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Research Article

Metacognitive Learning Strategies as Factors Influencing Academic Achievement among Students in Mathematics: A Correlational Study

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ABSTRACT

The study determined the metacognitive learning strategies as factors influencing mathematics students' academic achievement in Nigeria. Three (3) specific purposes with corresponding research questions and three (3) null hypotheses guided the study. Correlation research design was adopted for the study. The study involved of 357 mathematics students for 2022/2023 academic session. Two instruments; Students' Metacognitive Learning Strategy Questionnaire(SMLSQ) and Students' Mathematics Academic Achievement Proforma (SMAAP) developed by the researchers were used for data collection. The internal consistency reliability index obtained using Cronbach Alpha was 0.79. Data collected were analyzed using simple linear and multiple linear regression analyses through SPSS version 26.0 as well as regression analysis through Process model 1 procedure IBM SPSS version 4.00 by Hayes (2018). The findings of the study revealed that 24% variation in students' academic achievement in Mathematics can be attributed to planning ahead strategy, which is statistically significant. Also, 29% variation in students' academic achievement in Mathematics can be attributed to active learning strategy, which is statistically significant. Teachers should engage students with learning activities in mathematics that enable them to learn on their own using metacognitive strategies.

Keywords: Metacognitive learning, active learning strategy, planning ahead strategy, academic achievement, mathematics

1. Introduction

One core subject offered at basic and post basic education levels in the Nigerian education system is Mathematics. Mathematics is the science of structure, order and relationships that evolved from counting, measurements, expression of relationships and description of quantities, as well as, shapes of objects which help in solving a wide range of problems (Ekwueme, 2013). It is also defined as the logical language for expressing ideas, shapes, quantities, sizes, order, and change in a particular system (Ahmed & Bature, 2017). Agwagah (2017) also defined Mathematics as the science of numbers, patterns of counting, reasoning, communicating, motion, change, shape, spaces, structure, proportion and position. From these definitions, Mathematics is operationally defined in this study as a science that involves the study of numbers, shapes and logical expression of the relationships between and among things.

Mathematics helps individuals in logically establishing relationships between known and required facts, which enable them to generate possible solutions to their numerous problems. It also promotes the habit of accuracy, systematic and orderly arrangements of facts by students, and logical reasoning in order to arrive at valid conclusions. More precisely, the knowledge of Mathematics is highly relevant and applicable in engineering, medicine, architecture, agriculture, economics, marketing, and accounting, among other disciplines necessary for the nation's development (Ekwueme, 2013). Sarmah and Puri (2014) also noted that Mathematics helps people to think analytically, and promotes better organization of ideas and accurate expression of thoughts, and as such, it contributes significantly to the easy understanding of other subject areas, such as; sciences, social sciences, even music and art. Nitisha (2018) also mentioned that the knowledge of Mathematics helps Accountants and Bankers in executing operations like addition, subtraction, multiplication and division for proper record keeping and decision making.

Artisans such as carpenters, bricklayers, tailors, and welders also need the knowledge of Mathematics for proper and accurate measurements of shapes, length, width, and dimensions, among others (Ikwong, 2019). Titrek et al. (2019) also asserted that the knowledge of mathematics is fundamental in various sciences, such as pharmacy, medicine, computer studies, engineering, aviation, and information and communication technology, among others. From the foregoing, every individual, irrespective of career or profession, needs some knowledge of mathematics in order to function effectively in day-to-day life activities.

Mathematics can therefore be considered as an essential subject that cannot be undermined because most human activities, professions or occupations require the application of the knowledge of the subject. In fact, the role of Mathematics in the development of every individual and any nation like Nigeria cannot be underestimated. Thus, its teaching and learning from primary to tertiary levels of education need to be taken seriously. Considering the importance of Mathematics, Bot (2017) mentioned that the knowledge of Mathematics is very imperative in harnessing both human and material resources in order to promote development in any society. In the same vein, Ogundele (2018) stated that Mathematics cannot be neglected in any nation that wishes to develop scientifically, technologically, and even economically.

Thus, due to the importance of Mathematics, the Federal Republic of Nigeria in the National Policy on Education (NPE, 2014) recognised Mathematics as one of the core and compulsory subjects at the primary and secondary levels of education. The objectives of Mathematics according to the FRN include to:

- generate interest in Mathematics and to lay a solid foundation for everyday living;
- promote the acquisition of mathematical skills and processes necessary for further education in Mathematics and related skills;
- develop computational skills;
- foster the desire and the ability to be accurate to a degree relevant to the problem at hand;
- develop ability to recognize a problem and to solve the problem with latent mathematics knowledge; and to
- develop precise, logical and abstract thinking among others.

These objectives, as stated above in line with the curriculum, are the expected results of the teaching and learning of mathematics after exposing students to the various aspects of the subject through its syllabus and scheme of work. The objectives also seem to have positioned mathematics as a very vital subject for the development of the nation in various spheres of life. Thus, in line with the importance of mathematics to national development, it is necessary for every secondary school student to have a high level of academic achievement in mathematics.

Academic achievement is no doubt very central in the education domain. According to Bitrus (2014), academic achievement is a measure of a student's knowledge after a period of schooling, usually in the form of scores, grades, or a result. It is also defined as the outcomes that reflect the extent to which learners or students have achieved specific goals that were the focus of classroom instruction (Steinmayr et al., 2015). Furthermore, Onukwufor and Ugwu (2017) viewed academic achievement as a score that reflects the level of success a learner has attained after teaching and learning have taken place. In essence, it indicates the extent to which learning has taken place. In the context of this study, academic achievement refers to the scores, grades, and learning outcomes achieved by students after a period of instruction on a specific subject, such as Mathematics.

From the foregoing, one could assert that academic achievement plays a significant role in every education system. It is however unfortunate to note that students' academic achievement in Mathematics in Nigeria has been inconsistent and unimpressive. This is reflected in their achievement in external examinations in Mathematics. To support the claim, the West African Examination Council's (WAEC) Chief Examiner's Reports from 2016 to 2022 show that the percentage of candidates who enrolled for the examinations and scored more than a credit pass in Mathematics were 38.32% in 2016, 59.22% in 2017, 49.98% in 2018, 64.18% in 2019, 65.24% in 2020, 64.92% in 2021 and 76.36% in 2022. Although the result shows that there is improvement in students' achievement in the subject in 2019, 2020, 2021, and 2022 respectively, students' demonstration of ability to solve mathematics problems is still adjudged to be weak, while academic achievement is fluctuating (Okeke, 2022). This affirms the analysis of the West African Examination Council (WAEC) results in mathematics from 2014 to 2018 which showed that an average of 37.15% of the 1,597,711 candidates who enrolled for the examination passed with credit grades and above (Ikwong, 2019). This implied that 62.85% of the candidates had either a pass or fail in the subject. Further observations have also shown that students' academic achievement in the subject for the period under review was inconsistent and fell below average.

A number of factors have, however, been identified by many researchers as being responsible for the unsatisfactory state of poor and fluctuating academic achievement in mathematics. Some scholars have pointed out that the negative attitude of students towards the subject and lack of resources such as quality textbooks are some of the factors contributing to poor students` achievement in mathematics (King`Aru, 2014; Alache, et al., 2017). Class size, teaching methods, among others, are also factors giving rise to students` poor academic achievement in mathematics (Oluwasegun & Ekamoye, 2018). Okeke (2019) also mentioned some of the factors responsible for poor achievement in Mathematics as lack of qualified teachers, the teaching methods used by mathematics teachers, and lack of instructional materials. Consequently, educational stakeholders have made attempts to solve the problem of persistent fluctuations in academic achievement of students in Mathematics by recruiting professional and qualified teachers, providing relevant instructional materials, well-equipped classrooms, training and retraining of the teachers, encouraging the adoption of innovative teaching methods by teachers (Agboghoroma & Oyovwi, 2015). They have also organised seminars and workshops to improve teachers' quality outcomes, among others (Okeke, 2019).

Despite the above efforts made by educational stakeholders to resolve the problem of fluctuating academic achievement in Mathematics through improvement of the factors identified above, the academic achievement of secondary school students in the subject has remained unsatisfactory. The implication of this is that the nation`s quest to improve in areas of science and technology will not be feasible. This situation has become very worrisome to teachers, parents, and other educational stakeholders. There is therefore a need to consider the assertion by Beharu (2018) who stated that psychological variables such as students' interest, attitude, motivation, locus of control, critical thinking, meta cognitive strategies, among others, could affect students' academic achievement. In essence, if the problem of fluctuating student achievement in any school subject is to be resolved, there is also a need to look at the predictive power of the above-mentioned variables. Accordingly, the present study is focused on determining how much meta cognitive strategies could predict students' academic achievement in Mathematics, which is yet to be clearly established in the literature.

Metacognitive strategies appear to be very vital to students' learning of Mathematics. They include the students' awareness of whether or not they can comprehend what they are taught, their ability to judge the cognitive demands of learning tasks, and their knowledge of when and how to employ specific cognitive abilities (Hamdan et al., 2010). According to Zhang and Seepho (2013), metacognitive strategies are higher-order executive skills that deal with knowledge of cognitive processes and constitute an attempt to regulate one's own learning by means of planning, monitoring, and evaluating one's own performance. The strategies help in increasing students' knowledge of awareness and control to improve their learning and achievement in a particular subject (Beharu, 2018). Furthermore, Drew (2022) defined metacognitive strategies as the tactic of thinking about one's own thinking. Thus, metacognitive strategies involve reflecting on and regulating how one thinks.

Having the right strategies is essential for an individual to improve self-productivity and effectiveness at school or work. Metacognitive strategies, when adopted, could make an individual a better learner since they promote one's ability to control his or her thoughts and actions. Drew (2022) listed metacognitive strategies to include planning ahead, self-questioning, meditation, reflection, learning styles, mnemonic aids, thinking aloud, graphic organisers, self-regulation, and active learning. Others include advance organisers, organisational planning, selective attention, self-management, self-assessment, self-evaluation, and self-reflection. Thus,the present study focuses on the predictive power of some metacognitive strategies such as planning ahead and active learning on students' academic achievement in Mathematics. The reason for the choice of these strategies is because they appear more likely to have some impact on students' learning of Mathematics and achievement in the subject than others.

1.1 Literature Review

One of the metacognitive strategies, as mentioned above, is planning ahead. The concept of planning ahead is derived from the concept of planning. Planning is the process of setting out in advance a pattern of action to bring about a given overall policy by the shortest possible articulation of means (Boyitie, 2021). This implies that planning is the process of identifying means and ends. Planning requires someone to spend a bit of time to critically analyze the task at hand and come up with a workable plan on how to tackle the task. According to Kaur (2017), planning ahead refers to the appropriate selection of strategies and the correct allocation of resources that affect task performance. Beharu (2018) noted that it involves identification and selection of appropriate strategies and allocation of resources and includes goal setting, activating background knowledge, and budgeting time. Planning ahead also involves the selection of appropriate strategies and the allocation of resources that affect performance (Drew, 2022). In this study, planning ahead therefore refers to the proper sequencing and allocation of time or attention before beginning a task. This implies that a student needs to plan before time by strategizing and putting all the resources in place in order to achieve certain level of success in any subject. This, to some extent if not done could make or mar one's achievement in a subject like Mathematics.

Planning ahead enables students to inquire about their learning, gather information to be learned, and then learn the gathered information. The student is actively in control of his or her learning. Momanyi, et al. (2019) showed that the planning-learning strategy predicts academic performance in the English language.

1.2 Active Learning Strategy

Active learning, according to Shariff (2012), means that students actively participate in classroom activities throughout the lesson, rather than passively following the teacher who teaches it. Active learning strategy is regarded as any type of learning that involves the active participation of the students other than any method that involves passive listening by the student to the instructor or lecturer. During active learning, students can monitor their own progress and understanding. They "become aware of their progress and can be actively involved in finding solutions when they struggle with a particular aspect of the task" (Monk & Silman, 2013). Active learning strategies can also be used to evaluate students' understanding of material by giving them opportunities to apply knowledge and skills acquired through new methods and concepts. Active learning has an overall positive influence on student performance, with some relevant educational and pedagogical implications regarding teaching curriculum modifications that should be introduced into math class (Abdullah & Yang, 2018).

Active learning strategies can also be expected to have a promotional influence on students' achievement. Active learning, according to Shariff (2012), is described as a tactic in which students actively participate in classroom activities throughout the lesson rather than passively following the teacher who teaches it. Monk and Silman (2013) described active learning as a type of learning that involves the vigorous participation of the students and not passive listening to the instructor or teacher. The authors further buttressed that during active learning, students can monitor their own progress and understanding, which brings about improvements in their learning and achievement. This assertion, however, lacks empirical validation, especially when it comes to the amount of variation in students' achievement in mathematics that could be attributed to active learning as a metacognitive strategy. Active learning strategy is viewed as metacognitive learning tactics in which students actively participate in classroom activities throughout the lesson with full mental operation about the learning activities rather than paying passive attention to what is being taught. This means that for a student to achieve well in a particular subject that students would need to be actively involved in the learning process.

One critical factor that remains contentious in the literature when it comes to students' learning and achievement is their gender. This may also be a factor to consider when determining the amount of variation in students' academic achievement in mathematics that can be attributed to metacognitive learning strategies. Gender is a broad analytical concept that describes female roles and responsibilities in relation to those of males (Fan et al., 2016).They further buttressed that gender denotes all the characteristics of men and women that a particular society has determined and assigned to each of the sexes. Wayar (2017) also described gender as the social relationships, roles, and duties of men and women, and the expectations held about the characteristics, attitudes, and behaviours of both men and women. Gender is the socially ascribed roles and behaviours of male and female students that determine their metacognitive skills and achievement in mathematics.

Gender influences on students' achievement have been reportedly contradictory in the literature. While some previous researchers (Awofala, 2011; Ullah et al., 2015) have reported that male students achieved more than female students, others (Ogwuche & Kurumeh, 2011) reported that female students achieved higher than male students in mathematics. Whereas, researchers like Agashi (2014), Okigbo and Osuafor (2008) found no significant difference in the achievement of both male and female students in mathematics. The inconsistencies in these findings have continued to attract the attention of researchers about the potential influence of gender on a wide range of variables and achievements. Thus, this study examined the moderating influence of gender on the amount of variation in students' academic achievement in mathematics that can be attributed to metacognitive learning strategies in order to provide empirical evidence in that regard.

The trend in the academic achievement of students in Mathematics over the years indicates that students are not performing satisfactorily in the subject. This is despite efforts by education stakeholders and researchers towards improving the teaching and learning of the subject for better learning outcomes. The unsatisfactory state of students' achievement in Mathematics no doubt has negative implication on the growth and development of any country like Nigeria due to the enormous importance and wide application of the knowledge from the subject. This is why Mathematics is a compulsory subject that must be passed at credit level for one to be admitted into a wide range of science, commercial, and social science courses at institutions of higher learning in the country. This makes the issue of fluctuating achievement in mathematics very serious academic challenge. This study determined metacognitive learning strategies as factors influencing students' academic achievement in Mathematics. The following questions were addressed;

1. What is the amount of variation in students' academic achievement in Mathematics that can be attributed to planning ahead strategy?
2. What is the amount of variation in students' academic achievement in Mathematics that can be attributed to active learning strategy?

3. What is the amount of variation in students' academic achievement in mathematics that can be attributed to metacognitive learning strategies compositely?
4. What is the moderating influence of gender on the amount of variation in students' academic achievement in mathematics that can be attributed to metacognitive learning strategies?

Study Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance.
Ho$_1$: There is no significant variation in students' academic achievement in Mathematics that can be attributed to planning ahead strategy.
Ho$_2$: There is no significant variation in students' academic achievement in mathematics that can be attributed to active learning strategy.
Ho$_3$: There is no significant amount of variation in students' academic achievement in mathematics that can be attributed to metacognitive learning strategies compositely.
Ho$_4$: There is no significant moderating influence of gender on the amount of variation in students' academic achievement in mathematics that can be attributed to metacognitive learning strategies

2. Methods and Tools

2.1 Design of the Study

The researchers adopted correlation research design. According to Nworgu (2015), this type of design seeks to establish what relationship exists between two or more variables and also indicates the direction and magnitude of the relationship between the variables. The present study established the amount of variation in students' academic achievement in Mathematics that can be attributed to their metacognitive learning strategies (planning ahead and active learning), the design was therefore considered appropriate for this study.

2.2 Participants

The sample for this study comprised 357 (162 male and 195 female) senior secondary students (SS2).This sample size is based on Cohen's et al. (2018, p.206) criteria for choosing a sample size from a population that ranges from 5,000- 6,999 at 95% confidence level. The sample were drawn using multistage sampling procedure involving three stages. At the first stage, eight co-educational secondary schools were randomly drawn out of the 19 co-educational in the Abuja municipal council for the study using the simple random sampling technique. Using the simple random sampling technique, the names of the 19 co-educational schools were written on slips of paper, folded and put in a container, shuffled and the researcher then randomly drew the 8 coeducational schools from the container, one at a time with replacement. This technique was adopted because it is free of bias, and thus gives all the secondary schools the area equal chances of being included in the sample. The 8 co-educational secondary schools chosen were used for the study.
In the second stage, purposive sampling technique was employed in selecting the SS2 class in each of the 8 sampled schools for the study. This was to ensure that other classes are not selected. In the third stage, proportionately stratified random sampling technique was employed in drawing SS2 students from the 8 sampled schools for the study. The proportionate stratified random sampling technique adopted at the third stage because it ensured greater representativeness of the sample relative to the population and guarantees that minority components of the population are adequately represented in the sample. In other words, for the fact that the number of SS2 students in each of the schools are not equal, it becomes pertinent to ensure that the number of students across the schools are adequately represented in the sample proportionately.

2.3 Instrument

Two instruments developed by the researchers were used for data collection in this study. They are: Metacognitive Learning Strategy Questionnaire (MLSQ) and Mathematics Achievement Proforma (MAP). The MLSQ have two (2) sections; section A and section B. Section "A" elicits personal information of the respondents, such as gender. Section "B" has two (2) subscales (I& II) that elicits information on students' metacognitive learning strategies. Precisely, the subscale "I" elicits data on students' planning ahead strategy, "II" also elicit data on students' active learning strategy. The students were requested to express their level of agreement or otherwise to each of the items modeled on a modified four (4) point Likert-type scale with response options Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD) with numerical values of 4, 3, 2, and 1 respectively.
The Mathematics Achievement Proforma (MAP) was used to obtain the students' achievement scores in Mathematics from the sampled secondary schools. The proforma have three (3) columns: serial number, students' identification number, and the column for the most recent terminal score of the students in Mathematics.

2.5 Validity and Reliability

The face validation of the instruments was done by experts. Specifically, the expects were requested to validate the instruments, to ensure appropriateness of items, clarity of language, structure of items, suitability for the study, and to make suggestions for improvement of the instruments. The title of the study, purpose of the study, research questions and hypotheses were also given to each of the experts to scrutinize in relation to the instruments for data collection. Based on the Validators' comments, corrections and suggestions, the instruments were modified accordingly. The final draft version of the instruments was used for data collection.

The reliability of the MLSQ was determined after trial-testing the final version of the instrument on thirty (30) SS2 students randomly sampled from two Public Secondary Schools. The internal consistency of the instrument was determined using the Cronbach Alpha method of estimating reliability through SPSS version 24.0. The Cronbach Alpha method was employed because it applies to instruments that involve polytomous scoring such as the MLSQ used for this study. The reliability estimates obtained for the MLSQ were 0.80 and 0.78 for clusters I-II respectively, with an overall reliability index of 0.79. These reliability estimates are high in line with Cohen et al. (2018) who recommended that a correlation coefficient (r) of .70 and above should be considered high. Hence, the instruments are considered good for the study.

2.6 Data Analysis

Data collected were analyzed using simple linear and multiple linear regression analyses through SPSS version 26.0 as well as regression analysis through Process model 1 procedure IBM SPSS version 4.00 (Hayes 2018). The correlation coefficients (R) and coefficient of determination (R^2) obtained from simple linear regression analysis was used to answer research questions 1 to 3. This is because they involve bivariate relationship. Whereas, the correlation coefficient (R) and coefficient of determination (R^2) obtained from the multiple linear regression analysis used for answering research question four (4). This is because they involve the linear relationship between more than one predictor variables and the criterion variable. The correlation coefficient (R) and coefficient of determination (R^2) obtained from the regression analysis through Process model 1 procedure was also applied. This is because it is concerned with the moderating influence of a dichotomous variable such as gender. The null hypotheses 1 to 4 were tested using regression ANOVA. This is because it is more appropriate when testing the significance of multiple regression models, representing the correlation among two or more variables. All the hypotheses were tested at 0.05 level of significance. The decision rule for testing the hypotheses is that: Reject the null hypothesis (Ho) if the exact or associated probability to the test statistic is equal to or less than 0.05 level of significance, otherwise do not reject the null hypothesis

3. Results

Result in Table 1 shows the regression analysis for the amount of variation in students' academic achievement in Mathematics that attributed to planning ahead strategy. The result indicates that when the scores from the responses of students on planning ahead strategy were correlated with their academic achievement scores in Mathematics, a correlation coefficient (*R)* of 0.49 with associated coefficient of determination (R^2) of 0.24 were obtained. This coefficient of determination (r^2) of 0.24 denotes that 24% variation in students' academic achievement in Mathematics attributed to planning ahead strategy.

Table 1. Variation in students' academic achievement that was attributed to planning ahead strategy

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change
1	.492[a]	.242	.240	6.412	.242

a. Predictors: (Constant), Planning Ahead Strategy; R = Correlation coefficient

Result in Table 2 reveals the variation in students' academic achievement in Mathematics that attributed to planning ahead strategy is statistically significant (F (1, 356) = 113.441, p = .000). This is because the associated probability value of .000 when compared with 0.05 level of significance at which the hypothesis was being tested was found to be significant because .000 is less than 0.05. Thus, the null hypothesis was rejected, and inference drawn was that there is significant variation in students' academic achievement in Mathematics that attributed to planning ahead strategy. This implies that planning ahead strategy is a strongly predicts students' academic achievement in Mathematics.

Table 2. ANOVA Test of Significance for the variation in students' academic achievement that was attributed to planning ahead strategy

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Dec.**
	Regression	5229.045	1	5229.045	113.441	0.000	S
1	Residual	16363.715	355	46.095			
	Total	21592.760	356				

Note: df = degree of freedom, F= ANOVA Statistic, S = Significant (α < 0.05)

Result in Table 3 denotes the regression analysis for the amount of variation in students' academic achievement in Mathematics that can be attributed to active learning strategy. The result shows that when the scores from the responses of students on active learning strategy were correlated with their academic achievement scores in Mathematics, a correlation coefficient (*R*) of 0.54 with associated coefficient of determination (R^2) of 0.29 were obtained. This coefficient of determination (R^2) of 0.29 implies that 29% variation in students' academic achievement in Mathematics can be attributed to active learning strategy.

Table 3. Variation in students' academic achievement that was attributed to active learning strategy

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.537[a]	.288	.286	5.882	.288	161.024	1	355	.000

a. Predictors: (Constant), Planning Ahead Strategy; R = Correlation coefficient

Result in Table 4 indicates the variation in students' academic achievement in Mathematics that attributed to active learning strategy is statistically significant (*F* (1, 356) = 143.629, *p* = .000). This is given the fact that the associated probability value of .000 when compared with 0.05 level of significance at which the hypothesis was being tested was found to be significant because .000 is less than 0.05. Therefore, the null hypothesis was rejected, and the conclusion drawn was that there is a statistically significant variation in students' academic achievement in Mathematics that attributed to active learning strategy. In other words, active learning strategy is a considerable factor for predicting students' academic achievement in Mathematics.

Table 4. ANOVA Test of Significance for the variation in students' academic achievement that was attributed to active learning strategy

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Dec.**
	Regression	5570.798	1	5570.798	143.629	0.000	S
1	Residual	13769.202	355	38.786			
	Total	19340.000	356				

Note: df = degree of freedom, F= ANOVA Statistic, S = Significant (α < 0.05)

Result in Table 5 shows the regression analysis for the amount of variation in students' academic achievement in mathematics that attributed to metacognitive learning strategies compositely. The result indicates that when the scores from the responses of students on all the metacognitive learning strategies were correlated with their academic achievement scores in Mathematics, a correlation coefficient (*R*) of 0.75 with associated coefficient of determination (R^2) of 0.57 were obtained from the analysis. This coefficient of determination (R^2) of 0.57 means that 57% variation in students' academic achievement in Mathematics can be attributed to metacognitive learning strategies.

Table 5. Analysis of the variation in students' academic achievement that can be attributed to metacognitive learning strategies compositely

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.752[a]	.566	.559	4.166	.566	85.352	5	351	.000

a. Predictors: (Constant), Planning Ahead Strategy; R = Correlation coefficient

The result in Table 6 reveals the variation in students' academic achievement in Mathematics that attributed to metacognitive learning strategies is statistically significant (*F* (1, 356) = 91.476, *p* = .000). This is because the associated probability value of .000 when compared with 0.05 level of significance at which the hypothesis was being tested was found to be significant because .000 is less than 0.05. Thus, the null hypothesis was rejected, and inference drawn was that metacognitive learning strategies account for a statistically significant variation in students' academic achievement in Mathematics.

Table 6. ANOVA Test of Significance for the variation in students' academic achievement that can be attributed to metacognitive learning strategies

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Dec.**
	Regression	8887.808	5	1777.562	91.476	0.000	S
1	Residual	6820.632	351	19.432			
	Total	15708.440	356				

Note: df = degree of freedom, F= ANOVA Statistic, S = Significant (α < 0.05)

The result in Table 7 shows the moderating influence of gender on the amount of variation in students' academic achievement in mathematics that can be attributed to metacognitive learning strategies. The result indicates that a coefficient (R) of 0.04 was obtained from the analysis as a result of the interaction between metacognitive strategies and gender. This implies that gender has little moderating influence on the variation in students' academic achievement in Mathematics that can be attributed to metacognitive learning strategies.

Table 7. Regression Analysis of the moderating influence of gender on the amount of variation in students' academic achievement in mathematics that can be attributed to metacognitive learning strategies

Model	coeff	se	t	p	LLCI	ULCI
constant	85.88	4.75	18.07	.00	76.54	95.23
MLS	-.58	.08	-7.08	.00	-.75	-.42
Gender	-.19	2.97	-.06	.95	-6.03	5.65
Interaction	.04	.05	.09	.93	-.10	.11

The result in Table 8 shows that the moderating influence of gender on the amount of variation in students' academic achievement in mathematics that can be attributed to metacognitive learning strategies is not statistically significant (F (1, 351) = .01, p = .93). This is because the associated probability value of .93 when compared with 0.05 level of significance at which the hypothesis was being tested was considered not significant because .93 is greater than 0.05. Thus, the null hypothesis was rejected, and inference drawn was that there is no significant moderating influence of gender on the amount of variation in students' academic achievement in mathematics that can be attributed to metacognitive learning strategies.

Table 8. *RegressionTest(s)of highest order unconditional interaction(s)*

	R2-chng	**F**		**df1**	**df2**	**p**
X*W	.04	.01	1.00	351.00	.93	

Note: X = Metacognitive Strategies (MLS)
W = Gender

4. Discussion

Students' academic achievement that can be attributed to planning ahead strategy

The findings of this study shows that 24% variation in students' academic achievement in Mathematics was attributed to planning ahead strategy. Further analysis revealed significant variation in students' academic achievement in Mathematics that attributed to planning ahead strategy. This imply that an improvement in students' planning ahead strategy will likely lead to an increase in their academic achievement in Mathematics. The finding lend support to previous findings by Niyomugabo (2018) who's study on strategic planning and students' academic performance in Mathematics revealed that school strategic planning influenced students' academic performance in Mathematics to a large extent. The finding is also in line with Momanyi et al. (2019) who carried out a study on self-planning learning as predictor on academic performance of English language and reported that there is a positive and statistically significant effect of self-planning learning strategy on academic performance in English language. In addition, the finding adds credence to the report of Miskell (2020) that the practice of strategic planning affected students' achievement positively. Likewise, the finding is in agreement with Boyitie (2021) who after a study on the impact of effective planning on teaching and learning among some selected secondary school students, revealed a significant relationship between effective planning and academic performance of secondary school students.

The finding could be so because the planning ahead strategy involves proper identification and selection of appropriate ways of learning and allocation of resources and includes goal setting, activating background knowledge, and time budgeting. In essence, for students to achieve at a high level, they need to plan before time by strategizing and putting all the resources in place in order to achieve the desired level of success in any subject. This may be reason for significant prediction of students' achievement in mathematics as portrayed by this study.

Students' academic achievement that can be attributed to active learning strategy

The study also found that 29% variation in students' academic achievement in Mathematics was attributed to active learning strategy. It was further confirmed that there is significant variation in students' academic achievement in Mathematics that was attributed to active learning strategy. This means that any improvement in students' active learning strategy will result to a corresponding increase in students' achievement in Mathematics and vice versa. This finding is consistent with previous findings from a study conducted by Abdullah and Yang (2018) who investigated the impact of active learning on mathematical achievement and submitted that active learning enhances students' academic achievement. Also, the finding agrees with that of Khan (2019) who carried out a study on the impact of active learning on students' academic performance and the result indicated that the performance of students who adopted active learning improved tremendously. The finding is in consonance with Nurbavliyev et al. (2022) who reported that active learning greatly promotes students' learning and achievement.

The above findings could be so because during active learning strategy, students employ tactics that get them actively involved in the learning process. They actively participate in classroom activities throughout the lesson period rather than being passive. The students also keep their learning in check by monitoring their own progress and understanding, which can bring about improvements in their learning and achievement.

Thus, due to the active involvement of students in the learning process, it is likely that their achievement will improve. Perhaps, this is why this study portrayed that a significant variation in students' academic achievement in Mathematics can be attributable to students' active learning strategy.

Students' academic achievement that can be attributed to metacognitive learning strategies compositely

The study also indicated that 57% variation in students' academic achievement in Mathematics was attributed to metacognitive learning strategies. Thus, it further showed that metacognitive learning strategies account for a statistically significant variation in students' academic achievement in Mathematics. Metacognitive learning strategies contribute substantially to students' academic achievement in Mathematics. These findings add credence to the finding of Cahayasti and Indrasari (2017) who carried out an investigation on the metacognitive strategy for completion of mathematics word problems and mathematics achievement among 3rd-grade elementary pupils in Depok, Indonesi and revealed that there exists a relationship between metacognitive strategies and mathematics achievement among third-grade elementary school students. Likewise, the finding lends support to the outcome of the study by Siamusinza and Sakala (2019) who studied the impact of metacognitive teaching strategies on learners' performance in geometry aspect of mathematics and reported that students taught with metacognitive strategies had significant mean scores of the post-test results compared to those taught without metacognitive strategies.

This finding could be so because metacognitive learning strategies are higher-order learning skills that help students to regulate their own learning by means of planning, monitoring, and evaluating one's own performance, among others. The strategies help in increasing students' knowledge of awareness and control of self to improve their learning and achievement in any subject. They are tactics of reflecting on one's own thinking towards identifying areas of strength and weaknesses in order to be effortful in attempt to overcome the weaknesses. All these can lead to improvement in students' achievement, which may explain why metacognitive learning strategy significantly accounted for students' academic achievement in mathematics in the present study.

Influence of gender on the amount of variation in students' academic achievement that can be attributed to metacognitive learning strategies

This study showed that gender has little moderating influence on the variation in students' academic achievement in Mathematics that was attributed to metacognitive learning strategies. Thus, it was confirmed that there is no significant moderating influence of gender on the amount of variation in students' academic achievement in mathematics that was attributed to metacognitive learning strategies. This implies that gender is not a significant factor in the degree to which metacognitive learning strategies account for students' learning outcomes or academic achievement in mathematics.

The above findings are in agreement with Yunusa (2013) who revealed that gender was not a significant factor in the interaction of metacognitive strategies and mathematics achievement of undergraduate students. Nzeadibe et al. (2019) who carried out a study on the effect of two meta-cognitive strategies on students' achievement in mathematics also revealed that gender does not significantly influence students' achievement in geometry aspect of mathematics based on their meta-cognitive strategies. Ajisuksmo and Saputri (2017) investigated the influence of gender metacognitive awareness and mathematics achievement of high school students and revealed that metacognitive awareness towards mathematics and students' mathematics achievement were significantly correlated. It was reported that gender is not a determinant factor in the metacognitive awareness and mathematics achievement of high school students' mathematics achievement. Hence, the findings of this study which shows no significant moderating influence of gender on the amount of variation in students' academic achievement in mathematics that was attributed to metacognitive learning strategies could be in order. This implies that both male and female students may be demonstrating similar levels of metacognitive strategies and achievement in Mathematics.

5. Conclusion

The study revealed that metacognitive learning strategies such as active learning strategy and planning ahead separately and compositely account for a significant variation in students' academic achievement in mathematics. In essence, the strategies contribute substantially to students' academic achievement in mathematics. From these findings of the study, it is therefore concluded that metacognitive learning strategies contributes greatly to students' academic achievement in Mathematics and as such they need to be put into consideration in the learning of the subject. Gender is not a strong determinant of students' metacognitive learning strategy in connection with their academic achievement in mathematics. Based on the findings of the study, the following recommendations are made:

1. Students should be encouraged by Mathematics teachers to adopt metacognitive learning strategies when studying Mathematics to enhance their learning of the subject.
2. Teachers should engage students with learning activities in mathematics that enable them to learn on their own using metacognitive strategies.

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