



Effects of Two Formative Assessment Models on Senior Secondary School Students' Achievement in Mathematics in Enugu Education Zone

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Abstract

The study examined the effects of two formative assessment models on students' achievement in mathematics in senior secondary one (SS1) schools in Enugu Education Zone of Enugu State. The study adopted quasi-experimental research design, specifically, non-equivalent comparison group design. The study was carried out with a population of 4,915 SS1 students in Enugu Education Zone of the state. The sample size of the study comprised of 96 students drawn from two schools out of 9 public senior secondary schools in Enugu Education Zone of Enugu State through simple random sampling technique. Mathematics Achievement Test (MAT) was the instrument for data collection. Three experts validated the instrument. The instrument was subjected to reliability test using Kuder Richardson 20 ($K - R_{20}$), and a reliability coefficient of 0.86 was obtained. The data collected was analyzed using descriptive statistics. Mean and standard deviation were used to answer the research questions, whereas analysis of covariance (ANCOVA) was used to test the null hypothesis at 0.05 level of significance. Findings from the study revealed among others that there is no significant difference in the mean achievement scores of students in mathematics assessed with Margaret Heritage (MH) and Elicit Student Response and Use (ESRU) models. Based on the findings of the study, it recommends among others that teachers should be provided with professional development to enhance student understanding and implementation of formative assessment practices in classrooms including Margaret Heritage (MH) and Elicit Student Response and Use (ESRU) models to improve students' achievement in mathematics.

Keywords: Formative Assessment, Formative Assessment Model, Margaret Heritage Assessment Model, Elicit Student Response and Use, Students Academic Achievement

Introduction

Effective assessment is key to quality teaching, yet students' achievement in Nigeria, especially in Mathematics continues to decline, showing the need for better methods beyond traditional testing. Mathematics is essential in Nigeria's education system and national development because it builds logical reasoning, problem-solving, and technological skills (Federal Republic of Nigeria, 2013). It is central to science and technology, and as Babu, Nagaraju and Johnson (2023) note, it influences daily decision-making and supports innovation. Curriculum reforms have aimed to make mathematics more relevant and practical so learners can use it to solve real-life problems. According to Onoshakpokaiye and Avwiri (2025), no nation can

advance technologically without a strong mathematics foundation.

Despite its importance, mathematics performance in Nigeria remains poor. Reports show that less than half of students earn credit passes in WASSCE mathematics (National Bureau of Statistics, 2022). Researchers attribute this to unqualified teachers, low motivation, inadequate materials, overcrowded classrooms, weak teaching methods (Ieren, Kuje & Abdullahi, 2018), negative attitudes, mathematics anxiety, and stereotypes about who can succeed in the subject (Kyari, Akwana & Yalwa, 2018). Curriculum overload and misalignment between teaching and assessment also worsen the problem (Akisani & Ahmed, 2019).

To address these challenges, research increasingly supports formative assessment, which uses continuous feedback to improve learning rather than just measuring it at the end. Gratale and Ferolino (2018) and Heritage (2010) describe formative assessment as a cyclical process of collecting evidence, interpreting it, and adjusting teaching. It engages learners actively and improves motivation, understanding, and meta-cognition (Ezugwu, Nwani, Agbo & Mbonu-Adigwe, 2019). Heritage's model emphasizes setting clear goals, eliciting evidence through questioning or tasks, analyzing data, giving feedback, and helping students close learning gaps. Ruiz-Primo and Furtak's (2007) ESRU model Elicit, Student Response, Recognize, Use similarly stresses collecting and using student responses to guide instruction.

Both models encourage student-centered learning and help teachers adapt instruction in real time. However, the success of formative assessment can depend on learners' learning styles, since students process information differently visually, auditory, or kinesthetically (Aaron, 2017). When assessment practices match students' learning preferences, understanding and interest improve. This alignment promotes inclusiveness, confidence, and higher achievement (Rajak & Dey, 2025). There is still a need for empirical research on how formative assessment models influence mathematics achievement when considered alongside learning styles.

Statement of Problem

Despite the central role of mathematics in Nigeria's educational and technological development, students' performance in the subject has remained persistently poor. Reports from the West African Examinations Council (WAEC) and the National Bureau of Statistics (2022) reveal that a large percentage of secondary school students consistently fail to obtain credit passes in mathematics. This recurring trend suggests that existing teaching and assessment practices are not effectively supporting meaningful learning. Traditional teacher-centered methods and heavy reliance on summative assessments have limited students' engagement and understanding. Such approaches focus on measuring learning outcomes rather than improving them, providing little feedback to guide instructional decisions. Consequently, misconceptions remain uncorrected, leading to cumulative learning

difficulties and continued underachievement in mathematics.

Formative assessment has been identified as a promising alternative for improving students' learning outcomes. It emphasizes continuous feedback and active learner participation, enabling teachers to adjust instruction to meet students' needs. However, its effective implementation in Nigerian classrooms remains limited, largely due to inadequate teacher awareness, insufficient training, and a lack of empirical evidence on its impact in the local context. Moreover, existing studies seldom consider how learner characteristics such as learning styles and gender influence the effectiveness of formative assessment. Differences in how students process information (visual, auditory, or kinesthetic) and gender-related factors such as confidence and participation may significantly affect achievement. Yet, the interaction of these factors within formative assessment settings in Nigeria is largely unexplored. Therefore, this study seeks to examine the combined and relative effects of formative assessment models, learning styles, and gender on students' achievement in mathematics. Understanding these relationships is essential for designing equitable, evidence-based assessment practices capable of improving mathematics learning outcomes and bridging performance gaps among diverse learners.

Purpose of the Study

The general purpose of this study is to determine the effect of formative assessment models on students' achievement in mathematics. Specifically, the study tends to determine:

1. Mean achievement score of male and female students thought and assessed using Margaret Heritage and Elicit Students Response and Use (ESRU) formative assessment models in mathematics
2. influence of learning styles on students' achievement in mathematics
3. interaction effect of two formative assessment models and learning styles on students' achievement in mathematics

Research Questions

The study was guided by the following research questions:

1. What is the mean achievement score of students assessed using Margaret Heritage and Elicit Students Response and Use (ESRU)

formative assessment models in mathematics?

2. What is the influence of learning styles on students' achievement in mathematics?
3. What is the interaction effect of formative assessment models and learning styles on students' achievement in mathematics?

Hypotheses

The following hypotheses were formulated and will be tested at 0.05 level of Significance:

1. There is no significant difference in the mean achievement scores of students exposed to Margaret Heritage and those assessed using Elicit Students Response and Use (ESRU) formative assessment models in mathematics
2. There is no significant influence of learning styles on students' achievement in mathematics
3. There is no significant interaction effect of the two formative assessment models and learning styles on students' achievement in mathematics

Methods

The study adopted quasi-experimental research design. Specifically, the nonequivalent comparison group design. Non-equivalent comparison group design according to Yang (2023) is the type of quasi-experimental design used in research when random assignment of participants to the groups is not feasible. This design involves selecting two or more groups that are similar, but not randomly assigned, and then comparing the groups on some outcome measure. In this design, two intact groups are pretested, and treatment is administered to the respective groups after which the groups are post tested. The area of study is Enugu Education zone of Enugu state. This area was chosen because there has been over emphasis on continuous assessment by the school supervisors relegating the use of formative assessment model by the teachers in the zone. To many of the teachers, students' assessments are kick-off test, mid-term test, assessments, projects and the end of term examination as directed by the government. These assessment processes earn score for the students, but more or less do not improve their learning process. Hence, the need to make formative assessment model known to teachers and for them (teachers) to understand some innovative assessment

models away from continuous assessment which many misconstrue as continuous testing, in other to use assessment data to inform learning process.

The population of the study comprises of all the SS1 students in Enugu Education Zone of Enugu State, which is 4,915 (Post primary Schools Management Board Enugu, 2022/2023 academic session). Enugu-East has a total of ten (10) public secondary schools with total population of 2,552 SS1 students. Enugu-North has a total number of nine (9) public secondary schools with population of 1,744 SS1 students, while Isi-Uzo has a total number of eleven (11) public secondary schools with population of 619 SS1 students, making a total of 30 public secondary schools in Enugu Education Zone with grand total population of 4,915 SS1 students. The choice of this target population is that they (SS1 Students) have received the minimum mathematics education requirement as stipulated by the National Policy on Education, and they are about to make carrier choice of subject area of specialization within their senior secondary. The sample size of 94 SS1 mathematics students was used for the study. The researcher used multi-stage sampling procedure to select the sample.

Two instruments were used for this study namely; Mathematics Achievement Test (MAT) and Visual Auditory Kinaesthetic Learning Style Questionnaire (VAKLSQ). The Mathematics Achievement Test (MAT) comprised of two sections; Section A and section B. Section A comprised of the demographic information about the respondent such as gender, while section B were made up of 30 Multiple-choice items, each with four response options lettered A-D. Only one of the four response option is the key (correct answer) to the particular item. The items were constructed using three topic areas (Law of indices & standard form, set operations and subject of formulae & variation) in SS1 mathematics scheme of work through the aid of Test blue-print. Visual Auditory Kinaesthetic Learning Style Questionnaire (VAKLSQ) is an adapted instrument from Victoria Chislett, a specialist in performance psychology, developed in 2005. It is a tool designed to help individuals identify their preferred learning style among three primary learning modes: visual, auditory, and kinesthetic (VAK). In this study, it only meant to categorize learners according to their most preferred learning style(s). The instrument is a 20 multiple-choice items each with response options lettered A-C. None of the response

options are wrong, but depends on the learner's most preferred learning style. Rubric for scoring this instrument indicates that those who chose mostly; A's have a visual learning style, B's have an auditory learning style, and C's have a kinaesthetic learning style

To ascertain the validity of the instruments for this study, the VAK and MAT instruments were face validated by three experts, one from Mathematics Education Unit and two from Measurement and Evaluation Unit all from the Department of Science Education, Faculty of Education, University of Nigeria, Nsukka. The experts were required to validate the instruments with respect to the clarity of the items, relevance, suitability and effectiveness of the items for the study. Their corrections and modifications on phrasing of the items, language level and the relevance to the purpose of the study and research question were effected, such as reframing research questions and hypothesis and changing the language of adapted VAK instrument to suit mathematical questions. Similarly, the Mathematics Achievement Test (MAT) items were subjected to content validity using table of specification (Test blueprint). Items were generated from three topics in Mathematics, using SS1 scheme of work.

In order to ensure the reliability of the Mathematics Achievement Test (MAT), thirty (30) copies of the instrument was administered to SS1 mathematics students in Nsukka education zone of Enugu State, which was not part of the zone under study but shares similar characteristics with the area under study. The instrument was retrieved and subjected to reliability test in order to determine the internal consistency of the instrument using Kuder Richardson 20 ($K-R_{20}$). A reliability index of 0.86 was obtained for the MAT instrument. Kuder Richardson was used because the instrument was dichotomously scored. The Mathematics teachers teaching SS1 in each of the two schools acted as the research assistants. They were trained by the researcher for three different days in one week at Government Secondary School, Enugu at about 3-4pm each day before the commencement of the pretest. The assessment model, procedure and principles of each of the models were explained to the research assistants during the one-week pre-experimental training. A pretest was administered to each of the classes, marked and recorded in the same week after the research assistants have been trained.

The training was preceded by the treatments for the next three weeks (the first week for the first topic, the second week for the second topic and the third week for the third topic).

Each of the research assistant thought their class with the principles and procedures of the formative assessment models, after which the posttest were administered to all the students in each of the classes at the fifth week. The instruments (posttest) were collected and marked accordingly ensuring that scores are given to students strictly on merits. Both the students' pretest and posttest scores were collated according to the identification number of each student. Those numbers in pretest score without posttest score were dropped, but those with pretest and posttest scores were used for the study. The researcher controls some variables that can affect the result of the study. To prevent negation of the findings by extraneous variables, the following measures will be adopted by the researcher: controlling Treatment (Formative assessment models): This was done by ensuring that the steps outlined for the treatment was strictly followed for better timing and better results; controlling Hawthorne Effect: The researcher monitored the progress of the students during the teaching and learning process for desired changes. The researcher was discrete in observation and communicating clearly at the beginning of the experiments all specific objectives of the sessions; statistical control: Analysis of Covariance (ANCOVA) was used to analyze the instruments collected for this study. This is because ANCOVA is effective in removing from the treatment those differences which could be linearly correlated with the covariant and to adjust the post treatment means for difference between the various groups in the experimental conditions. This means that ANCOVA corrects errors arising from the covariant (Pre-test responses).

The data collected was analyzed using descriptive statistics of mean and standard deviation to answer research questions. Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. ANCOVA was used because it addresses the differences in the posttest scores which could arise from the non-equivalent group by adjusting the posttest scores using the pretest scores. The decision rule was that if the probability value is greater than 0.05 the null hypotheses is accepted but if the probability value is less than or equal to 0.05 the null hypotheses is rejected.

Results

Research Question One

What is the mean achievement score of students assessed using Margaret Heritage and Elicit Students Response and Use (ESRU) formative assessment models in mathematics?

Table 1: Mean and standard deviation of the achievement score of students assessed using Margaret Heritage formative assessment model and those taught Elicit Students Response and Use (ESRU) formative assessment models in mathematics

Formative Assessment Models	N	Pretest		Posttest		Mean Difference
		$\bar{X}$	SD	$\bar{X}$	SD	
MH Model	46	18.61	6.25	21.28	4.91	2.67
ESRU Model	48	18.58	5.13	21.54	4.90	2.96

The result in Table 1 shows the mean and standard deviation of the achievement score of students assessed using Margaret Heritage formative assessment model and Elicit Students Response and Use (ESRU) formative assessment models in mathematics. The result revealed that the students exposed to Margaret Heritage formative assessment model have a pretest mean score of 18.61 with a

standard deviation of 6.25 and a posttest mean score of 21.28 and a standard deviation of 2.67, with a mean gain of 2.67. The result also shows that the students exposed to Elicit Students Response and Use (ESRU) formative assessment model have a pretest mean score of 18.58 with a standard deviation of 5.13 and a posttest mean score of 21.54 with a standard deviation 4.90 and a mean gain of 2.96.

Hypothesis One

There is no significant difference in the mean achievement scores of students exposed to Margaret Heritage and those assessed using Elicit Students Response and Use (ESRU) formative assessment models in mathematics

Table 2: ANCOVA result on the significant difference in the mean achievement scores of students exposed to Margaret Heritage and those assessed using Elicit Students Response and Use (ESRU) formative assessment models in mathematics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1573.626 ^a	12	131.136	16.566	.000	.710
Intercept	490.787	1	490.787	62.000	.000	.434
Pretest	1341.790	1	1341.790	169.504	.000	.677
Gender	2.444	1	2.444	.309	.580	.004
Learning_Style	20.274	2	10.137	1.281	.283	.031
Assessment_Model	2.378	1	2.378	.300	.585	.004
Learning_Style * Assessment_Model	.991	2	.496	.063	.939	.002
Error	641.193	81	7.916			
Total	45323.000	94				
Corrected Total	2214.819	93				

a. R Squared = .710 (Adjusted R Squared = .668)

The result in Table 2 shows that an F-ratio of (1, 81 $p > 0.05$) = .300 with an associated probability value of .585 was obtained for the difference in the mean achievement scores of students exposed to Margaret

Heritage and those assessed using Elicit Students Response and Use (ESRU) formative assessment models in mathematics. Since the associated value of .585 is greater than the 0.05 level of significance set

as benchmark for taking decision, the null hypothesis was found not to be significant and therefore was not rejected. Therefore, the inference drawn is that there is no significant difference in the mean achievement scores of students exposed to Margaret Heritage and those assessed using Elicit Students Response and Use

(ESRU) formative assessment models. The result also revealed that the partial eta square (η^2p) of .004 implies that 0.4% increase in students academic achievement was due to the formative assessment model.

Research Question Two

What is the influence of learning styles on students' achievement in mathematics?

Table 3: Mean and standard deviation of the influence of learning styles on students' achievement in mathematics

Learning Styles	N	Pretest		Posttest		Mean Difference
		$\bar{X}$	SD	$\bar{X}$	SD	
Visual	45	18.07	6.62	20.62	5.14	2.55
Auditory	27	19.37	4.34	22.33	4.56	2.96
Kinesthetic	22	18.73	5.10	21.91	4.65	3.18

The result in Table 3 shows the mean and standard deviation of the influence of learning styles on students' achievement in mathematics. The result revealed that the students that are visual learners have a pretest mean score of 18.70 with a standard deviation of 6.62 and a posttest mean score of 20.62 with a standard deviation of 5.14 and a mean gain of 2.55. The result also revealed that the students that are auditory learners have a pretest mean score of 19.37 with a standard deviation of 4.34 and a posttest mean score of 22.33 with a standard deviation of 4.56 and a mean gain of 2.96. The result revealed that the students that are kinesthetic learners have a pretest mean score of 18.73 with a standard deviation of 5.10 and a posttest mean score of 21.91 with a standard deviation of 4.65 and a mean gain of 3.18.

Hypothesis Two

There is no significant influence of learning styles on students' achievement in mathematics

The result in Table 2 shows that an F-ratio of (2, 81 $p > 0.05$) = 1.281 with an associated probability value of .283 was obtained for the significant influence of learning styles on students' achievement in mathematics. Since the associated value of .283 is greater than the 0.05 level of significance set as benchmark for taking decision, the null hypothesis was found not to be significant and therefore was not rejected. Therefore, the inference drawn is that there is no significant difference in the influence of learning styles on students' achievement in mathematics. The result also revealed that the partial eta square (η^2p) of .031 implies that 3% increase in students academic achievement was due to their leaning styles.

Research Question Four

What is the interaction effect of formative assessment models and learning styles on students' achievement in mathematics?

Table 5: Interaction effect of formative assessment models and learning styles on students' achievement in mathematics

Learning Styles	Formative Assessment Models	Pretest			Posttest		Mean Difference
		N	$\bar{X}$	SD	$\bar{X}$	SD	
Visual	MH Model	21	18.52	7.53	21.05	5.05	2.53
	ESRU Model	24	17.67	5.84	20.25	5.30	2.58
Auditory	MH Model	12	19.42	4.19	21.83	4.55	2.41
	ESRU Model	15	19.33	4.61	22.33	4.68	3.00
Kinesthetic	MH Model	13	18.00	5.90	21.15	5.32	3.15
	ESRU Model	9	19.78	3.73	23.00	3.46	3.22

The result in Table 5 shows the interaction effect of formative assessment models and learning styles on students' achievement in mathematics. The result revealed that the visual learners have a pretest mean score of 18.52 with a standard deviation of 7.53 and a posttest mean score of 21.05 and a standard deviation of 5.05, with a mean gain of 2.53 for Margaret Heritage formative assessment model, and a pretest mean score of 17.67 with a standard deviation of 5.84 and a posttest mean score of 20.25 and a standard deviation of 5.30, with a mean gain of 2.58 for Elicit Student Response and Use formative assessment model. Auditory learners have a pretest mean score of 19.42 with a standard deviation of 4.19 and a posttest mean score of 21.83 and a standard deviation of 4.55, with a mean gain of 2.41 for Margaret Heritage formative assessment model, and a pretest mean score of 19.33 with a standard deviation of 4.61 and a posttest mean score of 22.33 and a standard deviation of 4.68, with a mean gain of 3.00 for Elicit Student Response and Use formative assessment model. Kinesthetic learners have a pretest mean score of 18.00 with a standard deviation of 5.90 and a posttest mean score of 21.15 and a standard deviation of 5.32, with a mean gain of 3.15 for Margaret Heritage formative assessment model, and a pretest mean score of 19.78 with a standard deviation of 3.73 and a posttest mean score of 23.00 and a standard deviation of 3.46, with a mean gain of 3.22 for Elicit Student Response and Use formative assessment model.

Hypothesis Four

There is no significant interaction effect of the two formative assessment models and learning styles on students' achievement in mathematics

The result in Table 2 shows that an F-ratio of $(2, 81 \text{ } p > 0.05) = .063$ with an associated probability value of .939 was obtained for the significant interaction effect of the two formative assessment models and learning styles on students' achievement in mathematics. Since the associated value of .939 is greater than the 0.05 level of significance set as benchmark for taking decision, the null hypothesis was found not to be significant and therefore was not rejected. Therefore, the inference drawn is that there is no significant difference in the interaction effect of the two formative assessment models and learning styles on students' achievement in mathematics. The result also revealed that the partial eta square ($\eta^2 p$) of .002 implies that 2% increase in students academic

achievement was due to assessment models and their learning styles.

Discussion

The findings of the study revealed that there is no significant difference in the mean achievement scores of students exposed to Margaret Heritage and those assessed using Elicit Students Response and Use (ESRU) formative assessment models. Although, the two formative assessment models proved to be effective in improving students achievement in mathematics, Elicit Students Response and Use formative assessment model seemed to be more effective with a pretest mean score of 18.58, having a standard deviation of 5.13 and a posttest mean score of 21.54, with a standard deviation 4.90 and a mean gain of 2.96 compared to the Margaret Heritage formative assessment model with a pretest mean score of 18.6, having a standard deviation of 6.25 and a posttest mean score of 21.28, with a standard deviation of 2.67 and a mean gain of 2.67, suggesting that the two Formative assessment models are effective in improving students achievement in mathematics among secondary school students.

The above finding is consistent with those of Olagunju (2015), Ugodulunwa and Okolo (2015) and Ame and Ebuoh (2018) who in their findings revealed that formative assessment improve learning and equally reduce anxiety level among students. This could be due to the fact that formative assessment provides immediate and constructive feedback to students, helping them understand their mistakes and learn from them. This feedback is crucial for students to improve their understanding of mathematical concepts and allows teachers to monitor students' progress regularly, identifying areas where students are struggling and providing targeted support. This helps prevent students from falling behind and allows for timely intervention. It could also be because assessment encourages active learning, as students are often involved in self-assessment, peer assessment, or discussions about their learning. This active engagement enhances their understanding of mathematical concepts and improves retention and teachers can use the feedback from formative assessment to adjust their instruction to better meet the needs of their students. This flexibility ensures that students receive the support and guidance they need to succeed in mathematics. On the other hand it could also be that Formative assessment increases students' motivation to learn mathematics, as they receive

regular feedback on their progress and can see their improvement over time. This can lead to a greater sense of achievement and a more positive attitude towards mathematics and serves as a diagnostic tool, helping teachers identify misconceptions or gaps in students' understanding. This allows teachers to address these issues promptly; preventing them from becoming larger barriers to learning as well as regular formative assessment can lead to improved performance in mathematics. Students who receive regular feedback and support are more likely to master mathematical concepts and achieve higher grades.

Learning styles positively influences students' academic achievement in mathematics. The result also shows that kinesthetic learners perform better than other learners with a mean gain of 3.18 from pretest and posttest scores followed by auditory learners with a mean gain of 2.96 when compared to Visual learners with 2.55 mean gain from pretest and posttest scores. But there is no significant difference in students' achievement in mathematics due to learning style.

This finding differs with study carried out by Nja et al (2019) which revealed that there was a significant difference in students' learning styles and a correlation between learning styles and academic achievement of the students. But in this case, learning style positively influences secondary school students. The reason for the positive influence of learning style on students' academic achievement in mathematics could be due to cognitive preferences. Learning styles reflect individuals' cognitive preferences for processing information. Students who align their learning with the way mathematics is taught and assessed may find it easier to understand and apply mathematical concepts, leading to higher achievement. Understanding one's learning style may help students develop self-regulation skills, such as setting goals, monitoring progress which are integral parts of Margaret Heritage models, and adapting learning strategies.

In other hand, this study corroborates with the findings of Duru (2021) in a research which showed that learning style, self-regulated learning skill and achievement motivation (individually and jointly) significantly predicts students' achievement in Mathematics. To the author, learning style is the best predictor variable to students' achievement in Mathematics.

The result of this study revealed that there is a positive interaction effect of formative assessment

models and learning styles on students' academic achievement in mathematics. Though the result showed positive interaction effect, but there is no significant difference in the interaction effect of the two formative assessment models and learning styles on students' achievement in mathematics. The outcome of this study supports the study investigated by Ozan and Kinac (2018) which showed that formative assessment practices have positive effects on students learning and achievement.

However, Elicit Student Response and Use (ESRU) formative assessment model improve students' achievement in mathematics with visual, auditory and kinesthetic learning styles compared to Margaret Heritage formative assessment model. This positive interaction effect could be that formative assessment models emphasize providing timely and specific feedback to students. Feedback provided through formative assessment has significant benefits when motivating students, helping them to improve their learning (Luckett and Sutherland, 2000). When this feedback is tailored to students' learning styles, it can be more effective in addressing their individual needs and guiding their learning process. More so, formative assessment models that incorporate interactive and hands-on activities can increase student engagement in mathematics. This engagement likely leads to higher levels of motivation and effort, which are the key factors in academic achievement.

Conclusion

The study on the effect of two formative assessment models on students' achievement in mathematics in Enugu education zone concludes that there is no significant difference in the mean achievement scores of students assessed using both the Margaret Heritage (MH) and Elicit Student Response and Use (ESRU) models of formative assessment. Based on the study, learning style and gender do not influence significantly the mean achievement score of students in mathematics. This is evident on the Kinesthetic learners performing better when compared to other learners and female students with higher mean achievement scores than their male counterparts, but no significant difference in their mean achievement scores due to gender and learning style. The findings of the study suggest that incorporating these formative assessment practices into regular classroom activities can lead to improved students' academic performance.

However, further research is recommended to explore the long-term effects and sustainability of these models across different educational contexts. In all, the study shows the importance of formative assessment in enhancing students' achievement in mathematics and provides practical implications for improving mathematics education in senior secondary schools in Enugu education zone.

Recommendations

The following recommendations were made based on the findings of the study:

1. Since the use of Margaret Heritage (MH) and Elicit Students Response and Use (ESRU) formative assessment models has been found effective in improving students' achievement in mathematics, teachers should be provided with professional development to enhance their understanding and implementation of formative assessment practices including MH and ESRU models. By so doing, students' achievement in mathematics could be improved.
2. The fact that students' gender and learning styles do not contribute significantly to students' academic achievement in mathematics, schools and educational institutions can allocate resources towards implementing a variety of teaching and learning strategies rather than investing in specific assessment models tailored to particular gender or learning styles.

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