatory behaviors are indeed associated with better academic outcomes in mathematics.

METHODOLOGY

Research Design

A correlational research design was employed for this study. This design is appropriate when the objective is to establish the nature and strength of the relationship between two or more naturally occurring variables without manipulating them (Sorensen, 2009). As the study's variables—self-regulated learning and mathematics achievement—could not be experimentally manipulated, this design was ideal for determining the degree to which they are associated.

Study Setting and Participants

The study was conducted in public secondary schools in Meru South Sub-County, Tharaka-Nithi County, Kenya. This location was purposively selected due to a consistent record of below-average performance in mathematics in the KCSE examinations. The target population consisted of all Form Three students in the sub-county. From an initial target of 392 students, a total of 276 students successfully completed and returned the questionnaires, yielding a response rate of 70.4%, which is considered adequate for analysis. The final sample (N = 276) showed a near-equal gender distribution, with 139 females (50.4%) and 137 males (49.6%). The majority of participants were 16 years old (36.6%), consistent with the typical age for their academic level.

Research Instruments

Data on self-regulated learning were collected using the Academic Self-Regulated Learning Questionnaire (ASRLQ), an instrument developed by Magno (2010). The questionnaire consists of 32 items measuring seven distinct facets of self-regulation: memory strategy, goal setting, self-evaluation, seeking assistance, environmental structuring, learning responsibility, and organizing. Participants responded to each item on a five-point Likert scale. A pilot study was conducted with 40 students to establish the instrument's psychometric properties for the local context. Reliability analysis yielded Cronbach's Alpha coefficients ranging from .748 to .874 for the seven subscales, indicating good to excellent internal consistency. Construct validity was established through a Confirmatory Factor Analysis (CFA), which confirmed the seven-factor structure of the model with good fit indices (CFI = .972, RMSEA = .031). Mathematics achievement was measured using the students' official school examination scores. The mean score from the midterm and end-of-term examinations for Term One 2023 was obtained for each participant. To ensure comparability across different schools and classes, these raw scores were converted into standardized T-scores ($T = 10Z + 50$).

Data Collection and Analysis

Following authorization from university and local education authorities, the researcher visited the selected schools. Questionnaires were administered to students who voluntarily consented to participate. To ensure confidentiality, students were assigned serial number codes, which were used to match their questionnaire responses with their mathematics scores from the official mark sheets. The collected quantitative data were coded and entered into SPSS. To address the study's objective, a Pearson product-moment correlation analysis was conducted to determine the relationship between the composite score for self-regulated learning and the T-scores for mathematics achievement.

Ethical Considerations

The study adhered to strict ethical guidelines. A research permit was obtained from the National Commission for Science, Technology and Innovation (NACOSTI). Permission was also secured from county and sub-county education offices and the principals of the participating schools. Informed consent was obtained from all student participants, who were assured of the voluntary nature of their participation and their right to withdraw at any time. All data were anonymized and treated with strict confidentiality.

RESULTS

This section presents the findings of the data analysis. It begins with the descriptive statistics for the students' use of self-regulated learning strategies, followed by the inferential analysis used to test the study's hypothesis.

Descriptive Findings on Self-Regulated Learning

The descriptive statistics for the Academic Self-Regulated Learning Questionnaire (ASRLQ) indicated that students, on average, reported a moderate use of self-regulatory strategies across all seven measured constructs. The mean scores for most of the 33 items clustered around the scale's midpoint of 3.0, suggesting that these learning behaviors are employed with some regularity but not to a high degree. The Learning Responsibility subscale yielded the highest average mean ($M = 3.05$), while the Organizing subscale had a slightly lower mean ($M = 2.86$). The standard deviations were consistently around 1.00, indicating a normal level of variation in students' responses. Table 1 provides a detailed summary of the item-level descriptive statistics.

Table 1: Descriptive Statistics for Self-Regulated Learning (SRL) Subscales (N = 276)

Subscale	**Statement**	**Mean**	**SD**
Memory Strategy	I write the information that I need to remember it.	2.98	1.01
	I use my own words in writing my notes.	3.00	0.99
	I represent concepts with symbols so that I can easily remember them.	2.89	1.04
	I construct questions based on what I have learned and attempt to answer them.	3.00	1.00
	Before I consider a topic finished, I make sure I can create and answer questions about it.	2.98	0.99

Goal Setting	I make a schedule of the activities I need to complete.	2.99	0.97
	I plan the things I have to do in a week.	3.01	1.01
	I keep track of myself if I am accomplishing my goals.	3.01	0.99
	I have in mind an end goal in every task that I engage.	3.02	0.90
Self-Evaluation	If I am having a difficulty, I inquire assistance from an expert.	2.94	1.00
	I evaluate my accomplishments at the end of each study.	3.02	1.04
	I keep track of my accomplishments.	2.92	1.04
	I ask feedback of my performance from someone whom I think is good on it.	3.04	0.99
	I check my progress by reviewing my past performance.	3.01	0.98
	I improve my work by considering relevant feedbacks I received.	2.94	1.07
Seeking Assistance	I use library resources to find the information that I need.	3.00	0.97
	I enjoy group work because of the cooperation.	2.96	1.03
	I ask a classmate about the homework that I missed.	2.97	0.98
	I compare my notes with that of my classmates.	2.97	1.03
	I share to my peers what I have learned.	2.96	1.02
Environmental Structuring	I avoid any distractions while doing school work.	3.01	0.97
	I find a place where I can study well.	3.01	0.99
	I am not easily distracted by the things around me when I study.	2.91	0.99
	I make a way to minimize distractions when I study.	2.93	0.95
Learning Responsibility	I recheck my homework if it is done properly before submitting.	3.05	0.98
	I finish all my homework first before doing unnecessary things.	3.06	0.95
	I make sure I submit good work on time.	3.03	0.90
	I continue studying on a topic even if it is not required.	3.07	0.97
Organizing	I mark important concepts and information I find in my readings.	2.96	0.96
	I anticipate the type of test questions to pace myself in studying.	2.92	0.97
	I keep my past notes.	2.89	0.98
	I study whenever I can.	2.87	0.98
	I organize the materials that I need to study.	2.98	0.93

Hypothesis Testing

The study sought to test the null hypothesis: *There is no significant relationship between self-regulated learning and mathematics achievement of students in Meru South sub-county*. To test this hypothesis, a Pearson product-moment correlation analysis was conducted between the students' composite scores on the ASRLQ and their T-scores for mathematics achievement.

The analysis revealed a strong, positive, and statistically significant relationship between the two variables, $r(274) = .766$, $p < .001$. The strength of the correlation is substantial, indicating a powerful positive association between students' use of self-regulated learning strategies and their performance in mathematics. This result signifies that as students' overall engagement in self-regulated learning behaviors increases, their scores in mathematics also tend to increase to a very large degree. Based on this highly significant correlation, the null hypothesis was rejected. This leads to the conclusion that a significant positive relationship exists between academic self-regulated learning and the mathematics achievement of students in Meru South sub-county. The results of the correlation are presented in Table 2.

Table 2: Relationship between Self-Regulated Learning and Mathematics Achievement

	Mathematics Achievement	Self-Regulated Learning
Mathematics Achievement		
Pearson Correlation	1	.766**
Sig. (2-tailed)		< .001
N	276	276
Self-Regulated Learning		
Pearson Correlation	.766**	1
Sig. (2-tailed)	< .001	
N	276	276
**. Correlation is significant at the 0.01 level (2-tailed).		

DISCUSSION OF FINDINGS

The primary objective of this study was to establish the relationship between self-regulated learning and mathematics achievement. The findings from the Pearson correlation analysis demonstrated a strong, positive, and highly significant relationship between these two variables ($r = .766$, $p < .001$). This result is not only statistically robust but also educationally meaningful, indicating that self-regulated learning is a powerful factor associated with academic success in mathematics for the students in this sample. The rejection of the null hypothesis provides compelling evidence that students who are more adept at managing their own learning processes are significantly more likely to perform well in mathematics.

This central finding lends strong empirical support to the study's theoretical foundation, Bandura's (1986) Social Cognitive Theory. The theory posits that learning is an agentic process, where individuals exercise control over their own cognitive processes, behaviors, and environments to achieve their goals. The powerful correlation observed in this study validates this framework within the Kenyan context. It suggests that the proactive, strategic behaviors measured by the ASRLQ—such as planning study time, monitoring understanding, seeking help when needed, and organizing learning materials—are tangible manifestations of the self-regulatory mechanisms described by Bandura. The result underscores that students who successfully engage in this cycle of self-observation, self-judgment, and self-reaction are better equipped to navigate the complexities of mathematics and, consequently, achieve higher academic outcomes.

Furthermore, the results of this study are highly consistent with the broader body of international and regional research, reinforcing the universal importance of self-regulated learning. The finding aligns perfectly with the conclusions of Harding et al. (2019) in Australia and Duru and Okeke (2021) in Nigeria, both of whom established self-regulated learning as a strong predictor of mathematics achievement. The consistency of this relationship across such diverse cultural and educational systems highlights the fundamental role that these strategic skills play in learning. The present study makes a significant contribution by confirming this relationship in a previously under-researched rural Kenyan setting.

Moreover, this study extends the existing local research. While previous Kenyan studies, such as those by Ong'uti et al. (2019) and Ochieng (2015), had identified positive relationships between specific sub-domains of self-regulation (metacognitive monitoring and self-efficacy, respectively) and mathematics performance, the current study provides a more comprehensive and holistic conclusion. By demonstrating a powerful correlation with a global measure of self-regulated learning, this research confirms that it is the broader constellation of these strategic behaviors, working in concert, that is most strongly linked to student achievement. This implies that educational interventions should not focus on a single skill in isolation but should aim to cultivate a comprehensive repertoire of self-regulatory strategies.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Based on the findings, this study concludes that a significant, strong, and positive relationship exists between self-regulated learning and mathematics achievement among Form Three students in Meru South Sub-County. The evidence strongly indicates that the extent to which students actively and strategically manage their own learning processes is a critical factor in their academic success. This result empirically validates the principles of Social Cognitive Theory in the local context, affirming that students who demonstrate greater agency through behaviors such as goal setting, self-evaluation, and strategic planning are significantly more likely to achieve at a higher level in mathematics. The study firmly establishes self-regulated learning not as a peripheral trait, but as a core competency that is powerfully associated with academic performance.

Recommendations

In light of these conclusions, several recommendations are made for educational policy, practice, and future research. Regarding policy and practice, it is strongly recommended that the Ministry of Education and school administrators support the explicit integration of Self-Regulated Learning (SRL) instruction into the mathematics curriculum. Given the strong association between SRL and achievement, teachers should be trained to model and provide practice in skills such as setting effective study goals, monitoring comprehension, and organizing learning materials. This requires enhancing teacher professional development by including modules focused on educational psychology and the practical application of theories like Social Cognitive Theory in both pre-service and in-service training. Equipping teachers with the knowledge to foster self-regulation is a critical step toward improving mathematics outcomes on a larger scale. Furthermore, it is recommended that mathematics instruction moves beyond traditional teacher-centered methods to include student-centered approaches like project-based learning and inquiry-based learning, which naturally require students to practice and develop the SRL skills linked to success.

For future research, the correlational design of this study, while establishing a strong relationship, cannot infer causality. It is therefore recommended that future research employ experimental or quasi-experimental designs to test the causal impact of SRL interventions on mathematics achievement. A longitudinal study tracking students' development of SRL skills over several years would provide invaluable insight into how these competencies evolve and impact long-term academic trajectories. To complement these quantitative approaches, it is also recommended that researchers undertake qualitative investigations using methods such as in-depth interviews and focus groups. This would provide a richer, more nuanced understanding of *how* students in this context perceive and utilize specific SRL strategies. Finally, to enhance the generalizability of the findings, this study should be replicated in other Kenyan contexts, such as urban schools, private institutions, and different counties, to determine if the powerful relationship observed here represents a more universal pattern within the nation's educational landscape.

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