2026 Volume: 02 Issue: 08 www.ijrpa.com ISSN 2456-9995 Research Article

International Journal Research Publication Analysis

Page: 01-18

IMPACT OF IMPROVISATION OF INSTRUCTIONAL MATERIALS ON TEACHING AND LEARNING OF SCIENCE

***Usman Shehu**

Department of Science Education Zamfara State University, Talata Mafara.

Article Received: 01 July 2026
Article Revised: 21 July 2026
Published on: 08 August 2026

***Corresponding Author: Usman Shehu**
Department of Science Education Zamfara State University, Talata Mafara.

DOI: https://doi-doi.org/101555/ijrpa.9683

ABSTRACT

This study evaluated the impact of improvised instructional materials on some selected secondary school students' academic achievement in Sciences. A quasi-experimental pretest-posttest design involved 120 students, divided into experimental (60) and control (60) groups. Data was collected using a Science Achievement Test and a Students' Perception Questionnaire. Results showed that the experimental group scored significantly higher post-intervention (M = 31.92) compared to the control group (M = 25.00), with statistical tests indicating significant improvements and a large effect size. Students reported moderately positive perceptions of improvised materials (M = 3.27). The study concluded that these materials enhance academic achievement and recommended training for science teachers to incorporate them into teaching to improve learning outcomes.

KEYWORDS: Instructional Materials, Teaching, Learning, Science.

1. INTRODUCTION

Science education is crucial for fostering technological advancement, innovation, and sustainable development. Effective teaching relies on instructional materials that allow students to engage with scientific concepts practically. However, many schools, especially in developing countries, struggle with a lack of standard laboratory equipment and resources due to funding issues. As a result, teachers often improvise with locally available, low-cost materials to support meaningful learning experiences. Sempala et al. (2003). Improvisation of instructional materials involves designing and adapting teaching aids using locally available resources to meet learning objectives. This method allows teachers to utilize materials from their environment instead of relying on costly equipment, thereby improving resourcefulness, learner engagement, creativity, and comprehension of scientific concepts. Egbodo (2019).The use of improvised instructional materials in science education enhances active learning, boosts student motivation, and improves retention of knowledge. Research indicates that students using these materials achieve higher engagement and understanding compared to conventional lecture methods. Additionally, improvisation allows teachers to connect abstract concepts to familiar materials, making lessons more meaningful and relevant. Adeyemi (2024). Despite the benefits of improvising instructional materials in science education, challenges such as inadequate teacher training, limited preparation time, and lack of administrative support impede effectiveness. These hurdles can negatively affect students' academic performance. Therefore, investigating the impact of improvisation on teaching and learning is crucial for enhancing instructional practices and improving student achievement in science. Orji (2011)

1.1 Science Education and the Importance of STEM for National Development

Science education occupies a strategic position in the educational system of every nation because it provides learners with the knowledge, skills, and competencies required to solve societal problems and contribute to national development. Scientific knowledge underpins technological innovation, industrial growth, healthcare advancement, environmental sustainability, and economic competitiveness. Consequently, countries that prioritize science education are better positioned to develop a skilled workforce capable of addressing emerging global challenges. In recognition of this role, science has remained one of the core components of secondary school education in Nigeria and many other countries. The Federal Republic of Nigeria (2013) emphasizes that science education should promote scientific literacy, critical thinking, creativity, and problem-solving abilities among learners to facilitate sustainable national development. The growing demand for technological advancement led to the emergence of Science, Technology, Engineering, and Mathematics (STEM) education as an integrated instructional approach. STEM education was formally promoted by the United States National Science Foundation (NSF) in the early 2000s to increase students' participation in science-related careers, broaden opportunities for women and underrepresented groups, and improve scientific literacy among all learners (Hallinen, 2011). Rather than treating science, technology, engineering, and mathematics as isolated disciplines, STEM integrates these subjects to enable learners to apply scientific knowledge in solving real-life problems. According to Ibe et al. (2021), STEM education encourages interdisciplinary learning that equips students with practical competencies needed for personal, societal, and national development. Likewise, Tera (2018) observed that effective STEM education is learner-centred, culturally responsive, inquiry-driven, and characterized by problem-solving and hands-on learning experiences that actively engage students in scientific investigations.Science itself has been described as a systematic and logical process of acquiring knowledge about the natural world through observation, experimentation, and evidence-based reasoning (Dike, 2013). This definition underscores the importance of practical activities in science teaching and learning. Experimental work enables students to verify scientific principles, develop manipulative skills, and relate theoretical concepts to real-life situations. Nbina et al. (2010) argued that experimentation remains one of the most important activities in science education because it helps learners understand abstract concepts while simultaneously developing psychomotor and process skills. However, effective practical instruction depends largely on the availability of appropriate instructional materials and functional laboratories (Ogwo, 2014). Unfortunately, many secondary schools in Nigeria continue to experience shortages of laboratory equipment, instructional resources, and adequately equipped science laboratories, thereby limiting effective science instruction (Njoku, 2011; Odigie, 2011). To overcome these challenges, science teachers are encouraged to adopt innovative instructional strategies, including the improvisation of locally available teaching materials, to make science learning more meaningful and practical (Dike, 2013; Ibe, 2014).

1.2 Challenges Facing Science and Chemistry Teaching in Secondary Schools

Chemistry occupies a central position among the science subjects because it provides the foundational knowledge required for understanding biological, physical, environmental, medical, agricultural, and engineering sciences. As a core science discipline, chemistry contributes significantly to technological innovation, industrial production, healthcare advancement, and sustainable national development. Okeke and Nwadinigwe (2015) describe chemistry as the gateway to modern science and technology because it equips learners with scientific reasoning, analytical thinking, and practical problem-solving skills. Consequently, the Nigerian educational system places considerable emphasis on the teaching and learning of chemistry to prepare students for science-related careers and higher education. Despite its strategic importance, students' achievement in chemistry at the secondary school level has remained consistently below expectations, raising concerns among educators, curriculum developers, and policymakers (Uchegbu et al., 2015). Poor academic performance in chemistry has continued to affect students' progression into science-oriented professions, thereby limiting the country's capacity to develop the skilled workforce required for scientific and technological advancement.

Several interrelated factors have been identified as contributing to students' poor academic performance in chemistry. One major challenge is the predominance of teacher-centred instructional methods, which often emphasize memorization rather than conceptual understanding and practical application. Onasanya and Omosewo (2010) observed that ineffective teaching strategies, inadequate laboratory facilities, overcrowded classrooms, and insufficient instructional resources significantly reduce students' interest and achievement in chemistry. Similarly, Nnoli (2014) reported that the abstract nature of many chemistry concepts, coupled with learners' misconceptions, inadequate teacher preparation, and limited opportunities for practical activities, makes the subject difficult for many students. In many public secondary schools, poor funding has resulted in inadequate laboratory equipment, shortages of chemicals and apparatus, and poorly maintained science laboratories, thereby preventing teachers from conducting meaningful practical lessons (Ogwo, 2014). Consequently, classroom instruction frequently becomes theoretical, limiting students' opportunities to develop scientific process skills and relate classroom knowledge to real-life experiences.

Evidence from national examination bodies further demonstrates the persistent challenges facing chemistry education in Nigeria. Reports from the West African Examinations Council (WAEC) consistently indicate that students perform poorly in fundamental chemistry concepts such as acids, bases, acid-base reactions, stoichiometry, titration calculations, and quantitative analysis (WAEC, 2018). These reports attribute students' weak performance largely to inadequate practical exposure, poor understanding of laboratory procedures, and insufficient mastery of basic scientific concepts. Since many of these topics require experimental demonstration and hands-on learning experiences, the absence of appropriate instructional materials and functional laboratories significantly limits effective teaching and learning. Ibrahim (2012) therefore emphasized that laboratory activities remain indispensable for effective chemistry instruction because they enable students to observe scientific phenomena directly, verify theoretical concepts, and acquire essential experimental skills. Addressing these challenges requires innovative teaching approaches that promote active learning and maximize the use of available instructional resources, particularly in schools where conventional laboratory facilities are inadequate.

1.3 Objectives of the Study

The aim of this study was to investigate the impact of improvised instructional materials on students' academic achievement in Science in some selected secondary schools.

The study sought to:

1. Determine the difference between the pretest and posttest science achievement scores of students taught using improvised instructional materials.
2. Compare the posttest science achievement scores of students taught using improvised instructional materials and those taught using conventional instructional materials.
3. Determine the effect of improvised instructional materials on students' science achievement after controlling for their pretest achievement scores.
4. Examine students' perceptions of the use of improvised instructional materials for learning Science.

2. Literature Review

2.1 Concept of Instructional Materials in Science Education

Instructional materials are fundamental components of effective teaching and learning because they facilitate the communication of knowledge, promote active learner participation, and enhance students' understanding of complex concepts. They include all physical, visual, audio, audiovisual, and technological resources employed by teachers to simplify instruction and make learning more meaningful. Rather than relying solely on verbal explanations, instructional materials provide learners with concrete experiences that stimulate multiple senses, thereby improving comprehension, retention, and application of knowledge. Amos et al. (2022) emphasized that instructional materials transform abstract concepts into observable experiences, making classroom instruction more realistic, interesting, and learner-centred. Similarly, Abolade (2009) described instructional materials as educational resources deliberately selected and utilized to support the achievement of instructional objectives, while Ikerionwu (2000) noted that they serve as valuable teaching aids that enhance communication between teachers and learners. Their effective utilization therefore contributes significantly to improving the quality of classroom instruction across different subject areas.

In science education, the importance of instructional materials becomes even more pronounced because science emphasizes observation, experimentation, and practical application of theoretical concepts. Biology, like other science subjects, requires students to interact with living organisms, laboratory equipment, specimens, and scientific models to develop meaningful understanding of biological principles. Amos et al. (2022) observed that biology teaching becomes more effective when instructional materials are incorporated into classroom activities because they encourage inquiry, experimentation, and learner participation. Similarly, Ogbaji (2017) argued that instructional materials improve students' acquisition of factual knowledge and scientific skills by enabling them to relate classroom instruction to real-life experiences. In addition, Alabere (2017) maintained that appropriate instructional resources motivate learners, sustain their interest, and promote deeper understanding by appealing simultaneously to different learning styles and sensory experiences. Consequently, the effective integration of instructional materials into science classrooms enhances both teaching effectiveness and students' academic achievement.

Despite their educational benefits, many science teachers continue to experience challenges in accessing and utilizing instructional materials effectively. Amos et al. (2022) reported that inadequate instructional resources, inappropriate teaching methods, and limited teacher competence in improvising teaching materials contribute significantly to students' poor academic performance in biology practical lessons. Similar concerns were expressed by Kwarteng (2016), who noted that educational reforms often fail to produce the desired learning outcomes when teachers lack adequate instructional support and teaching resources. Consequently, many science concepts are taught theoretically rather than practically, limiting students' opportunities to develop scientific inquiry skills and conceptual understanding. These challenges underscore the need for greater investment in instructional resources and continuous professional development programmes that equip science teachers with the skills required to effectively utilize and improvise instructional materials.

2.2 Types and Classification of Instructional Materials

Instructional materials may be classified according to the sensory channels through which they communicate information or the instructional functions they perform. The major categories include visual materials, audio materials, audiovisual resources, graphic materials, realia, models, mock-ups, and projected media (Amos et al., 2022). Visual instructional materials include charts, diagrams, photographs, posters, specimens, flashcards, chalkboards, and illustrations that communicate information primarily through the sense of sight. Audio materials, on the other hand, include radio programmes, tape recorders, podcasts, and recorded instructional presentations that appeal to learners through hearing. Audiovisual materials integrate both visual and auditory elements and include television, educational videos, multimedia presentations, and digital learning platforms, thereby providing richer learning experiences than single-sense instructional resources.

Another important category consists of **realia**, which refers to authentic objects obtained directly from the natural environment for instructional purposes. Realia include plants, animals, rocks, insects, agricultural products, and laboratory specimens that provide learners with firsthand learning experiences. Amos et al. (2022) explained that realia stimulate students' curiosity and improve conceptual understanding because learners observe actual objects rather than pictures or verbal descriptions. Similarly, Kemp and Dayton (1998) emphasized that authentic instructional experiences enhance learners' motivation, increase retention, and strengthen practical skills. Graphic instructional materials, including charts, graphs, maps, diagrams, and posters, also simplify complex information by presenting relationships visually, thereby making abstract scientific concepts easier to understand (Wittich & Schuller, 1981).

Three-dimensional instructional materials such as models and mock-ups are equally important in science education because they represent objects that are either too large, too small, too dangerous, or inaccessible for direct classroom observation. Models of the human body, the solar system, plant cells, and molecular structures enable students to visualize concepts that cannot easily be observed directly. Similarly, projected instructional media such as overhead projectors, filmstrip projectors, digital projectors, educational videos, and computer-based presentations provide opportunities for interactive and collaborative learning. According to Amos et al. (2022), the combination of multiple instructional resources accommodates diverse learning styles, improves classroom interaction, and promotes meaningful learning by engaging learners through several sensory channels simultaneously.

2.3 Instructional Materials and Students' Academic Achievement

The effectiveness of instructional materials is reflected in their positive influence on students' academic achievement, classroom participation, motivation, and retention of knowledge. Numerous studies have demonstrated that learners perform better academically when instructional materials are effectively integrated into classroom teaching. Amos et al. (2022) found that instructional materials significantly enhance the teaching and learning of biology by making lessons more practical, stimulating learner interest, and improving students' conceptual understanding. Likewise, Onasanya and Omosewo (2011) reported that students taught using appropriate instructional materials achieved significantly higher academic performance than those taught through conventional lecture methods without adequate teaching resources. These findings suggest that instructional materials support learner-centred pedagogy by encouraging active participation, collaboration, and experiential learning.

The positive relationship between instructional materials and academic achievement is largely explained by the fact that instructional resources reduce the level of abstraction associated with science concepts. Biology, chemistry, and physics involve numerous theoretical ideas that become easier to understand when students observe demonstrations, manipulate specimens, or perform experiments. According to Eniayewu (2005), instructional materials provide learners with realistic experiences that improve comprehension, reinforce previous knowledge, and facilitate long-term retention. Similarly, Ogaga and Wallace (2016) concluded that effective utilization of instructional resources significantly improves students' learning outcomes because it creates meaningful interactions between teachers, learners, and instructional content. These interactions enhance critical thinking, creativity, and problem-solving abilities, all of which are essential competencies in science education.

Given the persistent shortage of standard laboratory facilities in many developing countries, the improvisation and effective utilization of locally available instructional materials remain viable strategies for improving science education. Teachers who creatively adapt available community resources can provide meaningful practical experiences even in resource-constrained environments. Amos et al. (2022) therefore recommended that educational institutions should strengthen teacher capacity in the selection, production, and utilization of instructional materials while governments should invest in improving instructional resource provision in schools. Such interventions would not only improve students' academic achievement but also promote scientific literacy, practical competence, and positive attitudes toward science learning.

3. METHODOLOGY

Data were analyzed using IBM SPSS Statistics version 26.0, employing descriptive statistics for demographics and science achievement scores. Baseline equivalence was checked with pretest statistics. The effectiveness of improvised instructional materials was evaluated using paired-samples t-test and independent-samples t-test. ANCOVA assessed the intervention's effect on posttest scores while controlling for pretests. Students' perceptions were analyzed using means and standard deviations based on a Likert scale, with internal consistency evaluated through Cronbach's alpha. All tests were conducted at a 95% confidence level, with significance at $p < 0.05$.

4.Data Presentation, and Analysis

Table 1: Demographic Characteristics and Study Group Distribution.

Variable	Category	Frequency (n)	Percentage (%)
Gender	**Male**	**68**	**56.7**
	Female	52	43.3
Age (Years)	**13**	**14**	**11.7**
	14	51	42.5
	15	42	35.0
	16	13	10.8
Study Group	**Experimental**	**60**	**50.0**
	Control	60	50.0
Total		120	100.0

Table 1 presents the demographic characteristics and study group distribution of the 120 respondents included in the study. Regarding gender, 68 respondents (56.7%) were male, while 52 respondents (43.3%) were female, indicating that both genders were adequately represented, with a slightly higher proportion of male participants. The age distribution shows that the majority of the respondents were between 14 and 15 years of age. Specifically, 51 respondents (42.5%) were 14 years old, while 42 respondents (35.0%) were 15 years old. Respondents aged 13 years accounted for 14 (11.7%), whereas those aged 16 years constituted 13 (10.8%). This distribution reflects the expected age range of students in the selected class level and suggests that the participants were relatively homogeneous in terms of age. With respect to the study groups, the respondents were evenly divided between the experimental and control groups, with each group comprising 60 students (50.0%). This equal allocation ensures balance in the research design, minimizes selection bias, and enhances the validity of comparisons between the two groups. Overall, the demographic characteristics indicate that the sample was appropriately distributed across gender, age, and study groups, providing a suitable basis for subsequent statistical analyses and interpretation of the study findings.

Table 2: Descriptive Statistics of Pretest and Posttest Science Achievement Scores by Study Group.

Test	Group	N	Mean	Std. Deviation	Minimum	Maximum
Pretest	**Experimental**	**60**	**17.85**	**3.91**	**8**	**26**
	Control	60	17.90	3.69	10	27
	Overall	120	17.88	3.79	8	27
Posttest	**Experimental**	**60**	**31.92**	**4.20**	**23**	**39**
	Control	60	25.00	4.27	13	34
	Overall	120	28.46	5.46	13	39

Table 2 presents the descriptive statistics of the respondents' science achievement scores at both the pretest and posttest stages for the experimental and control groups. The pretest results indicate that the two groups were comparable before the intervention. The experimental group recorded a mean score of 17.85 (SD = 3.91), while the control group had a slightly higher mean score of 17.90 (SD = 3.69). The negligible mean difference of only 0.05 points suggests that the participants possessed similar levels of science achievement at the beginning of the study. This similarity demonstrates baseline equivalence between the groups and reduces the likelihood that any subsequent differences in achievement could be attributed to initial academic disparities. The pretest scores also served as a covariate in the ANCOVA to statistically control for any minor baseline variations.

Following the instructional intervention, notable differences emerged in the posttest achievement scores. The experimental group obtained a mean score of 31.92 (SD = 4.20), whereas the control group recorded a mean score of 25.00 (SD = 4.27). This represents a mean difference of 6.92 points in favour of the experimental group. The higher posttest performance of the experimental group suggests that students exposed to improvised instructional materials demonstrated substantially greater improvement in science achievement than those who received conventional instruction. Although both groups showed progress from their pretest performance, the magnitude of improvement was considerably greater among students in the experimental group.

Table 3: Paired Samples Statistics for Experimental Group.

Measure	N	Mean	Std. Deviation	Std. Error Mean
Pretest	60	17.85	3.91	0.505
Posttest	60	31.92	4.20	0.543

The experimental group's mean increased from 17.85 at pretest to 31.92 at posttest, representing a mean gain of 14.07 points.

Table 4: Paired Samples Test for Experimental Group.

Pair	Mean Difference	Std. Deviation	Std. Error Mean	Df	T	Sig. (2-tailed)
Pretest – Posttest	-14.07	2.74	0.353	59	-39.821	< .001

The paired-samples t-test produced $t(59) = -39.821$, $p < .001$. Since p is below 0.05, the null hypothesis of no difference between experimental-group pretest and posttest achievement is rejected. The experimental group therefore showed a statistically significant improvement in Science achievement following exposure to improvised instructional materials.

4.1 Experimental–Control Independent Comparison

Table 5: Levene's Test and Independent Samples t-Test for Posttest Achievement.

Test	Statistic	df1/df	Sig.
Levene's test	0.046	1, 118	0.831
Independent-samples t-test	t = 8.945	118	< .001

Levene's test was non-significant, $F(1,118) = 0.046$, $p = 0.831$, supporting the equal-variance assumption. The independent-samples t-test showed a statistically significant difference in posttest achievement, $t(118) = 8.945$, $p < .001$. The experimental group had the higher mean (31.92) compared with the control group (25.00). This provides evidence of a meaningful difference in achievement between the two teaching conditions.

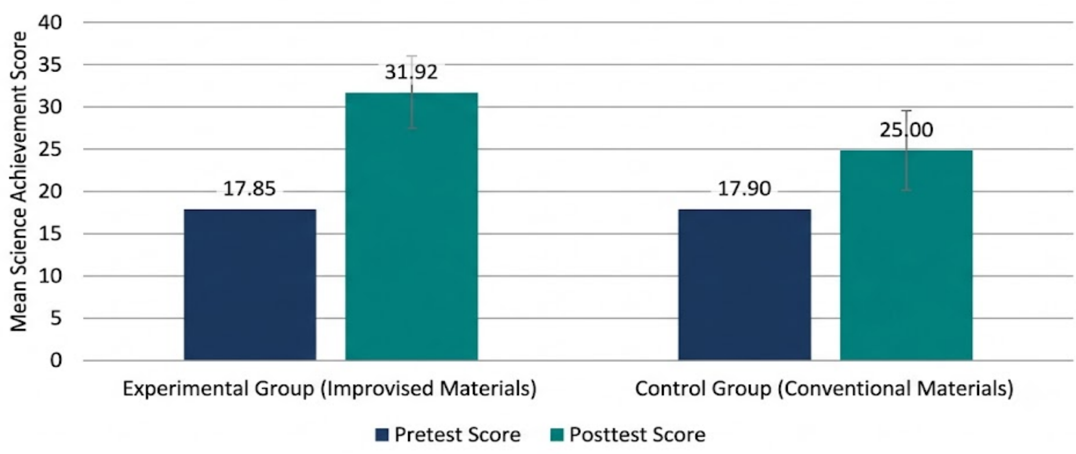

Figure 1: Chart represent Experimental–Control Independent Comparison.

4.1.1 Ancova for the main hypothesis

ANCOVA was used as the principal inferential procedure because it compares posttest achievement between the experimental and control groups while controlling statistically for pretest achievement. This is especially appropriate for a pretest–posttest quasi-experimental design.

Table 6: ANCOVA Model Summary.

Model	N	R	R Square	Adjusted R Square
1	120	0.873	0.763	0.759

The ANCOVA model yielded $R^2 = 0.763$, indicating that approximately 76.3% of the variance in posttest achievement was explained jointly by pretest achievement and group membership. The adjusted R^2 was 0.759, showing substantial explanatory power.

Table 7: ANCOVA Tests of Between-Subjects Effects.

Source	SS	Df	MS	F	Sig.
Pretest Score	1274.692	1	1274.692	177.147	< .001
Group	1453.142	1	1453.142	201.947	< .001
Error	841.892	117	7.196	—	—
Corrected Total	3569.725	119	—	—	—

Pretest achievement was a significant covariate, $F(1,117) = 177.147$, $p < .001$. More importantly, the effect of study group remained statistically significant after controlling for pretest achievement, $F(1,117) = 201.947$, $p < .001$. The partial eta squared for group was 0.633, representing a large effect under commonly used benchmarks. The result indicates that the teaching condition was strongly associated with posttest Science achievement beyond students' initial achievement levels.

Table 8: ANCOVA Parameter Estimates.

Parameter	B	Std. Error	T	Sig.
Constant	9.523	1.213	7.849	< .001
Experimental group	6.960	0.490	14.211	< .001
Pretest Score	0.865	0.065	13.310	< .001

Holding pretest achievement constant, students in the experimental group were estimated to score approximately 6.96 points higher on the posttest than students in the control group. The group coefficient was statistically significant ($t = 14.211$, $p < .001$), confirming that the adjusted group effect favoured improvised instructional materials.

4.2 Students' Perceptions of Improvised Instructional Materials

The perception questionnaire was administered to the 60 students in the experimental group. Items were rated on a five-point Likert scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, and 5 = Strongly Agree. For this sample interpretation, means below 2.50 indicate low/negative perception, 2.50–3.49 indicate moderate/positive perception, and 3.50–5.00 indicate high/strong positive perception.

Table 9: Mean and Standard Deviation of Students' Perceptions.

Perception Statement	Mean	SD	Interpretation
Improvised materials help me understand Science concepts.	3.22	0.67	Moderate/positive perception
Improvised materials increase my interest in Science.	3.33	0.77	Moderate/positive perception
Improvised materials encourage my participation.	3.13	0.83	Moderate/positive perception
Improvised materials make Science lessons interesting.	3.35	0.68	Moderate/positive perception
Improvised materials help me remember what I learn.	3.30	0.74	Moderate/positive perception
Improvised materials clarify difficult Science topics.	3.45	0.89	Moderate/positive perception
Improvised materials encourage practical learning.	3.20	0.73	Moderate/positive perception
Improvised materials make good use of local resources.	3.28	0.67	Moderate/positive perception
Improvised materials increase my motivation.	3.25	0.77	Moderate/positive perception
Improvised materials are useful for learning Science.	3.17	0.72	Moderate/positive perception
Overall perception	3.27	0.48	Moderate/positive perception

The above table indicates generally favourable perceptions of improvised instructional materials. The overall perception mean was 3.27 (SD = 0.48), which falls within the moderate/positive range. The highest-rated item concerned clarification of difficult Science topics (M = 3.45), while the lowest-rated item concerned encouragement of participation (M = 3.13). Although perceptions were not uniformly high, all item means were at least 3.13, suggesting an overall positive learner response.

4.3 Reliability of the Perception Questionnaire

Table 10: Reliability Statistics.

Instrument	Number of Items	Cronbach's Alpha
Perception Questionnaire	10	0.838

The questionnaire produced a Cronbach's alpha coefficient of 0.838. This exceeds the commonly used 0.70 benchmark and indicates good internal consistency among the ten perception items. The instrument can therefore be considered sufficiently reliable for measuring students' perceptions in this sample.

Table 11: Summary of Hypothesis Decisions.

Hypothesis	Statistical Result	Decision
H01: No significant difference between experimental pretest and posttest achievement.	$t(59) = -39.821$, $p < .001$	Reject H01
H02: No significant difference in posttest achievement between experimental and control groups after controlling for pretest.	$F(1,117) = 201.947$, $p < .001$	Reject H02
H03: No significant difference in experimental and control posttest achievement.	$t(118) = 8.945$, $p < .001$	Reject H03

At the 0.05 level of significance, all three achievement-related null hypotheses are rejected because their p-values are below 0.05. The results therefore indicate significant improvement within the experimental group and significant differences between the experimental and control groups. Objective 4 is descriptive in nature and does not require a hypothesis unless the approved research proposal specifically states an inferential hypothesis concerning perception. The analysis revealed five key findings: 1) Both experimental and control groups had similar pretest achievement; 2) The experimental group's score significantly improved from 17.85 to 31.92; 3) The posttest mean of the experimental group (31.92) exceeded that of the control group (25.00); 4) ANCOVA indicated a significant effect of the group after controlling for pretest scores, $F(1,117) = 201.947$, $p < .001$; 5) Students perceived improvised instructional materials positively, with a reliable perception questionnaire ($\alpha = 0.838$). Overall, the findings suggest that improvised materials are linked to improved Science achievement, although caution is advised due to the synthetic dataset and quasi-experimental design, necessitating further field observations for broader conclusions.

5. CONCLUSION

Based on the findings of this study, it is concluded that the use of improvised instructional materials has a significant positive effect on students' academic achievement in Science. The comparable pretest scores of the experimental and control groups confirmed that both groups had similar levels of academic ability before the intervention. However, after exposure to improvised instructional materials, students in the experimental group demonstrated a remarkable improvement in their academic performance compared with those taught using conventional instructional materials.

The study confirms that improvised instructional materials significantly enhance students' understanding of scientific concepts, with results remaining significant even after controlling for initial achievement levels. Students reported positive perceptions of these materials, noting improvements in participation, interest, simplicity of difficult concepts, practical learning, and motivation. Overall, the findings suggest that improvised instructional materials serve as an effective and practical alternative for improving science education, especially in resource-limited schools.

6. RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

1. Science teachers should routinely use improvised instructional materials to enhance student understanding and achievement.
2. School administrators need to support teachers with time, resources, and incentives for developing and using these materials.
3. Educational ministries should conduct workshops and professional development to equip teachers with skills for improvising instructional materials.
4. Teacher education programs should focus on practical training in producing and utilizing improvised materials in science methodology courses.
5. Government should provide policy support and funding for schools to create resource centers for developing effective instructional aids from local materials.
6. Students should be involved in designing and constructing these materials to foster creativity, problem-solving, and active engagement in science.

7. Contribution to Knowledge

This study contributes empirically by showing that improvised instructional materials enhance students' academic performance in Science more effectively than traditional methods. Methodologically, it employs a quasi-experimental design, using ANCOVA for rigorous evaluation. Practically, locally sourced materials can replace expensive resources without sacrificing learning outcomes, making education accessible. Policymakers are informed about the cost-effectiveness of improvisation in science education. Pedagogically, students not only excel academically but also develop positive attitudes towards science. Research-wise, it demonstrates a significant instructional effect, supporting future studies on teaching innovation.

REFERENCES

1. Abolade, A. O. (2009). Basic criteria for selecting and using learning and instructional materials. In I. O. Abimbola & A. O. Abolade (Eds.), *Fundamental principles and practices of instruction*. Olives Production Ltd.

2. Adeyemi, I. O. (2024). *Improvised science teaching materials: A tool for enhancing student engagement and understanding programs*. *Social Science and Educational Research Journal, 12*(2), 28–37. https://doi.org/10.5281/zenodo.17286190
3. Alabere, R. A. (2017). The importance of instructional materials in teaching English as a second language. *International Journal of Humanities and Social Science Invention, 6*(9), 36–44.
4. Amos, S., Eghan, M. P. K., & Oppong, E. (2022). The impact of instructional materials in teaching and learning of biology in the colleges of education in the Central Region of Ghana. *Open Journal of Educational Research, 2*, 400–411. https://doi.org/10.31586/ojer.2022.400
5. Dike, R. C. (2013). *Impact of substituting standard materials with local materials on chemistry achievement and interest of senior secondary school students in Imo State, Nigeria* (Unpublished doctoral dissertation). Nnamdi Azikiwe University.
6. Egbodo, B. A. (2019). *Improvisation and effective utilization of instructional materials in science education by student teachers*. https://doi.org/10.13140/RG.2.2.26131.12325
7. Eniayewu, J. (2005). Effect of instructional materials on teaching of economics in secondary schools in Akoko North-East Local Government Area of Ondo State. *Ikere Journal of Education, 7*, 117–120.
8. Federal Republic of Nigeria. (2013). *National policy on education* (6th ed.). Nigerian Educational Research and Development Council.
9. Hallinen, J. (2011). *STEM education*. Encyclopaedia Britannica. https://www.britannica.com/topic/STEM-education
10. Ibe, F. N., Obikezie, M. C., &Chikendu, R. E. (2021). Effect of improvised instructional materials on chemistry students' academic retention in secondary schools. *International Journal of Research in Educational Development, 1*(5), 19–31.
11. Ibrahim, A. (2012). *The role of the laboratory in the teaching of chemistry in Nigeria*. Poster paper presented at Kano State Polytechnic.
12. Ikerionwu, J. C. (2000). Importance of teaching aids and resources in classroom teaching. In A. M. Oyeneyin (Ed.), *Perspective of classroom teaching*. Martmonic Investment Ltd.
13. Kemp, J. E., & Dayton, D. K. (1998). *Planning and producing instructional media*. Harper & Row.

14. Kwarteng, J. T. (2016). Concerns of accounting teachers in implementing Ghana's 2007 education reform: Revisited. *International Online Journal of Education and Teaching, 3*(3), 212–216.
15. Nbina, J. B., Viko, B., &Birabil, S. T. (2010). Developing improvisation skills for alleviating poverty in Nigeria.
16. Njoku, Z. C. (2011). Engendering learning equity in science and technology classrooms for sustainable development. In *Proceedings of the 54th Annual Conference of the Science Teachers Association of Nigeria* (pp. 372–401). HEBN Publishers.
17. Nnoli, J. N. (2014). Teaching chemistry for creativity: The effect of the use of improvised organic reagents on students' achievement in chemistry. In Z. C. Njoku (Ed.), *Proceedings of the 55th Annual Conference of the Science Teachers Association of Nigeria* (pp. 265–270). HEBN Publishers.
18. Odigie, J. I. (2011). Women in biology education: Their improvisation ability in non-conducive working environment. In *Proceedings of the 46th Annual Conference of the Science Teachers Association of Nigeria* (pp. 280–288). HEBN Publishers.
19. Ogaga, A. G., & Wallace, I. (2016). Effects of instructional materials on the teaching and learning of social studies in secondary schools in Oju Local Government Area of Benue State. *International Journal of Current Research, 8*(7), 33859–33863.
20. Ogbaji, I. D. (2017). Teachers' perception of the utilization of instructional materials in teaching social studies in junior secondary schools in Calabar Municipality, Cross River State, Nigeria. *Global Journal of Educational Research, 16*, 95–100.
21. Ogwo, B. A. (2014). *Improvisation in teaching and learning*. Paper presented at the Train-the-Teacher Workshop organized by the Education Trust Fund and National Commission for Colleges of Education, Rivers State College of Education, Port Harcourt.
22. Okeke, P. N., &Nwadinigwe, C. A. (2015). *Physical sciences: Scope, career opportunities and contributions to national development*. Prince Jerryflex Global Resources.
23. Onasanya, B. I., &Omosewo, O. O. (2010). Effect of using standard instructional materials and improvised instructional materials on secondary school students' academic performance in physics in Ilorin, Nigeria.
24. Onasanya, S. A., &Omosewo, E. O. (2011). Effect of improvised and standard instructional materials on secondary school students' academic performance in physics in Ilorin, Nigeria. *Singapore Journal of Scientific Research, 1*(1), 68–76.

25. Orji, N. O. (2011). *Implications of improvisation of and use of instructional materials in science teaching*. https://doi.org/10.13140/RG.2.2.35344.48645
26. Sempala, F., & colleagues. (2003). Improvisation as a strategy for providing science teaching resources: An experience from Kenya. *International Journal of Educational Development, 23*(1), 75–84. https://doi.org/10.1016/S0738-0593(01)00054-2
27. Tera, G. M. (2018). The importance of physics classes for a career in STEM. *The Hechinger Report*. https://givingcompass.org/article/the-importance-of-physics-classesfor-a-career-in-stem/
28. Uchegbu, R. I., Anozieh, M. C., Mbadiugha, C. N., Ibe, C. O., & Njoku, P. C. (2015). Teachers' perception of the impediments to chemistry teaching in secondary schools in Imo State, Nigeria. *Open Science Journal of Education, 3*(5), 26–31.
29. West African Examinations Council. (2018). *Chief examiners' report on the West African Senior School Certificate Examination*. WAEC.
30. Wittich, W. A., & Schuller, C. F. (1981). *Instructional technology: Its nature and use*. Harper & Row.