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Effects of Integrated Group-Based Mastery Learning Model (IGBLM) on mathematics achievement of secondary school students in Lagos State, Nigeria.

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ABSTRACT

The study examines the Effects of the Integrated Group-Based Mastery Learning Model (IGBLM) on the mathematics achievement of secondary school students in Lagos State, Nigeria. The study employed a quasi-experimental research design. Four secondary schools were randomly selected from 29 secondary schools in Alimosho. Senior secondary school two (SS2) arms of the selected schools were purposively selected for study. Two out of the selected four schools were randomly assigned to the experimental group and two to the control group. A total of 96 students were in the experimental group and 87 in the conventional group, making a total of 183 for the experiment. Intact classes were used in all the classes involved in the experiment. The findings of the study show a statistically significant difference between the mean achievement scores and the retention mean score of students taught using the IGBLM and those taught using the conventional teaching method. Also, the study indicated no significant difference in the mean achievement scores of male and female students taught mathematics using IGBLM strategies. The study recommended, among other that mathematics teachers should employ interactive methods such as IGBLM in the teaching of mathematics

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**Introduction**

Mathematics is one of the most important subjects in the secondary school curriculum in Nigeria because it serves as the foundation for scientific, technological, and economic development. The subject plays a vital role in developing students' logical reasoning, critical thinking, problem-solving abilities, and computational skills needed for everyday life and future careers. Mathematics is also a compulsory subject for admission into many science-based and professional courses in tertiary institutions. Despite its significance, students' achievement in mathematics in Nigerian secondary schools has remained consistently poor, particularly in external examinations conducted by the West African Examinations Council and the National Examinations Council. Reports from examination bodies have shown persistent low performance among students, which has become a source of concern to educators, parents, and government authorities (WAEC, 2022; Ossai, Eboh, & Dania, 2024).

A typical mathematics class is usually composed of learners who are heterogeneous in several characteristics. A good method considers these variations in learners' abilities. Low-ability students, in particular, face greater challenges in mathematics because traditional classroom teaching often neglects their pace of learning, leading to frustration, lack of confidence, and eventual disengagement from the subject. As a result, these students remain at risk of educational

underachievement, which in turn affects their future academic and career opportunities (Akinsola & Olowojaiye, 2008; Slavin, 2014 b; Amalia, 2018; Adebayo & Adepoju, 2021; Adeniy & Akinoso, 2019; Adeniyi & Awofala, 2023).

The Integrated Group-Based Mastery Learning Model (IGBML) is an instructional approach designed to ensure that students achieve a high level of mastery of specific objectives while working within a group-based environment. It builds on the principles of mastery learning, adapting them to accommodate group dynamics, collaborative learning, and structured instructional activities. The core idea of IGBML is that, through targeted interventions and cooperative strategies, all students can achieve the same learning objectives at varying paces without compromising educational outcomes (Njoku, 2019; Sobola & Adediran, 2022).

The IGBML is rooted in Bloom's *Learning for Mastery* model, which proposed that mastery learning could be applied in group instructional settings. Unlike individualized mastery learning, which focuses on personal instruction, IGBML uses teacher-paced methods to facilitate group learning while incorporating corrective and enrichment activities to address individual needs (Njoku, 2019). According to Okwudiba (2021), this approach combines the benefits of structured group instruction with the personalised support typically associated with one-on-one teaching. This approach emphasizes content mastery as well as collaboration among learners.

Mastery learning is a teaching approach based on the belief that every learner can successfully understand and master academic content when provided with appropriate instruction and enough time. It offers an alternative approach to teaching in which students must demonstrate a predetermined level of mastery in one unit before moving on to the next. As noted by Aregbesola (2023), mastery learning combines teaching techniques and individualized instruction in a group. Mastery learning is an effective instructional approach that can be applied to almost all learners. The main goal is to enhance students' depth of understanding and overall academic achievement, based on the belief that all students are capable of success when given sufficient time to learn (Patrick & Olivia, 2020; Egharevba & Iyamu, 2020). Mastery is achieved when learners attain the required benchmark on a diagnostic assessment for a unit. This model not only equips students with the necessary foundational skills to advance but also allows teachers to detect and address learning difficulties, thereby preventing repeated failure. Evidence from research shows that mastery learning enhances knowledge retention, facilitates transfer of learning, promotes engagement, and fosters more positive learner attitudes compared to conventional teaching methods.

Mastery learning is an instructional process that provides students with multiple opportunities to demonstrate their understanding of the content. Initial instruction is delivered to engage all learners; those who do not achieve mastery are given additional instruction aimed at correcting their misunderstandings. Re-teaching usually employs different strategies from the original teaching methods (Sobola and Adeniran 2022). According to Chukwudi & Mba (2022), if the initial presentation involved demonstration and visuals, re-teaching might include hands-on activities and cooperative learning strategies. A retest is then administered to these students to allow them to demonstrate mastery of the content.

The theories of mastery learning resulted in a radical shift in responsibility for teachers; the blame for a student's failure rests with the instruction, not a lack of ability on the part of the student. In this type of learning environment, the challenge becomes providing enough time and employing instructional strategies so that all students can achieve the same level of learning (Okeke, & Amah, 2021).

The group-based mastery learning model is an organized instructional method in which students work in small groups to complete tasks, solve problems, or discuss issues for the purpose of enhancing both individual and collective learning outcomes (Johnson & Johnson, 2018). It differs from a simple group because it is highly structured and

focuses on promoting positive interdependence, accountability, and cooperative skills (Adegboye, 2020; Yusuf & Afolabi, 2019).

Researchers have identified several factors influencing students' performance in mathematics. One of the major factors is the teaching method adopted by teachers. According to Adeniyi & Akanmu (2019), student-centred instructional methods such as cooperative learning and problem-solving approaches improve students' understanding and achievement in mathematics. Similarly, George Polya emphasized that active participation and logical reasoning enhance mathematical learning and retention. However, despite the growing worldwide advocacy for innovative instructional practices, there is limited empirical evidence on the effectiveness of IGBLM in Nigerian secondary schools, especially within Lagos State.

Hence, this study is on the effects of the Integrated Group-Based Mastery Learning Model on the mathematics achievement among low-ability learners in secondary schools in District V, Lagos State, Nigeria.

### **Objectives of the Study**

The main objective of this study is to investigate the effects of the Integrated Group-Based Mastery Learning Model (IGBMLM) on students' achievement in mathematics. The specific objectives are to:

1. Compare the achievement of students taught mathematics using the IGBMLM and those taught using conventional teaching methods
2. Find out the effects of IGBMLM on secondary school students' achievement in mathematics based on gender
3. Investigate the effect of the integrated group-based mastery learning model on students' retention of mathematical knowledge.

### **Research Hypotheses**

The following hypotheses guided this study:

**H0<sub>1</sub>:** There is no significant difference in the achievement of secondary school students taught using the Integrated Group-Based Mastery Learning Model (IGBMLM) and those taught using the conventional method

**H0<sub>2</sub>:** There is no significant difference in the achievement of students taught mathematics using the IGBMLM based on gender

**H0<sub>3</sub>:** The Integrated Group-Based Mastery Learning Model has no significant effect on secondary students' retention ability in mathematics

### **Methods**

The population for the study consisted of all public secondary school students in Lagos State, Nigeria, specifically Education District V, which was randomly selected from the six educational districts in Lagos State. Also, Alimosho local government was selected out of the 3 local government areas in the district. Four schools were randomly selected from the 29 secondary schools in Alimosho. Two out of the selected four schools were randomly assigned to the experimental group and two into the control group. Senior secondary school two (SS2) was purposively selected for the experiment because it is believed that they have adequate experience for the study, and they are not preparing for any external examination presently. A total of 96 were in the experimental group and 87 in the conventional group, making a total of for the experiment. Intact classes were used in all the classes in the experiment. The instrument for data collection was the Mathematics Achievement Test (MAT). The MAT consists of 40 multiple-choice questions on mathematics content. The topics covered include: Word problems leading to a quadratic equation, geometry, mensuration, and probability-related. The instrument was validated by two experienced mathematics teachers in the selected districts and one test and measurement expert. Kuder–Richardson Formula 20 (KR-20) was used to determine the reliability of the achievement test (MAT), and KR-20 reliability coefficient of 0.78 was obtained.

The researcher visited the selected schools to seek permission from the school management and discuss her mission with the mathematics teacher to solicit their support. The 4 research assistants involved in the study were trained on how to use the integrated group-based learning model (IGBMLM) to instruct students before the commencement of the experiment. The researcher plus the research assistant administered the pre-test in the first week. The actual teaching started in the second week and lasted for four weeks. The post-test was administered in the 6<sup>th</sup> week. The results of the pretest and the post-test were used as data for the study. The data collected were analysed using mean, standard deviation, and Analysis of Covariance (ANCOVA) at a 0.05 level of significance.

The major steps involved in using IGBLM for teaching mathematics include:

1. Identification of Learning Objectives
2. Diagnosis of Learners' Prior Knowledge
3. Formation of Learning Groups.
4. Presentation of Mathematics Concepts
5. Group-Based Learning Activities
6. Mastery Evaluation
7. Corrective Instruction.
8. Enrichment Activities for Mastered Learners
9. Reassessment
10. Evaluation and Reflection

## Results

**Hypothesis 1:** There is no significant difference in the mean achievement scores of students taught mathematics using IGBMLM and the conventional method of instruction

**Table 4. 1: Mean achievement scores of students taught mathematics using the IGBMLM and those taught using traditional teaching methods**

Groups		Pre-Test	Post-Test	Mean difference
IGBMLM	N	87	87	
Method	Mean	20.37	56.28	35.91
	Std. Deviation	3.21	9.32	
Conventional	N	96	96	
Method	Mean	20.01	42.62	22.61
	Std. Deviation	2.89	6.89	

As presented in Table 1, the pre-test and post-test mean achievement scores of senior secondary school students who were taught mathematics IGBMLM and conventional methods were 56.28 and 42.62, respectively. The difference in mean scores for students taught using IGBMLM was  $(56.28 - 20.37) = 35.91$ . Also, the difference in the pre-test and post-test mean scores for students taught using conventional methods was  $(42.62 - 22.61) = 22.61$ . Therefore, the mean gain in achievement scores for students taught using IGBMLM (35.91) exceeded that of those taught using the conventional methods mean gain (22.61). This suggests that IGBMLM approaches improved students' educational outcomes in mathematics better than the conventional methods. To determine whether these observed differences were statistically significant, additional analysis was performed using ANCOVA.

**Table 2: Analysis of covariance (ANCOVA) on achievement on the mean scores of experimental and control groups**

Source	Type III Squares	Sum of Df	Mean Square	F	Sig.
Corrected Model	14856.55	3	3875.13	216.24	.002
Intercept	32009.42	1	33021.42	4422.20	.001
Pretest	128.05	1	148.07	26.20	.001
Groups	13612.05	2	4656.06	864.03	.001
Error	4847.56	180	6.07		
Total	26881.00	183			
Corrected Total	23502.11	182			

Table 2 showed that an F-value for the groups was found to be 864.3,  $P=.001$ , which is significant at the 0.05 level of significance since  $.05 > .001$ , the null hypothesis is rejected. Hence, there is a significant difference in the mean achievement scores of students taught mathematics using the Integrated group-based learning model (IGBLM) and the conventional method of instruction. There is a statistically significant difference in the mean achievement scores of students taught mathematics using the Integrated Group-Based Learning Model (IGBLM) and those taught using the conventional method of instruction.

Hypothesis 2: There is no statistically significant difference in the performance of students taught using the Integrated Group-Based Mastery Learning Model (IGBLM) based on gender.

**Table 3: Mean achievement test of male and female students taught using the Integrated group-based mastery learning model**

Sex		Pre-Test	Post-Test	Mean difference
Male	N	41	41	
IGBMLM	Mean	19.87	50.54	30.67
	Std. Deviation	12.41	12.52	
Female	N	46	46	
IGBMLM	Mean	20.26	52.02	31.76
	Std. Deviation	12.71	13.06	

Table 3 displays the mean performance scores of participants in the experimental group (IGBMLM) according to gender. The difference in the pre-test and post-test mean scores of male and female students in the experimental group was 30.67 and 31.76, respectively. The mean gain for male students was slightly higher than that of their female counterparts taught with IGBMLM strategies. To determine whether these differences were statistically significant, further analysis was conducted using ANCOVA.

**Table 4: Analysis of covariance (ANCOVA) on achievement difference between the mean scores of the experimental group based on gender**

Source	Type III Squares	Sum of Df	Mean Square	F	Sig.
Corrected Model	3243.56 <sup>a</sup>	3	2025.64	2414.07	.045
Intercept	31435.20	1	21427.30	2.69	.003
Pretest	144.92	1	2220.92	24.74	.006
Sex	3560.87	2	150.29	162.13	.087

Error	4554.32	84	8.02
Total	24543.00	87	
Corrected Total	8578.25	86	

Table 4 presents the Analysis of Covariance (ANCOVA) on the achievement differences between male and female students in the experimental group. The results show an F-value of 162.13 and a P-value of 0.87. Since the P-value is greater than 0.05, the null hypothesis is not rejected, indicating that the mean difference in achievement between male and female students taught mathematics using the Integrated Group-Based Mastery Learning Model (IGBLM) is not statistically significant. This suggests that both male and female students benefited equally from the IGBLM instructional strategy.

**Hypothesis 3:** There is no significant difference in the mean retention scores of students taught mathematics using IGBLM and the conventional method.

**Table 5: Mean retention scores of students taught using IGBMLM and the Conventional method.**

Groups		Post test	Retention Test	Mean
IGBMLM Method	N	96	96	
	Mean	56.28	54.78	1.50
	Std. Deviation	9.32	12..33	
Conventional Methods	N	87	87	
	Mean	42.62	36.01	6.61
	Std. Deviation	6.38	12.51	

Table 5 revealed the retention score of the students who were taught using IGBMLM (54.78), and conventional method (36.01). The experimental group's mean retention score was greater than that of traditional methods. The difference between the post-test means and the retention score of the control group was 6.61, as against 1.50 in the experimental group. This shows that students who received the IGBMLM intervention retained more of the content taught compared to their counterparts in the conventional methods group. To ascertain whether the difference was significant, a further statistical analysis was carried out using ANCOVA.

**Table 6: Analysis of covariance (ANCOVA) for the difference in the retention test mean scores of the experimental and the control group**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	14884.72 <sup>a</sup>	3	4329.51	2.2933	.000
Intercept	2861.44	1	2461.72	704.14	.000
Posttest	689.54	1	668.36	162.4	.000
Groups	2653.25	2	1224.43	188.42	.000
Error	3049.08	180	3.80		
Total	284765.00	183			
Corrected Total	24031.59	182			

Table 6 shows that the F-value for the groups was 188.2 with a significance level of  $P=.000$ . This indicates that the null hypothesis is rejected because the difference in the retention test mean scores between the groups was significant at the .05 level of significance ( $.05 > .00$ ). There is a significant difference in the mean retention scores of students taught using the IGBLM strategy and the conventional method

### **Discussion of the findings**

The results of the mathematics achievement test show that IGBLM strategies improve students' educational outcomes in mathematics compared with those taught using the conventional approach, as the mean gain for students taught through IGBLM methods surpassed that of students taught using the conventional approach. This aligns with the assertion of (Okwudiba, 2021). The Integrated Group-Based Mastery Learning Model (IGBMLM) combines mastery learning with group-based strategies, creating a balanced instructional approach that supports both individual and collective learning.

In addition, the findings showed no significant difference in the mean achievement scores of male and female students when taught mathematics using IGBLM strategies. This finding indicates that the IGBLM approach is equally effective for both genders, suggesting that its cooperative and mastery-oriented features help to reduce gender disparities often observed in mathematics achievement (Akinsola & Olowojaiye, 2008; Johnson & Johnson, 2009). By providing opportunities for peer support, interactive problem-solving, and individualized remediation within groups, IGBLM allows all students, regardless of gender, to engage meaningfully with mathematical content and achieve mastery. However, this finding contrasts with the results of Oladayo (2021), who examined the effects of mastery learning on students' achievement and retention in Social Studies among junior secondary school (JSS) students in Ikere Local Government Area, Ekiti State, Nigeria. Oladayo's study reported a significant effect of the treatment on students' achievement and retention based on gender. The study concluded that the application of the mastery learning model by teachers could substantially enhance students' achievement levels and retention.

Also, the study found a significant difference in the mean retention scores of students taught mathematics using IGBLM and those taught using conventional methods. This result indicates that IGBLM not only improves immediate achievement but also enhances long-term retention of mathematical concepts. The retention advantage can be explained by the model's emphasis on active learning, frequent formative assessment, and peer teaching, which reinforce understanding and facilitate recall (Guskey, 2010; Slavin, 2014). This finding aligns with existing literature demonstrating that mastery-based instructional approaches lead to higher retention rates compared to traditional, teacher-centered methods (Njoku, 2019; Amalia, 2018).

The findings of this study indicated a significant difference in the mean retention scores of. Students were taught using the IGBLM strategy and those taught using the conventional approach. This aligns with the assertion of Oladayo (2021), who investigated the effects of mastery learning on students' achievement and retention in Social Studies in junior secondary schools (JSS) in Ikere Local Government Area, Ekiti State, Nigeria. The result of the study showed that there was a significant effect of treatment (IGBLM) on Social Studies students' achievement. The study concluded that students' achievement level and retention will greatly increase if teachers apply the mastery learning model.

### **Conclusion**

Based on the findings from the study, it can be concluded that the Integrated Group-Based Mastery Learning Model (IGBLM) enhances students' achievement in mathematics. Also, the study reveals no significant difference in the mean achievement scores of male and female students taught mathematics using IGBLM strategies. It can be concluded that IGBLM is effective in boosting students' retention ability in mathematics compared to those taught with conventional methods.

## Recommendation

The study recommended that:

1. Mathematics teachers should employ interactive methods such as mastery learning and group learning frequently in the teaching of mathematics.
2. Seminars/workshops should be organised regularly to update mathematics teachers' knowledge on the use of various learner-centered methods to enhance learners' performance
3. The government, school owners, and stakeholders in education make available the necessary resources that can enhance active learning of mathematics

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