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Improvisation of Instructional Materials and its Effects on Students' Academic Achievement in Resource-Constrained STEM Classrooms in Owerri Municipal Secondary School, Imo State

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ABSTRACT

The study examined the effect of improvised instructional materials on students' academic achievement in Basic Science in resource-constrained STEM classrooms in Owerri Municipal Local Government Area of Imo State, Nigeria. Three objectives, three research questions and three hypotheses guided the study. A pretest–posttest, non-randomised quasi-experimental design involving experimental and control groups was adopted. A sample of 77 Junior Secondary School students was drawn from a population of 3,579 students in nine public secondary schools in Owerri Municipal. The instrument used for data collection was the validated STEM Performance Test in Basic Science (STEMPTBS), comprising 25 multiple-choice items. The instrument yielded a reliability coefficient of 0.83 using the Kuder–Richardson 21 formula. Students in the experimental group were taught Basic Science using improvised instructional materials, while those in the control group were taught without the use of improvised instructional materials. Data were analysed using mean, standard deviation and analysis of covariance (ANCOVA) at the 0.05 level of significance. The results showed that students taught with improvised instructional materials recorded a higher mean achievement gain (31.36) than those taught without them (10.00). ANCOVA revealed a statistically significant difference in achievement between the two groups, $F(1, 74) = 78.696$, $p < .001$, partial $\eta^2 = .515$. Although male students in the experimental group recorded a slightly higher mean gain (31.85) than female students (30.59), the difference was not statistically significant, $F(1, 41) = 0.000$, $p = .994$. Furthermore, the interaction between instructional strategy and gender was not statistically significant, $F(1, 72) = 0.991$, $p = .323$, partial $\eta^2 = .014$. The findings suggest that improvised instructional materials can enhance students' achievement in Basic Science without producing a significant gender-based differential effect. It was recommended that Basic Science teachers should integrate locally available and improvised instructional materials into classroom instruction, particularly in resource-constrained STEM learning environments.

Keywords: Improvisation, Instructional Materials, Students' Achievement, Resource-Constrained, STEM.

INTRODUCTION

Science, Technology, Engineering, and Mathematics (STEM) education has increasingly become a central focus of educational reform worldwide because of its critical role in driving innovation, economic development, and technological advancement (Halawa et al., 2024). Modern societies demand individuals who are not only knowledgeable but also able to solve complex, real-world problems through critical thinking, creativity, and the practical application of scientific knowledge (Songer et al., 2024). Consequently, educational systems face growing pressure to adopt teaching strategies that promote active learning, inquiry, and hands-on experiences rather than passive knowledge transmission.

However, in many developing countries, including Nigeria, the effective implementation of STEM education remains constrained by persistent challenges, particularly the lack of adequate instructional materials and laboratory facilities (UNESCO, 2022). In many secondary schools, science teaching remains largely theoretical, with limited opportunities for students to engage in practical activities that foster deeper understanding (Ebhomien, 2022). This disconnect between theoretical instruction and practical application has led to a learning gap, with students struggling to transfer classroom knowledge to real-world contexts, particularly in science subjects (Adeyemi, 2024).

The consequences of this gap are evident in students' poor academic achievement, low interest in science subjects, and limited development of essential scientific skills (Nzechie et al., 2025). Contemporary research emphasises that effective STEM education should involve instructional strategies such as inquiry-based learning, problem-based learning, and design-based learning, all of which require active student engagement and appropriate teaching resources (Halawa et al., 2024). However, in resource-constrained classrooms, the absence of standard laboratory equipment often makes it difficult for teachers to implement such learner-centred approaches effectively (UNESCO, 2022).

One practical and contextually relevant strategy for addressing this challenge is to improvise instructional materials. Instructional improvisation entails using locally available resources to create teaching aids that can substitute for standard scientific equipment (Ebhomien, 2022). This approach is particularly important in settings where financial and infrastructural constraints limit access to conventional teaching materials (Dave-Ugwu, Chukwunwogo; Onah, Anieke, & Ali 2025). Improvisation not only offers an alternative way to demonstrate scientific concepts but also fosters creativity, innovation, and contextualised learning (Adeyemi, 2024).

Recent empirical studies highlight improvisation as a viable strategy for enhancing teaching and learning in science education. For instance, improvised instructional materials have been shown to improve students' engagement, understanding, and retention of scientific concepts by providing opportunities for hands-on learning and experimentation (Adeyemi, 2024). Similarly, Nzechie et al. (2025) found that students taught with improvised materials performed significantly better than those taught with conventional methods, particularly in Basic Science and Technology.

Beyond addressing resource constraints, improvisation also aligns with contemporary views on effective STEM pedagogy. Modern STEM education emphasises interdisciplinary learning and real-world problem-solving, requiring students to actively construct knowledge through experience and interaction (Songer et al., 2024). Improvised materials, often drawn from students' immediate environment, make learning more meaningful and relatable, thereby enhancing conceptual understanding (Dave-Ugwu et al., 2025).

Despite these advantages, the implementation of instructional improvisation in many classrooms remains limited. Studies have shown that many teachers lack the necessary skills, training, or confidence to effectively design and utilise improvised materials (Dave-Ugwu et al., 2025). In some cases, teachers perceive improvisation as time-consuming or less effective than standard laboratory equipment, thereby limiting its adoption (Ebhomien, 2022). Furthermore, curriculum structures and assessment practices often emphasise theoretical knowledge over practical skills, discouraging the use of innovative teaching approaches (UNESCO, 2022).

The persistence of these challenges raises important questions about the effectiveness of current teaching practices and the need for pedagogical innovation in STEM education. Although policy frameworks advocate inquiry-based and activity-oriented learning, a significant gap remains between policy intentions and classroom realities (Halawa et al., 2024). Addressing this gap requires not only improved access to resources but also a shift in teaching philosophy towards more flexible, creative, and learner-centred approaches (Songer et al., 2024).

This study is grounded in Constructivist Learning Theory, which holds that learners actively construct knowledge through interaction with their environment rather than passively receiving information (Songer et al., 2024). According to this theory, meaningful learning occurs when students engage in hands-on activities, experimentation, and problem-solving, enabling them to connect new knowledge with prior experiences (Halawa et al., 2024).

Constructivist theory emphasises that learning is most effective when it is student-centred and contextually relevant. Instructional improvisation supports this perspective by enabling active engagement and experiential learning, even in resource-constrained settings (Adeyemi, 2024). By using locally available materials, teachers can create learning experiences that are meaningful and accessible, thereby enhancing students' understanding and retention of scientific concepts (Ebhomien, 2022).

Furthermore, constructivism emphasises the importance of contextual learning, in which knowledge is linked to real-life experiences. Improvised instructional materials, derived from the local environment, enable students to relate scientific concepts to their everyday lives, thereby improving comprehension and motivation (Dave-Ugwu et al., 2025). Empirical evidence supports this view, indicating that instructional strategies that promote active engagement significantly improve students' academic achievement and problem-solving skills (Songer et al., 2024).

Synthesis of Literature and Research Gap

The literature reviewed shows that effective STEM education requires instructional strategies that promote active learning, inquiry, and practical engagement (Halawa et al., 2024). While the importance of instructional materials in enhancing student's, academic achievement is well established, there is growing recognition of improvisation as a cost-effective and contextually relevant alternative in resource-constrained settings (UNESCO, 2022).

Despite growing interest in instructional improvisation, several gaps remain. First, many existing studies are descriptive and lack rigorous experimental designs, limiting the strength of their conclusions (Nzechie et al., 2025). Second, there is insufficient empirical evidence specifically examining the effect of improvisation on students' achievement in STEM classrooms. Third, few studies integrate improvisation within a robust theoretical framework, such as constructivism.

This study addresses these gaps by employing a quasi-experimental design to examine the effect of improvising instructional materials on students' academic achievement in STEM classrooms. Grounding the study in constructivist learning theory provides both theoretical and empirical insights into how improvisation can enhance teaching and learning in resource-constrained environments.

In summary, the challenges facing STEM education in resource-constrained environments necessitate innovative and practical teaching strategies. Instructional improvisation offers a promising approach to enhancing students' academic achievement by promoting active engagement, contextual learning, and practical application of knowledge (Adeyemi, 2024).

By investigating the effect of improvisation on students' achievement, this study contributes to ongoing efforts to improve the quality and relevance of STEM education. It also provides evidence-based recommendations for educators, policymakers, and curriculum developers seeking to bridge the gap between theory and practice in science education.

Statement of Problem

Despite the growing global emphasis on Science, Technology, Engineering, and Mathematics (STEM) education as a driver of innovation and national development, students' academic achievement in science subjects in many developing countries, including Nigeria, remains persistently low. One of the major factors contributing to this challenge is the inadequate availability and utilisation of instructional materials in STEM classrooms. In many secondary schools, science teaching remains predominantly theoretical, with limited opportunities for practical engagement, experimentation, and hands-on learning.

This situation has created a significant gap between classroom instruction and the real-world application of scientific knowledge. Students often struggle to develop the critical thinking, problem-solving skills, and conceptual understanding necessary for meaningful learning. Consequently, many learners resort to rote memorisation, which undermines retention, interest, and overall performance in STEM subjects.

Although instructional improvisation has been widely recommended as a practical and cost-effective strategy for addressing resource shortages, its implementation in classrooms remains inconsistent and, in many cases, ineffective. A considerable number of teachers lack the requisite skills, training, and motivation to design and utilise improvised instructional materials effectively. In addition, there is a prevailing perception among some educators that improvised materials are inferior to standard laboratory equipment, further limiting their adoption.

Furthermore, although existing studies have highlighted the potential benefits of improvisation for teaching and learning, many are either descriptive or lack rigorous empirical designs. There is therefore insufficient evidence to conclusively determine the extent to which improvising instructional materials influences students' academic achievement, particularly in STEM classrooms in resource-constrained environments.

Given these challenges, there is a pressing need to empirically investigate the effectiveness of improvising instructional materials as a pedagogical strategy to improve students' achievement in STEM education. This study therefore seeks to address this gap by examining the effect of improvised instructional materials on students' academic performance, with a view to providing evidence-based recommendations to enhance teaching practices and learning outcomes in resource-constrained STEM classrooms.

Aim and Objectives of the Study

The aim of this study is to investigate the effect of improvising instructional materials on students' academic achievement in resource-constrained STEM classrooms.

Specifically, the study seeks to:

1. determine the effect of improvised instructional materials on students' academic achievement in STEM subjects.
2. ascertain the difference in the performance of the male and the female students taught Basic Science with improvised Instructional Materials.
3. ascertain Interaction effect between the teaching strategy (improvised instructional materials) and gender on students' academic achievement in STEM subjects (Basic Science).

Research Questions

The following research questions guide the study:

1. What is the effect of improvised instructional materials on students' academic achievement in STEM subjects?

2. What is the difference in the performance of the male and female students taught Basic Science with Improvised Instructional Materials?

3. What is the Interaction effect between the teaching Strategy (Improvised Instructional Materials) and gender on students' academic achievement in STEM subjects (Basic Science)?

Research Hypotheses

The following null hypotheses are formulated and were tested at 0.05 level of significance:

1. There is no significant difference in the mean achievement scores of students taught using improvised instructional materials and those taught using conventional methods.

2. There is no significant difference between the performance of the male and female students taught Basic Science with Instructional Materials.
3. There is no significant Interaction between the teaching strategy (Improvised Instructional Materials) and gender on students' academic achievement in STEM subjects (Basic Science).

Significance of the Study

This study is expected to benefit several stakeholders in the field of education:

Teachers: The findings provided teachers with practical insights into how improvising instructional materials can be effectively used to enhance teaching and improve students' learning outcomes. The study also encourages teachers to adopt more innovative and resourceful teaching strategies, especially in resource-constrained environments.

Students: Students benefited from improved teaching approaches that promote active participation, deepen understanding of scientific concepts, and increase interest in STEM subjects. The use of improvised materials is expected to make learning more engaging and meaningful.

Curriculum Planners: The study informed curriculum developers of the need to integrate improvisation strategies into STEM curricula, ensuring that teaching approaches are adaptable to varying resource conditions.

Educational Policymakers: The findings provided empirical evidence to support policies that promote resource utilization, teacher training in improvisation, and the adoption of cost-effective teaching strategies in schools.

Researchers: This study contributed to the existing literature on STEM education and instructional improvisation, serving as a reference for future research in related fields.

METHODOLOGY

To achieve the objective of the study, the following methods are used.

Research Design

The research design used was a pretest, posttest, non-randomised, and nonequivalent quasi-experimental design. The reason for using this design was that the investigation was carried out on students who are human and whose internal and external influences were not under the control of the researcher. The second reason for choosing this design was that this type of design does not involve randomisation of subjects, but rather intact classes were used. This design presented two groups. One group was tagged as the experimental group, while the other group was tagged as the control group.

Study Area

This study was carried out in Owerri Municipal Local Government Area of Imo State. The Local Government comprises nine (9) secondary schools, which include co-education and single sex's schools.

Population, Sample and Sampling Techniques

The population of this study comprised the entire junior secondary school two students from the Nine (9) secondary schools in the Municipal Local Government Area of Imo State. Using a simple random technique, two (2) schools were selected. The participants were drawn from two intact JSS II classes in the selected schools. The relevant intact classes in the selected schools were identified and considered for participation in the study based on the established eligibility criteria. A total of 77 students participated in the study, comprising 44 students from School **N** and 33 students from School **W**. The use of intact classes was considered appropriate because the study adopted a pretest–posttest, non-randomised quasi-experimental design, in which individual students could not be randomly assigned to treatment conditions without disrupting the existing class structure.

One intact class was designated as the experimental group, while the other served as the control group. The experimental group, comprising 44 students, received instruction in Basic Science using improvised instructional materials, whereas the control group, comprising 33 students, received instruction on the same Basic Science content without such materials. The selection of schools and classes was guided by specific eligibility criteria. The selected schools were public junior secondary schools within the Owerri Municipal Local Government Area of Imo State, and the participating classes were at the appropriate junior secondary level for the study. In addition, the students were enrolled in Basic Science, and the selected classes were available to participate throughout the intervention period.

Research Instrument, Validity and Reliability of the Instrument

The instrument used to collect data was a validated STEM Performance Test on Basic Science (STEMPTBS) with twenty-five multiple-choice test items. A reliability coefficient of 0.83 was established for the instrument using the Kuder-Richardson 21 formula. The experimental group were taught Basic Science using improvised instructional materials, while the control group were taught without improvised instructional materials.

Intervention

The intervention covered two Basic Science topics: Plane Mirror: Verification of the Characteristics of the Image Formed by a Plane Mirror and the Law of Reflection, and Acids and Bases. It comprised eight lessons of approximately 40 minutes each, with four lessons devoted to each topic. Before the intervention, the researcher oriented the teacher to the objectives, content, use of improvised instructional materials, and procedures for implementing the lessons. For the experimental group, locally available materials such as mirrors or polished glass, cardboard, drawing paper, rulers, pencils, protractors, pins, flat boards, plastic containers, water, lemon juice or vinegar, mild soap solution, and natural indicators were used. Students actively participated in practical activities, including observing image formation, measuring angles of incidence and reflection, testing substances for acidic and basic properties, recording observations, discussing findings, and drawing conclusions. The teacher served as a facilitator, providing guidance, asking questions, monitoring activities, and relating students' observations to the relevant Basic Science concepts.

The control group was taught the same topics for the same number and duration of lessons, but without improvised instructional materials. Instruction involved teacher explanations, the presentation of relevant examples, questioning, classroom discussion, and evaluation of students' understanding. To minimise the influence of extraneous variables, both groups received the same content, instructional time, learning objectives, and assessment procedures. The same achievement test was administered to both groups as a pre-test before the intervention and as a post-test after the intervention. The researcher monitored lesson implementation to ensure adherence to the prescribed procedures, while the teacher delivered instruction in both groups. Thus, the principal difference between the two groups was the use of improvised instructional materials and associated practical activities in the experimental group.

Method of Data Analysis

Analysis was done using mean, standard deviation and analysis of covariance (ANCOVA) at 0.05 significant level using SPSS (Statistical Package for Social Science version 25).

RESULTS AND DISCUSSION

Research Question 1: What is the difference in the performance of students taught Basic Science with and without Instructional Materials?

Table 1: Mean and standard deviation on the performance of students taught Basic Science with and without improvised Instructional Materials

		Pretest		Post-test		Performance Gain
Group	**N**	**Mean**	**S.D**	**Mean**	**SD**	**Mean**
With Improvised Instructional Materials	44	39.32	20.33	70.68	13.45	31.36
Without improvised Instructional Materials	33	36.67	20.83	46.67	18.94	10.00

Table 1 showed that students who were taught Basic Science with improvised instructional materials in experimental group had a performance mean gain of 31.36 and those taught without improvised instructional materials in the control group had a mean gain of 10.00. The data analyzed on table 1 showed that students taught Basic Science with improvised instructional materials performed better than the students taught without improvised instructional materials.

Ho_1: There is no significant difference between the performance of students taught Basic Science with and without Improvised Instructional Materials.

Table 2: Summary of ANCOVA of Performance scores of students taught Basic Science using improvised Instructional Materials and those taught without improvised Instructional Materials.

Source	Type III Sum of Squares	Df	Mean Square	F	p-value
Corrected Model	21198.012[a]	2	10599.006	87.729	.000
Intercept	23241.218	1	23241.218	192.371	.000
PRETEST	10322.579	1	10322.579	85.441	.000
GROUP	9507.634	1	9507.634	78.696	.000
Error	8940.300	74	120.815		
Total	310950.000	77			
Corrected Total	30138.312	76			
a. R Squared = .703 (Adjusted R Squared = .695)					

Table 2 shows the summary of ANCOVA of Performance scores of students taught Basic Science using improvised Instructional Materials and those taught without improvised Instructional Materials. The result showed that there is a significant difference in the performance of students taught Basic Science using improvised instructional materials and those taught without improvised instructional materials ($F1, 74=78.696$, $p = .000 <.05$). The null hypothesis one, H_{O1} was rejected at 0.05 alpha level.

Research Question 2: What is the difference in the performance of the male and female students taught Basic Science with Improvised Instructional Materials?

Table 3: Mean and standard deviation on the performance of male and female students taught Basic Science with Improvised Instructional Materials

			Pretest		Posttest		Performance Gain
Group	**Gender**	**N**	**Mean**	**SD**	**Mean**	**SD**	**Mean**
With Improvised Instructional Materials	Male	27	38.52	18.34	70.37	14.07	31.85
	Female	17	40.59	23.71	71.18	12.81	30.59

Table 3 showed the mean and standard deviation on how the performance mean score of male and female students taught Basic Science using improvised instructional materials in the experimental group differ by gender. The data in table 3 revealed that the male students that were taught Basic Science using improvised instructional materials had a performance mean gain of 31.85 while the female students in the same group had a performance mean gain of 30.59. It is evident from table 3 that the male students who were taught Basic science using instructional materials out-performed their female counterpart in the same group.

H_{O2}: There is no significant difference between the performance of the male and female students taught Basic Science with Improvised Instructional Materials.

Table 4: Summary of ANCOVA on the difference in the performance of the male and the female students taught Basic Science with Improvised Instructional Materials

Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**p-value**
Corrected Model	2871.707[b]	2	1435.853	11.995	.000
Intercept	26844.254	1	26844.254	224.256	.000
PRETEST	2864.928	1	2864.928	23.934	.000
GENDER	.007	1	.007	.000	.994
Error	4907.839	41	119.703		
Total	227600.000	44			
Corrected Total	7779.545	43			
a. GROUP = Instructional Materials					
b. R Squared = .369 (Adjusted R Squared = .338)					

Table 4 shows the summary of ANCOVA on the difference which exists in the performance of the male and the female students who were taught basic science using instructional materials in the experimental group. The result showed that no significant difference exists in the performance of the male and the female students in the experimental group who were taught basic science using improvised instructional materials ($F_{1,41}$= 0.000, p = 0.994 >.05). H_{O2} was therefore retained at 0.05 alpha level.

Research Question 3: What is the Interaction effect between the teaching Strategy (Improvised Instructional Materials) and gender on students' academic achievement in STEM subjects (Basic Science)?

Table 5. Interaction effect between the teaching Strategy and gender on students' academic achievement in Basic Science.

Group	**Gender**	**N**	**Pretest**		**Post-test**		**Performance Gain Mean**
			Mean	**S.D**	**Mean**	**SD**	
With Improvised Instructional Materials	Male	27	38.52	18.34	70.37	14.07	31.85
	Female	17	40.59	23.71	71.18	12.81	30.59
	Total	44	39.32	20.33	70.68	13.45	31.36
Without improvised Instructional Materials	Male	20	35.75	17.71	44.25	16.16	8.5
	Female	13	28.08	25.62	50.38	22.77	22.3
	Total	33	36.67	20.83	46.67	18.94	10
Total	Male	47	37.34	17.93	59.25	19.75	21.91
	Female	30	39.5	24.15	62.17	20.37	22.67
	Total	77	38.42	21.04	60.39	20.06	21.97

Based on Table 5, it revealed that the experimental group has a mean gain of 31.36 while the male and female in the group has its gain as 31.85 and 30.59 respectively. The control group had 10.00 (male had 8.50, female had 22.30). In all (both experimental and control groups) had mean gain of 21.97. To determine whether this observed difference is statistically significant, H03 was tested. The results of the analysis testing H03 are presented in Table 6.

Ho3: There is no significant Interaction between the teaching strategy (Improvised Instructional Materials) and gender on students' academic achievement in STEM subjects (Basic Science).

Table 6. ANCOVA Summary of teaching strategy-gender interaction on students' academic achievement in Basic Science.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	21381.668[a]	4	5345.417	43.952	.000
Intercept	23118.421	1	23118.421	190.087	.000
PRETEST	10202.950	1	10202.950	83.892	.000
GROUP	8620.739	1	8620.739	70.883	.000
GENDER	88.304	1	88.304	.726	.397
GROUP * GENDER	120.548	1	120.548	.991	.323
Error	8756.644	72	121.620		
Total	310950.000	77			
Corrected Total	30138.312	76			

In Table 6, The Interaction effect between teaching strategy and gender on students' on students' academic achievement in Basic Science was not significant ($F_{(1,72)} = 0.991$, p-value=0.323 > 0.05). The teaching strategy used for the experimental group increase (enhance) students' (male & female) academic achievement. It shows that there was interaction effect between teaching strategy and Gender. Further statistical testing, as indicated in Table 6, indicated no significant interactions between gender and the instructional style on students' academic achievement ($F_{(1,72)} = 0.991$, p-value = 0.323 > 0.05) while learning Basic Science.

DISCUSSION OF FINDINGS

The performance of students taught with and without Improvised Instructional Materials

Table 1 showed that students who were taught basic science with improvised instructional materials in experimental group had a performance mean gain of 31.36 and those taught without improvised instructional materials in the control group had a mean gain of 10.00. The data analyzed on table 1 showed that students taught basic science with improvised instructional materials performed better than the students taught without improvised instructional materials. This finding is in agreement with the result of Abdu-Raheem (2016) which concluded that students who were taught with instructional materials performed better than those taught without; Adalikwu and Iorkpilgh (2013) which showed that students taught with instructional materials performed significantly better than those taught without instructional materials and also that the use of instructional materials generally improved students' understanding of concepts and led to high academic achievements. Arop, Umanah and Effiong (2015) showed that the use of instructional materials has a favorable effect on students' achievement in science concepts. Also, in agreement with this result is the research finding of Nwala (2021), Asrizal, Amran, Ananda and Festiyed (2019), Abdu-Raheem (2016) and Chong (2016). Musa and Umar (2023) revealed that when the applications of instructional resources are emphasized in schools, students perform better in mathematics. Instructional resources constitute a potent factor influencing the teaching and learning of mathematics in schools.

For instance, improvised instructional materials have been shown to improve students' engagement, understanding, and retention of scientific concepts by providing opportunities for hands-on learning and experimentation (Adeyemi, 2024).

When subjected to statistical analysis the result showed that there is a significant difference in the performance of students taught integrated science using instructional materials and those taught without instructional materials (F1, 74=78.696, p = .000 <.05). The null hypothesis one, H_{O1} was rejected at 0.05 alpha level. This agrees with the research evidence of Nzechie et al. (2025) who found that students taught with improvised materials performed significantly better than those taught with conventional methods, particularly in Basic Science and Technology; Nwala (2021), who revealed that difference between the performances of students taught Basic Science with and without learning resources was significant. Also, Olaniyan (2020) revealed that instructional materials significantly determine students' academic performance in the teaching and learning of Arabic studies. Yahaya (2018) findings revealed that there was significant difference in the effect of instructional materials on students' performance in Hausa language in senior secondary schools considered (p-value of 0.003 < 0.005).

Gender and the performance of students taught with Instructional Materials

Table 3 showed the mean and standard deviation on how the performance mean score of male and female students taught integrated science using improvised instructional materials in the experimental group differ by gender. The data in table 3 revealed that the male students that were taught basic science using improvised instructional materials had a performance mean gain of 31.85 while the female students in the same group had a performance mean gain of 30.59. It is evident from table 3 that the male students who were taught basic science using improvised instructional materials out-performed their female counterpart in the same group. The finding is inconsistent with result of Nwala (2021) who showed that the difference in the performance of the male (M= 78.09; SD=16.63) and the female (M = 84.46; SD=10.43) students taught Basic Science with learning resource was M=6.37; SD =6.20 in favour of the female students but consistent with that of Yahaya (2018) result that shows that the male students taught Hausa language using instructional materials had a better performance mean score than the female students taught with instructional materials in senior secondary schools in Kaduna State

Table 4 shows the summary of ANCOVA on the difference which exists in the performance of the male and the female students who were taught basic science using improvised instructional materials in the experimental group. The result showed that no significant difference exists in the performance of the male and the female students in the experimental group who were taught basic science using improvised instructional materials (F1, 41= 0.000, p = 0.994 >.05). H_{O2} was therefore retained at 0.05 alpha level. This finding is in consonance with that of Abdu-Raheem (2016) whose study also found that gender effect was not statistically significant in social studies; Nwala (2021) who revealed that gender difference was not significant and also debunked Arop, Umanah and Effiong (2015) whose result also indicated that there is a significant difference in the mean achievement scores of students with females having a higher mean score than males and Yahaya (2018) showed there was significant difference in the effect of instructional materials on the performance of male and female students (p-value of 0.000 < 0.005).

SUMMARY OF MAJOR FINDINGS

Analysis of the data generated at the end of the study based on the pretest and the post-test as executed showed that:

i. The data analyzed showed that students taught basic science with improvised instructional materials performed better than the students taught without improvised instructional materials.
ii. The result showed that there is a significant difference in the performance of students taught basic science using improvised instructional materials and those taught without improvised instructional materials.
iii. It is evident from the results that the male students who were taught basic science using improvised instructional materials out-performed their female counterpart in the same group.
iv. The result showed that no significant difference exists in the performance of the male and the female students in the experimental group who were taught basic science using improvised instructional materials.

CONCLUSION

Based on the findings of the study, it was concluded that Improvisation of Instructional Materials in Resource-Constrained STEM Classrooms enhanced the performance of students in STEM Classrooms. However, the use of improvised instructional materials did not have any statistically significant difference on the performance of the male and female students in STEM Classrooms.

RECOMMENDATIONS

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

1. STEM teachers should integrate the use of improvised Instructional Materials to teach STEM subjects since it enhances teaching and learning (students' performance).
2. Students should accept and embrace the use of instructional materials to improve their understanding of STEM Subjects.
3. STEM teachers should embrace the use of instructional materials to teach STEM Subjects concepts because it has proven not to be gender biased with respect to performance.

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