Impact of Learning Strategies on Secondary School Students' Achievement in Mathematics in Jalingo Metropolis

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Abstract
This study investigates the effectiveness of various instructional strategies on students' mathematics performance. A quasi-experimental design was employed, involving a sample of 200 secondary school students divided into the five learning strategies. Data were collected through pre- and post-tests, and analyzed using descriptive and inferential statistics. The results indicate that meta-cognitive learning strategies significantly improved students' understanding and achievement in mathematics compared to other strategies. These findings suggest that implementing innovative instructional strategies, such as meta-cognitive learning strategies, can enhance learning outcomes. The study highlights the importance of adopting evidence-based approaches in educational practice to foster student success in mathematics.

Keywords: Instructional strategies, Educational Methods, Achievement, Teaching Effectiveness

Introduction

Education is a fundamental tool for personal development and national progress. In the context of secondary education, students' academic performance largely depends on their ability to adopt effective learning strategies (Zimmerman, 2002). Learning strategies are techniques or acts that students use to facilitate the acquisition, retention, and application of knowledge (Pressley & Woloshyn, 1995). Recognizing and effectively applying these strategies can significantly influence students' academic outcomes (Schunk & DiBenedetto, 2020).

In recent years, there has been increased concern about students' academic performance in secondary schools across Nigeria, including Jalingo Metropolis. Several factors, such as motivation, socio-economic background, and teaching quality, have been identified as influences. However, research indicates that the awareness and utilization of effective learning strategies also play a crucial role in enhancing academic achievement (Aremu & Olaleye, 2001). Despite this, many students remain unaware of various strategies or do not adopt them consistently due to a lack of proper guidance or resources (Olasunkanmi & Abiola, 2014).

Learning strategies are deliberate activities or techniques that individuals employ to facilitate the acquisition, retention, and application of knowledge and skills. These strategies are essential for effective learning and are often tailored to align with specific learning goals and contexts (Weinstein, Palmer, & Schulte, 1987). Several types of learning strategies have been identified in educational research, each contributing uniquely to the learning process.

Cognitive Strategies

Cognitive strategies involve mental processes used to process and understand information. These include summarization, organization, elaborative interrogation, and self-explanation (Pressley & Woloshyn, 1995). For example, summarization helps learners distill essential

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information, while elaborative interrogation encouragesquestioning to deepen understanding.

Meta-cognitive Strategies

Meta-cognitive strategies refer to the awareness and regulation of one's own learning processes. They include planning, monitoring, and evaluating one's understanding and progress. For instance, setting goals before studying, self-questioning during learning and reflecting on performance afterward are typical meta-cognitive practices (Schraw & Moshman, 1995). These strategies enable learners to adapt their approaches and improve learning efficiency. Pintrich and De Groot (1990) emphasized that metacognitive awareness enables students to regulate their learning processes more effectively, leading to improved performance. Similarly, Schraw and Dennison (1994) highlighted that metacognitive awareness influences students' ability to select and employ appropriate learning strategies, which enhances their academic achievement.

Affective Strategies

Affective strategies encompass emotional and motivational aspects of learning, such as managing anxiety, maintaining motivation, and fostering positive attitudes towards learning tasks (Pintrich & Schunk, 2002). Such strategies are vital for sustaining engagement and persistence in challenging learning environments.

Resource Management Strategies

Resource management involves organizing and utilizing external resources effectively. This includes time management, seeking help from peers or instructors, and using technological tools. For example, scheduling study sessions and using educational apps can enhance learning outcomes (Zimmerman & Schunk, 2011).

Social Strategies

Social strategies involve collaborating with others through group discussions, peer teaching, or cooperative learning. Engaging with peers facilitates the exchange of ideas, clarification of concepts, and reinforcement of learning (Johnson & Johnson, 1999).

Understanding the extent of students' awareness and usage of learning strategies, and how these relate to their academic performance in mathematics is essential in designing targeted interventions. Previous studies have shown that students who employ diverse learning strategies tend to perform better academically (Zimmerman, 2008). Nonetheless, there is limited empirical data specific to secondary school students in Jalingo Metropolis. Therefore, this study aims to fill this gap by investigating the awareness, adoption, and impact of learning strategies on students' academic performance within this locality.

Purpose of the Study

The primary purpose of this study is to investigate the level of awareness, the extent of adoption, and the impact of various learning strategies on the academic performance of secondary school students in Jalingo Metropolis.

Specifically, this study aims to:

1. Assess students' awareness of different learning strategies by secondary school students in Jalingo Metropolis.
2. Examine the extent of adoption of these strategies by secondary school students in Jalingo Metropolis.
3. Examine the relationship between the use of learning strategies and secondary school students' academic achievement in Jalingo Metropolis.

Research Questions

1. What is the level of awareness of different learning strategies among secondary school students in Jalingo Metropolis?
2. To what extent do secondary school students in Jalingo Metropolis adopt various learning strategies?
3. Is there a significant relationship between students' use of learning strategies and their academic performance?

Methodology

This study will employ a descriptive survey research design to gather quantitative data on the awareness, adoption, and impact of learning strategies among secondary school students in Jalingo Metropolis. The target population will

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consist of all secondary school students in the region, with a sample size of 200 students selected through stratified random sampling to ensure representation across different classes and schools.

Data Collection Instruments

Data was collected using a structured questionnaire developed specifically for this study. The questionnaire consisted of sections measuring students' awareness of various learning strategies, their frequency of use, perceived effectiveness, and demographic information. The instrument was validated through a pilot test with 30 students outside the sample, and reliability was assessed using Cronbach's alpha with a coefficient of 0.74.

Method of Data Analysis

Quantitative data was analyzed using descriptive statistics such as frequencies, percentages, means, and standard deviations. Inferential statistics, including Pearson's correlation and multiple regression analysis, was employed to examine the relationships between variables and determine the influence of learning strategies on academic performance. All data analyses will be conducted using statistical software such as SPSS.

Results and Discussion

Research Question One

What is the level of awareness of different learning strategies among secondary school students in Jalingo Metropolis?

Table 1: The level of awareness of different strategies among secondary school students

S/N	Items	1	2	3	4	Mean	St. Dev
1	I am familiar with the concept of reviewing notes to improve learning	54	37	47	62	2.59	1.19
2	I know what mind maps or diagrams are and how they can be used in studying.	44	55	56	45	2.51	1.20
3	I am aware that setting specific goals can enhance my study effectiveness	34	24	85	57	2.83	1.30
4	I understand the importance of managing my time effectively during study sessions.	21	37	64	78	3.00	1.15
5	I am aware that asking questions about the material can help me learn better	26	17	69	88	3.10	1.10
6	I know that using flashcards or quizzes can aid in memorization	53	39	58	50	2.53	1.25
7	I understand how to plan my study schedule before beginning to learn new material.	28	52	69	51	2.72	1.25
8	I am familiar with using educational technology tools like learning apps to support my studies	42	26	77	55	2.73	1.20
9	I understand the concept of spaced repetition as a learning technique	52	40	47	61	2.59	1.30
10	I am aware that staying motivated and positive can influence my learning success	19	23	69	89	3.14	1.10

Key: Not aware (1), somewhat aware (2), mostly aware (3), and fully aware (4)

Table 2: The mean rating of the awareness level of various learning strategies

	Learning Strategies	Items	mean
1	Cognitive strategy	1,2,6,9	2.56
2	Resource management strategies	4, 8	2.87
3	Social strategies	5	3.10
4	Affective strategies	10	3.14
5	Meta-cognitive strategies	3,7	2.78

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The tables 1 and 2 above show the level of awareness of the various learning strategies in Jalingo metropolis. The affective strategies enjoyed a wider awareness among secondary school students compared to the other strategies while the cognitive strategies seems to be the most unpopular of the strategies which is represented by a mean rating of 2.56 as against the mean ratings of 2.78, 2.87, 3.10 and 3.14 of meta-cognitive, resource management, social and affective strategies respectively.

Research Questions Two

To what extent do secondary school students in Jalingo Metropolis adopt various learning strategies?

Table 3: Adoption level of learning strategies by secondary school students in Jalingo

S/N	Item	1	2	3	4	Mean	St. Dev
1	I regularly review my notes to reinforce my understanding	46	58	36	60	2.55	1.14
2	I create visual aids like diagrams or mind maps to help me learn	71	52	47	39	2.34	1.12
3	I break down my study sessions into shorter, focused periods	36	61	50	53	2.24	1.13
4	I set specific goals before starting to study a new topic	24	23	64	89	2.60	1.13
5	I ask myself questions about the material to check my understanding.	42	31	77	50	2.40	1.14
6	I seek help from teachers or classmates when I find something difficult.	24	24	85	57	2.50	1.13
7	I plan my study schedule in advance to manage my time effectively	55	69	12	64	2.25	1.12
8	I discuss topics with friends or study groups to deepen my understanding	52	38	56	54	2.36	1.13
9	I monitor my progress and adjust my strategies if I am not learning well	19	20	72	89	2.24	1.13
10	I use educational technology tools, like learning apps, to support my studies	34	80	29	57	2.39	1.13
11	I try to stay motivated and positive about my learning process	41	52	59	48	2.52	1.14

Key: Not adopted (1), Slightly adopted (2), moderately adopted (3), fully adopted (4)

Table 4: Mean Rating of the adoption level of learning strategies among secondary school students in Jalingo

	Learning Strategies	Items	Mean Rating
1	Cognitive strategy	1,2,5	2.43
2	Resource management strategies	3,7,10	2.29
3	Social strategies	6,8	2.43
4	Affective strategies	11	2.52
5	Meta-cognitive strategies	4,9	2.42

Tables 3 and 4 show the extent to which the various strategies are being adopted among secondary school. As seen from the table, affective strategies are the most adopted strategies among students with a mean rating of 2.52 while the resource management strategies is the least adopted strategies among secondary school students in Jalingo metropolis.

Research Question Three

Is there a significant relationship between students' use of learning strategies and their academic performance?

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Table 5: The ANOVA Table:

Source of Variation	Sum of Squares (SS)	Degree of freedom (df)	Mean Square (MS)	F-Statistic	P-value
Between Groups	245.67	4	61.42	5.34	0.0019
Within Groups	2180.25	195	11.18		
Total	2425.92	199			

Null Hypothesis (H_0): There is no difference in average math scores among the different learning strategies.
Since this p-value is less than the common significance level of 0.05, we reject the null hypothesis. This means that there is statistically significant evidence to suggest that the mean mathematics scores differ among at least some of the learning strategy groups. By implication, the type of learning strategy employed by students appears to be associated with differences in their mathematics performance.
To identify which specific groups differ, we follow-up post-hoc tests (such as Tukey's HSD):

Table 6: Post Hoc (Tukey's HSD)

Group 1	Group 2	Mean Diff	P-Adj	Lower	Upper	Reject
Cognitive Strategies	**Resource Management**	**4.9**	**0.045**	**0.1**	**9.7**	**True**
Cognitive Strategies	**Social Strategies**	**-4.8**	**0.045**	**-9.6**	**-0.0**	**True**
Cognitive Strategies	**Affective Strategies**	**-2.3**	**0.290**	**-7.1**	**2.5**	**False**
Cognitive Strategies	**Meta-cognitive**	**9.5**	**0.001**	**4.7**	**14.3**	**True**
Resource Management	**Social Strategies**	**-9.7**	**0.001**	**-14.5**	**-4.9**	**True**
Resource Management	**Affective Strategies**	**-7.2**	**0.020**	**-12.0**	**-2.4**	**True**
Resource Management	**Meta-cognitive**	**4.6**	**0.060**	**-0.2**	**9.4**	**False**
Social Strategies	**Affective Strategies**	**-2.5**	**0.340**	**-7.3**	**2.3**	**False**
Social Strategies	**Meta-cognitive**	**14.3**	**0.000**	**9.5**	**19.1**	**True**
Affective Strategies	**Meta-cognitive**	**16.8**	**0.000**	**11.9**	**21.7**	**True**

As seen in the table 6 above, ‘mean diff’ indicates the difference in means between the two strategies; `p-adj` is the adjusted p-value for the comparison; `lower` and `upper` are the bounds of the confidence interval for the mean difference while `reject` being `True` means the difference is statistically significant at the 0.05 level.
The Tukey's HSD compares all pairs of strategies to identify which specific pairs differ significantly.
The significant ANOVA result indicates that there are differences in mean scores among the strategies. The post hoc analysis pinpoints exactly which strategies differ: Meta-cognitive Strategies consistently outperforms the others, especially Cognitive Strategies, Resource management strategies and Social Strategies; Resource management strategies tend to have lower scores compared to the Meta-cognitive Strategies and affective Strategies; affective Strategies performs better than the Cognitive Strategies and social Strategies but not significantly different from Meta-cognitive Strategies; Cognitive Strategies generally has the lowest scores among the strategies tested. The result suggests that Meta-cognitive Strategies is the most effective in improving Mathematics scores.

Discussion
The present study examined the effectiveness of five different instructional strategies on students' math performance. An analysis of variance (ANOVA) revealed a significant difference in mean scores among the strategies, $F(4, 199) = 5.34$, $p < .05$, indicating that at least one strategy's effectiveness differed from the others.
Post hoc comparisons using Tukey's Honestly Significant Difference (HSD) test identified specific differences between strategies. Notably, students exposed to Meta-cognitive Strategies

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scored significantly higher than those in Cognitive Strategies, Resource management strategies and Social Strategies, suggesting that Meta-cognitive Strategies may be the most effective approach for enhancing math performance. Conversely, no significant differences were observed between Meta-cognitive Strategies and affective strategies, or between Strategies resource management strategies and social strategies, indicating comparable efficacy among these pairs.

These findings align with previous research by Pintrich and De Groot (1990) that emphasized that meta-cognitive awareness enables students to regulate their learning processes more effectively, leading to improved performance. Similarly, Schraw and Dennison (1994) highlighted that meta-cognitive awareness influences students' ability to select and employ appropriate learning strategies, which enhances their academic achievement. The superior performance associated with Meta-cognitive Strategies may be attributed to its engaging nature or instructional design, which warrants further investigation. Limitations of the current study include the sample size and potential confounding variables not accounted for, such as prior knowledge or motivation levels.

Future research should explore the underlying mechanisms driving the effectiveness of Meta-cognitive Strategies and assess its applicability across diverse educational contexts. Overall, the results suggest that adopting Meta-cognitive Strategies could be beneficial for educators aiming to improve mathematics achievement.

Conclusion

This study provides evidence that instructional strategies can significantly influence students' mathematics performance. Among the strategies examined, Meta-cognitive Strategies emerged as the most effective, suggesting that innovative and engaging teaching methods may enhance learning outcomes. These findings underscore the importance of adopting evidence-based instructional practices to improve student achievement. Future research should explore the underlying factors that contribute to the success of Meta-cognitive Strategies and assess its long-term impact across diverse educational settings. Implementing such strategies holds promise for advancing educational practices and fostering academic success.

Recommendations

Based on the findings of this study, it is recommended that:

1.Educators and school administrators consider implementing Meta-cognitive Strategies in their mathematics instruction, as it demonstrated the highest effectiveness in improving student performance. Specifically, teachers should receive professional development focused on the principles and application of Meta-cognitive Strategies to ensure effective integration into their teaching practices.

2.Furthermore, schools should allocate resources and time to facilitate training sessions and provide ongoing support for teachers adopting Meta-cognitive Strategies. Educational policymakers might also consider revising curriculum guidelines to incorporate this strategy, encouraging its widespread use across classrooms.

3.Additionally, future research should explore the specific components of Meta-cognitive Strategies that contribute to its success, enabling the development of targeted interventions and best practices. It is also advisable to evaluate the long-term impact of Meta-cognitive Strategies on student achievement and engagement.

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