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Research Article

Effect of Improvised Instructional Materials on Students' Academic Achievement in Mathematics in Bayelsa State, Nigeria

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Abstract
This study examined the effect of improvised instructional materials on students' academic achievement in mathematics. The purpose of this study geared towards determining the impact of improvised instructional materials on students' academic achievement in mathematics. The study was directed by two research questions and two hypotheses. Determining the effect of improvised instructional materials on junior secondary school (JSS) students' academic achievement in mathematics and investigate the effect of improvised instructional materials on the academic achievement of students in mathematics to gender. Quasi-experimental design was employed in this study. The population included 1,546 JSS II students from 34 public secondary schools in Ogbia Local Government Area, Bayelsa State, with a sample of 80 students selected through simple random sampling from two schools, one serving as the experimental group and the other as the control group. Each group consisted of 40 students (22 males and 18 females). The Mathematics Achievement Test (MAT), developed by the researcher, was used as the research instrument, and a test-retest procedure established its reliability at 0.77 using Pearson Product Moment Correlation Coefficient (PPMCC). Mean and standard deviation were used to answer the research questions and t-test analysis applied to test the null hypotheses at a 0.05 significance level. The findings indicated a significant difference in the academic achievement of mathematics students, suggesting that improvised instructional materials were a more effective learning method in contrast to the traditional method. This implies that improvised instructional material plays a vital role in improving mathematics students' academic achievement. Therefore, it was recommended that mathematics teachers incorporate improvised materials in their teaching and that the government provide funding to support this initiative.

Keywords: Academic Achievement, Gender, Improvised Instructional Materials, Mathematics

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1. INTRODUCTION

Mathematics is a crucial component of education worldwide, and in Nigeria, it is required from early schooling through higher education. It significantly impacts daily life and is essential for advancing through different educational levels in the country. Its importance is underscored by the necessity for it in post-secondary education (Anibueze, 2017). Mathematics is key in fields like science, technology, and industry, focusing on developing students' logical reasoning and readiness for higher learning. The curriculum aims to cultivate scientific skills and attitudes that help students tackle real-world issues (Okori & Jerry, 2017). Usman and Nwoye (2010) emphasize that it underpins many academic disciplines, shaping various aspects of human activity. This importance is affirmed by Nigeria's National Policy on Education, which classifies mathematics as a core subject in primary and secondary education (Federal Republic of Nigeria (FRN), 2014), highlighting its role in everyday life, business, scientific progress, problem-solving, and decision-making.

The challenge of learning mathematics remains a significant concern, attracting research attention (Pasha et al., 2012). Many students come into math classes with the belief that the subject is challenging and abstract, making it hard to grasp (Njoku, 2010). Unfortunately, numerous students struggle and perform poorly in external exams. Despite recognizing its importance, teachers strive to employ effective teaching strategies, often lacking necessary instructional materials due to inadequate funding for education. Consequently, improvisation has emerged as a solution, allowing for the creation of handmade or locally sourced materials.

Improvisation involves using locally created materials by teachers, students, or educational agencies as substitutes for standard equipment in times of need (Omiko, 2015). According to George and Amadi (2016), it refers to instructors' ability to develop suitable and relevant resources when ready-made materials are unavailable or inappropriate for instructional goals. This practice becomes essential in situations where resources and facilities are limited (Okori & Jerry, 2017). Improvisation allows educators to utilize available materials effectively to achieve educational objectives, providing alternatives in resource-scarce environments. It involves substituting learning materials to enhance the learning experience. In mathematics instruction, using improvised materials fosters an engaging classroom environment and enhances understanding by providing hands-on learning experiences that are memorable. Additionally, these materials support individualized learning, enabling students to pursue self-directed study in mathematics.

Academic achievement refers to the progress made in acquiring educational skills, knowledge, and materials across various disciplines, focusing specifically on performance in academic settings rather than general knowledge (Bolt, 2011). It reflects how well individuals meet specific educational goals in schools, colleges, and universities. For students, academic achievement is often measured by their scores and overall progress. Effective learning requires active student engagement in the teaching process. However, it is concerning that student performance has been declining annually, which could hinder the country's economic and technological development if the trend continues.

The use of instructional materials greatly influences students' performance in mathematics. Researchers have long been concerned about the influence of gender on academic achievement, but consistent results have been elusive. The gender gap in mathematics has been a topic of interest for decades and, while it has narrowed in some areas, it remains relevant, particularly in higher grades (Stoet & Geary, 2012). Lee (2011) discovered that notable gaps exist between boys and girls in multi-child families, but not in single-child families, indicating that the one-child policy may promote educational development. Further studies reveal that boys often perform better in mathematics and use more surface-level learning strategies, while girls typically achieve lower results and display a stronger dislike for the subject (Lubienski & Ganley, 2017).

1.1. Statement of the Problem

The lack of instructional materials adversely affects students' academic achievement in mathematics. Without adequate visual aids, hands-on resources, and interactive tools, students often find it difficult to understand abstract concepts, resulting in poor performance. Given that mathematics requires a certain level of technical skill, relying solely on traditional teaching methods may exacerbate existing low performance levels. However, implementing strategies that are tailored to the specific educational environment can improve classroom interaction in mathematics. Thus, this study seeks to explore how improvised instructional materials affect the academic performance of Junior Secondary School students in mathematics.

1.2. Objectives of the Study

The objectives of the study is to ascertain the effect of improvised instructional materials on Junior Secondary School students' academic achievement in mathematics. The study specifically intends to:

1. determine the effect of improvised instructional materials on Junior Secondary School students' academic achievement in mathematics.

2. investigate the effect of improvised instructional materials on the academic achievement of students in mathematics with respect to gender.

1.3. Research Questions

To guide this study, the following research questions will be addressed:

1. What is the effect of improvised instructional materials on the academic achievement of JSS2 students in mathematics?
2. What is the effect of improvised instructional materials on the academic achievement of male and female students in mathematics?

1.4. Hypotheses

In this study, the following hypotheses were tested:

H_{o1}: There is no significant difference in the academic achievement of students taught mathematics with improvised instructional materials and those taught without improvised instructional materials.

H_{o2}: There is no significant difference in the academic achievement scores of male and female students taught mathematics with improvised instructional materials.

2. METHODOLOGY

2.1. Research Design

This study utilizes a quasi-experimental design, which is similar to experimental designs but does not randomly assign participants to experimental and control groups.

2.2. Participants

This study was conducted in the Ogbia Local Government Area of Bayelsa State. Ogbia L.G.A is bounded by Yenagoa and Nembe. Its administrative headquarters is in Ogbia Town. The people of this area are the indigenous people of Bayelsa State in the Niger Delta region of Nigeria. Ogbia town is noted for its large deposit of crude oil as houses the first oil well in Nigeria.

The study's population comprises 1,546 JSSII students from 34 public secondary schools, as reported by the Bayelsa State Ministry of Education (Bayelsa-Emis, 2024). A sample of 80 JSSII students was selected from two of these schools using simple random sampling techniques, with one class designated as the experimental group and the other as the control group. The experimental group included 40 students (22 males and 18 females) who were randomly selected and taught mathematics with improvised instructional materials, while the control group also had 40 students taught using traditional lecture methods.

2.3. Instruments

Data collection involved a Mathematics Achievement Test (MAT) with two sections: Section A gathered personal information, and Section B included 15 questions divided into three categories: mensuration, trigonometry, and geometry with five questions in each. These questions were derived from past Basic Education Certificate Examination (BAECE) papers (2010-2012) to evaluate learning outcomes from the interventions. The MAT was reviewed for validity by two experts: one in mathematics education and the other in measurement and evaluation.

A pilot study was carried out with 20 students from a different secondary school in Ogbia, who were not included in the main sample. The test-retest method was applied by administering the MAT to the same group twice, two weeks apart. The scores from both administrations were analyzed using the Pearson Product Moment Coefficient, resulting in a reliability index of .77.

2.4. Data Analysis

For data analysis, mean and standard deviation were used to address the research questions, while t-tests were performed to test the null hypotheses at a .05 significance level with SPSS V25.

3. RESULTS

Research Question 1: What is the effect of improvised instructional materials on academic achievement scores of JSSII students in mathematics?

Table 1. Mean Achievement Scores and Standard Deviations of Students Taught Mathematics With Improvised Instructional Materials and Those Taught Without Improvised Instructional Materials

Group	N	Pre-test		Post-test		Mean Gain
		Mean	SD	Mean	SD	
Experimental	40	7.35	1.67	10.83	1.81	3.48
Control	40	6.43	1.47	7.75	1.28	1.32

The result in Table 1 shows that the mean difference in students' achievement scores of those taught with improvised instructional materials are higher than those taught without improvised instructional materials because the gain in mean of 3.48 for the experimental group is greater than the 1.32 gain in mean for the control group.

H_{01}: There is no significant difference in the academic achievement scores of students taught mathematics with improvised instructional materials and those taught without improvised instructional materials.

Table 2. Summary of T-Test Analysis on the Mean Achievement Scores of Students Taught Mathematics With Improvised Instructional Materials and Those Without Improvised Instructional Materials

Group	N	Mean	SD	df	t	Sig(2tailed)	Decision
Experimental	40	10.83	1.81	78	8.78	.00	S
Control	40	7.75	1.28				

**significant at p<.05*

Table 2 above revealed that t (78) = 8.78 is significant at .00 and also significant at .05 level of significance. Therefore the null hypothesis is rejected which indicates that there is a significant difference between the mean achievement score of students taught mathematics with improvised instructional materials than those taught without.

Research Question 2: What is the effect of improvised instructional materials on the academic achievement scores of male and female students in mathematics?

Table 3. Mean Achievement Scores and Standard Deviations of Male and Female Students Taught Mathematics Using Improvised Instructional Materials

Gender	N	Pre-test		Post-test		Mean Gain
		Mean	SD	Mean	SD	
Male	22	8.09	1.41	11.68	1.52	3.59
Female	18	6.44	1.54	9.78	1.59	3.34

The result in Table 3 shows that the mean difference for male students' achievement scores of those taught with improvised instructional materials are slightly higher than those of their female counterpart with a mean of 11.68±1.52 for male and a mean of 9.78±1.59 for female. The mean gain of 3.59 for male and 3.34 for female which favours the male students.

H_{02}: There is no significant difference in the academic achievement of scores of male and female students taught mathematics with improvised instructional materials.

Table 4. Summary of T-Test Analysis on the Mean Achievement Scores of Male and Female Students Taught Mathematics Using Improvised Instructional Materials

Gender	N	Mean	SD	df	t	Sig(2tailed)	Decision
Male	22	11.68	1.52	38	3.85	.00	S
Female	18	9.78	1.59				

**significant at p<.05*

Table 4 above revealed that t (38) = 3.85 is significant at .00 and also significant at .05 level of significance. Therefore the null hypothesis is rejected which indicates that there is a significant difference between the mean achievement score of male and female students taught mathematics with improvised instructional materials.

4. DISCUSSION

The findings indicated that students taught mathematics with improvised instructional materials outperformed those who were not, demonstrating a positive effect on the use of improvised instructional materials. This was consistent with the study by Akpan and Mkpa (2015), which highlighted the impact of instructional materials on performance. They found that using relevant and interesting instructional materials significantly improved students' comprehension and memory of concepts, leading to better academic results. This result also aligns with the conclusions of Miciano (2019) and Brown and Thieman (2014), who also found significant effects on student performance resulting from the use of instructional materials. Their study concluded that well-designed instructional materials tailored to the curriculum and student needs could substantially improve learning outcomes.

Furthermore, the results showed that male students taught with improvised materials performed better than their female counterparts, revealing a notable gender difference in achievement. These findings align with Niemi and Osa (2018) and Akpan and Ekpe (2017), who noted similar trends in post-test scores. The findings indicated differences in the learning capabilities of boys and girls. It was observed that boys tended to lean more towards performance-oriented goals and utilized more surface-level learning techniques compared to girls. However, this contrasts with Akin (2020), who found minimal gender differences, suggesting that girls performed comparably or better than boys. This might be due to factors such as differences in the methodology, sample size, classroom environment and teaching quality of the study.

5. CONCLUSION AND LIMITATIONS OF THE STUDY

The findings of this study served as the basis for making the following conclusions:

1. The use of improvised instructional materials in teaching mathematics was effective compared to the conventional method of teaching mathematics.
2. The mean achievement scores of male students were higher than the female counterparts. This implies that there was a significant difference between male and female students in the use of improvised instructional materials.

The analysis indicated that using improvised instructional materials was more effective than traditional teaching methods. Additionally, a notable gender disparity emerged, with male students achieving higher mean scores than their female counterparts. This suggests a significant difference in academic performance between male and female students when using improvised instructional materials.

The generalization of this study has been limited by certain factors:

1. It is important to state that the sample size used was small. The researcher encountered some difficulties in reaching many schools due to money and time constraints and this limited the numbers of schools used for this study.

2. This study was limited to Ogbia Local Government Area of Bayelsa state. This might have given rise to the data gathering and conclusion drawn in this study.
3. The content scope was also limited to three topics (Mensuration, trigonometry and geometry) in mathematics. This is due to the short time frame of the study.

6. CONTRIBUTIONS OF THE STUDY TO KNOWLEDGE

Based on the findings of the study, there are a number of contributions to the body of knowledge. They are as follows:

1. The study established that the employment of improvised instructional materials in teaching can help in improving students' academic performance in mathematics in junior secondary school levels.
2. The improvised instructional materials could be used to improve the achievement of male and female students when taught mathematics.

7. RECOMMENDATIONS

Based on the findings of the study, the following recommendations are proposed:

1. Mathematics teachers should actively create and utilize improvised instructional materials to enhance the teaching and learning process in secondary schools.
2. The government should allocate funds to secondary school mathematics teachers to support the improvisation of instructional materials for effective teaching.
3. School administrators should encourage mathematics teachers to create and use relevant instructional materials during their lessons.
4. Curriculum planners should emphasize the significance of improvising instructional materials in teaching mathematics at the junior secondary school level.

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REFERENCES

Akin, R. T. (2020). Gender difference in mathematics. *Journal of Educational Psychology, 112*(2), 350-362.

Akpan, A. A., & Mkpa, M. A. (2015). Investigate the effect of instructional materials on students' achievement. *Educational Research International, 4*(1), 89-102.

Akpan, G. A., & Ekpe, E. A. (2017). Study on influence of ability and gender grouping on student achievement on the concept of redox reaction. *Chemistry Education Research and Practice, 18*(4), 712-726.

Anibueze, C. O. (2017). Improvisation of instructional materials for the functional teaching/learning of mathematics in Enugu North L.G.A in the 21st Century. *IMT International Journal of Arts and Science, 1*(1), 26-34.

Bolt, N. (2011). Academic achievement. In S. Goldstein, & J. A. Naghieri (Eds.), *Encyclopaedia of a child behaviour and development*. Springer. https://doi.org/10.1007/978.0.387-79061-9_20.

Brown, J. D., & Thieman, G. Y. (2014). The effect of instructional materials on students' performance. *Educational Technology Research and Development, 62*(3), 393-405.

Federal Republic of Nigeria (2014). *National Policy on Education* (Revised Edition). NERDC Press.

George, N., & Amadi, O. (2016). Improvisation skills possessed by mathematics teaching in junior secondary schools in Rivers State, Nigeria. *International Journal of Education Research. 4*(7), 35-48. https://doi.org/10-1007/s10834-001-9277-9.

Lee, M. H. (2011). The one child policy and gender equality in education in China: Evidence from household data. *Journal of Family and Economic Issues, 33*(1), 41-52.

Lubienski, S. T., & Ganley, C. M. (2017). Research on gender and mathematics. In J. Cai, (Ed.), *Compendium for research in mathematics education* (pp.649-666). National council of Teacher of mathematics.

Miciano, M. T. (2019). The use of instructional materials in improving academic performance in mathematics. *Journal of Mathematics Education, 8(*2), 150-165.

Niemi, A. C., & Osa, E. D. (2018). Gender difference in mathematics. *Gender and Education*, 30(4), 507-520.

Njoku, F. O. C. (2010). A search for unifying concepts, Destiny and change, Freedom and determinism in African philosophy. In I. E. Benjamin, (Ed.), *Philosophical Reflections on African issues*. Magnet Business Enterprise.

Okori, O. A., & Jerry, O. (2017). Improvisation and utilization of resources in the teaching and learning of science and mathematics in secondary schools in Cross River state. *Global Journal of Educational Research*, *16*(1), 21-28. https://doi.org/10.4314/gjedr.v16i1.4

Omiko, A. (2015). Laboratory teaching: Implication on students' achievement in chemistry in secondary schools in Ebonyi State of Nigeria. *Bulletin of Environment, Pharmacology and Life Sciences, 4*(12), 86-94.

Pasha, K., Rao, N. J., & Veerababu, P. (2012). Importance of mathematics laboratories in higher school level. *IOSR Journal of Mathematics (IOSRJM), 1*(4), 24-28.

Stoet, G., & Geary, D. C. (2012). Can stereotype threat explain the gender gap in mathematics performance and achievement? *Review of General Psychology, 16*(1), 93-102. https://doi.org/10.1037/a0626617

Usman, K. O., & Nwoye, M. N. (2010). Effect of graphical-symbol approach on the pupils' achievement in ratio at upper primary school level in Nsukka Central Local Government Area. *Journal of Mathematical Centre, Abuja, 1*(1), 123-132.