



Impact of Instructional Materials on Achievement in ... Oguche, E. A. & Yahaya, R. E. (2026)

Impact of Instructional Materials on Achievement in Physics Concept among Secondary School Students in APA Local Government Area of Benue State, Nigeria,

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Abstract

This paper compared the impact of instructional materials on achievement in physics concept among secondary students in Apa LGA, Benue State. The study also compared the impact of instructional materials on male and female students in Physics. A quasi-experimental design was employed to compare learning outcomes between an experimental group and a control group. The study population consisted of 4,255 SS II students offering Physics in 15 public secondary schools, from which 165 students were randomly selected as participants. Instruction for the experimental group incorporated appropriate instructional materials, whereas the control group received instruction through traditional teaching methods without instructional support. Data were gathered using a Physics Achievement Test developed from previous West African Examinations Council examination items. The instrument was validated by specialists in Science Education and produced a reliability coefficient of 0.88. Statistical analysis of pretest and posttest scores was carried out using independent-samples t-test at the 0.05 level of significance. The findings showed that students taught with instructional materials demonstrated significantly higher academic achievement than those taught without them. The results further revealed that gender did not significantly influence the achievement of students exposed to instructional materials. The study concluded that the integration of instructional materials plays a critical role in improving students' understanding and achievement in Physics, regardless of gender. It was therefore recommended that Physics teachers consistently employ instructional materials to enhance classroom learning outcomes.

Keywords: Instructional materials; physics education; academic achievement; secondary schools

Introduction

Science represents a systematically organized body of knowledge, developed through careful observation, experimentation, and logical reasoning. It serves as a tool for solving problems, explaining natural phenomena, and improving human life. Ogunmola (2008) described science as a dynamic human activity that generates principles—laws, theories, and hypotheses—that explain events and enable predictions. Recognizing science's vital role in national development, the Federal Government of Nigeria, through the Federal Ministry of Education, has integrated science education into the national school curriculum. Science education extends beyond learning facts to include methods and strategies for effectively teaching and understanding scientific concepts. It also prepares students for careers in science, technology, engineering, and mathematics (STEM), fields that provide substantial professional opportunities (Eze, 2020). According to Okeke (2007), science education integrates content knowledge with effective instructional practices across subjects like Physics, Chemistry, and Biology. At the Senior Secondary School (SSS) level, Physics is a key subject that introduces learners to concepts of matter, energy, motion, and forces. The Nigerian Educational Research and Development Council (NERDC) emphasizes that the Physics curriculum aims to develop scientific skills, critical thinking, technological awareness, and readiness for further studies and STEM careers (Isola, 2010). Despite Physics' importance, students' performance in the subject is generally low in many Nigerian secondary schools. Factors contributing to this include the abstract nature of Physics concepts, ineffective teaching methods, insufficient laboratory facilities, and limited use of instructional materials (Yusuf, 2012). Concepts such as mechanics, electricity, and waves are particularly difficult when instruction relies solely on verbal explanations without supporting resources.

Instructional materials play a crucial role in Physics education by enhancing understanding, sustaining interest, and simplifying complex ideas. They include experiments, models, charts, and technological tools that convert theory into practical learning experiences. Research underscores their impact: Abubakar (2020) noted that instructional materials



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improve comprehension and examination performance, while Olaide (1990) emphasized that their effectiveness depends on teachers' competence. Oguche (2025) highlighted that visual and audio-visual aids promote active learning and facilitate teaching objectives. Kay (2008) also reported that instructional materials encourage learner-centered instruction, active participation, and engagement. Academic achievement, measured through examinations and tests, reflects how well learners attain instructional objectives (Daniel, 2021; Jafar, 2025). Studies indicate that effective use of instructional materials enhances motivation, reinforces retention, strengthens problem-solving skills, and improves Physics performance. Active engagement with these resources promotes deeper conceptual understanding and long-term knowledge retention. Nevertheless, many Physics students in Apa Local Government Area of Benue State continue to underperform, largely due to reliance on traditional lecture methods and minimal use of instructional materials. This approach hinders comprehension, diminishes interest, and lowers performance in both internal and external assessments. Considering the critical role of Physics in scientific literacy and technological advancement, this situation is a major concern for educators, parents, and policymakers. This study, therefore, examines the effect of instructional materials on the academic achievement of Physics students in Apa Local Government Area of Benue State. Its goal is to determine how effective utilization of instructional resources can improve understanding, retention, and overall performance in Physics.

Statement of the Research Problem

A major challenge confronting secondary education in Nigeria is the persistent low academic achievement of students in the sciences, particularly in Physics. In Apa Local Government Area of Benue State, many students continue to perform poorly in Physics, as reflected in both internal and external examinations. This trend undermines the development of scientific literacy and limits students' preparedness for careers in engineering, technology, and other science-related fields. Research suggests that inadequate use of instructional materials significantly contributes to poor student performance in Physics. Many classrooms lack sufficient teaching aids, laboratory equipment, and visual or practical resources to support effective learning. Additionally, some teachers rely heavily on traditional lecture methods, where students remain passive recipients of information, resulting in limited practical engagement and poor understanding of abstract concepts (Abdullahi, 2010; Atadoga & Lakpini, 2013). Large class sizes, limited time for experiments, and insufficient improvisation of instructional materials further exacerbate the problem. Consequently, students have minimal exposure to hands-on learning experiences that are essential for comprehension, retention, and problem-solving in Physics. Despite the recognized importance of instructional materials in enhancing academic achievement, their utilization in Physics classrooms in Apa remains inadequate. This study, therefore, seeks to investigate the effect of instructional materials on the academic achievement of Physics students in Apa Local Government Area, Benue State, with the aim of determining whether the use of such resources can improve understanding, retention, and overall performance in the subject.

Objectives of the Study

The study was guided by the following objectives:

1. To investigate the effect of using instructional materials on the academic achievement of Physics students in Apa Local Government Area, Benue State.
2. To determine whether there is a gender-related difference in academic achievement among students exposed to instructional materials in Physics.

Research Questions

The study sought to answer the following questions:

1. What are the mean achievement scores of students exposed to physics concept using instructional materials and those taught without instructional materials in Apa local government Area, Benue State?
2. What are the mean achievement scores of male and female students exposed to physics concept using instructional materials and those taught without instructional materials in Apa local government Area, Benue State?

Hypotheses

The following null hypotheses were formulated for testing at the 0.05 level of significance:

H₀₁: There is no significant difference between mean achievement scores of students exposed to physics concepts using instructional materials and those taught without instructional materials in Apa local government Area, Benue State?



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H₀₂: There is no significant difference between the mean achievement scores of male and female students exposed to physics concepts using instructional materials in Apa Local Government Area, Benue State?

Methodology

This study employed a quasi-experimental research approach using a pre-test and post-test control group design. The choice of this design was informed by its suitability for comparing the learning outcomes of students taught with instructional materials and those taught through traditional teaching methods, while maintaining the natural classroom setting without altering existing school arrangements. The design made it possible to ascertain the impact of instructional materials on students' academic achievement in Physics by examining differences in pre-test and post-test performance between the experimental and control groups. The research was carried out in Apa Local Government Area of Benue State, Nigeria. Apa is largely a rural area with public secondary schools where Physics is offered at the senior secondary level. The area was purposively selected due to persistent poor performance of students in Physics and the limited application of instructional materials during classroom instruction. The population for the study consisted of 4,255 Senior Secondary School II (SS II) Physics students drawn from 15 public secondary schools in Apa Local Government Area. SS II students were considered appropriate for the study because they had already been exposed to fundamental Physics concepts and were not yet preparing for external examinations, making them suitable for experimental investigation. A sample of 165 SS II Physics students was selected using a multi-stage sampling procedure. In the first stage, two public secondary schools were purposively chosen from the 15 schools to ensure the presence of qualified Physics teachers and the availability of basic instructional facilities. In the second stage, intact classes from the selected schools were randomly assigned to either the experimental or control group in order to minimize disruption to normal school activities. One intact class was designated as the experimental group, while the other served as the control group. The instrument used for data collection was the Physics Achievement Test (PAT). The PAT comprised 40 multiple-choice items adapted from past West African Examinations Council (WAEC) Physics questions and structured in line with the SS II Physics curriculum. The items covered the topics taught during the treatment period and were designed to assess students' conceptual understanding, application of knowledge, and problem-solving abilities in Physics. To establish the validity of the instrument, the PAT was subjected to face and content validation by specialists in Science Education and Measurement and Evaluation. The experts reviewed the items for clarity, relevance, alignment with the curriculum, and suitability of difficulty level. Their recommendations were incorporated before the final administration of the test. The reliability of the PAT was determined using the Kuder-Richardson Formula 20 (KR-20), which is appropriate for dichotomously scored items. A reliability coefficient of 0.88 was obtained, indicating a high level of internal consistency and reliability of the instrument. Before the treatment commenced, the PAT was administered as a pre-test to both the experimental and control groups to establish their initial level of academic achievement in Physics. The experimental group was subsequently taught selected Physics topics using instructional materials such as charts, models, real objects, laboratory equipment, and improvised teaching aids. Conversely, the control group received instruction on the same topics using the conventional lecture method without instructional materials. The treatment spanned a period of seven weeks, during which both groups were exposed to equal instructional time and taught by qualified Physics teachers using identical lesson objectives and content outlines. At the end of the treatment, a post-test, which was a rearranged version of the PAT, was administered to both groups to determine the effect of instructional materials on students' academic achievement in Physics. Data obtained from the pre-test and post-test were analyzed using descriptive statistics, including mean and standard deviation, to answer the research questions. The null hypotheses were tested using the independent samples t-test at the 0.05 level of significance. All statistical analyses were performed using the Statistical Package for the Social Sciences (IBM SPSS Version 26).

Presentation of Results

Research Question 1: What is the mean achievement scores of students exposed to physics concept using instructional materials and those taught without instructional materials in APA local government Area, Benue State?

Table1: Mean, Standard Deviation Statistics Post-test PAT scores for Students in Experimental and Control Groups



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Group	N	Mean	STD	Mean difference
Experimental	80	18.01	4.80	2.97
Control	85	15.04	3.80	

Source: Field Study, 2025

Table 1 indicates that the experimental group achieved a mean score of 18.01 with a standard deviation of 4.80, whereas the control group recorded a mean score of 15.04 and a standard deviation of 3.80. The observed mean difference of 2.97 suggests that students who were taught using instructional materials performed better than their counterparts who received conventional instruction.

Research Question 2: What is the mean achievement scores of male and female students exposed to physics concept using instructional materials and those taught without instructional materials in APa local government Area, Benue State?

Hypotheses

Table 2: Mean, Standard Deviation Statistics of Post test PAT scores for Male and Female Students in Experimental Group

Gender	N	Mean	STD	Mean difference
Male	44	18.40	3.90	0.41
Female	37	17.99	4.20	

Source: Field Study, 2025

Table 2 shows that male students in the experimental group achieved a mean score of 18.40 with a standard deviation of 3.90, while female students recorded a mean score of 17.99 with a standard deviation of 4.20. The mean difference of 0.41 indicates that both male and female students exhibited very similar levels of academic achievement when taught Physics using instructional materials.

H01: There is no significant difference between mean achievement scores of students exposed to physics concepts using instructional materials and those taught without instructional materials in APa local government Area, Benue State?

Table 3: t-test analysis of difference in the academic achievement of experimental and control groups.

Group	N	Mean	S.D	D.F	T-value	P-value	Remark
Experimental	80	18.01	4.80	163	8.05	0.003	Rejected
Control	85	15.04	3.80				

p<0.05

Table 3 presents a p-value of 0.003 with 163 degrees of freedom. Since this p-value is less than the 0.05 level of significance, it indicates a statistically significant difference in the mean achievement scores between secondary school Physics students taught using instructional materials and those taught the same concepts through the conventional lecture method.

H02: There is no significant difference between the mean achievement scores of male and female students exposed to physics concepts using instructional materials in APa Local Government Area, Benue State?

Table 4: t-test analysis of achievement between male and female students in Experimental group

Group	N	Mean	S.D	D.F	T-value	P-value	Remark
Male	44	18.40	3.90	78	0.43	0.91	Accepted
Female	37	17.99	4.20				



p<0.05

Table 4 indicates that male students achieved a mean score of 18.40 with a standard deviation of 3.90, while female students recorded a mean score of 17.99 and a standard deviation of 4.20. The mean difference of 0.41, together with a calculated t-value of 0.43 and a p-value of 0.91, suggests that there is no statistically significant difference in the academic achievement of male and female students taught Physics using instructional materials.

Discussion of Findings

The results presented in Tables 1 and 3 demonstrate a notable difference in the academic performance of students taught Physics using instructional materials compared to those taught through traditional lecture methods. This indicates that instructional resources have a pronounced positive impact on students' learning outcomes. These findings are consistent with previous research by Abdullahi (2010), Yusuf (2012), and Abubakar (2020), who reported that students exposed to instructional materials consistently achieved higher scores than their peers taught without such resources. Likewise, studies by Daniel (2021), Naki (2018), Apondi (2015), and Abdurraheem (2014) observed that the use of instructional aids enhances comprehension, simplifies complex concepts, and contributes to improved academic performance. A primary reason for this improvement is the multisensory engagement that instructional materials provide. By stimulating visual, auditory, and tactile senses, students can see, hear, and manipulate learning objects, thereby reinforcing understanding and long-term retention. Such multisensory experiences facilitate deeper cognitive processing, making learning more meaningful. From a constructivist standpoint, learners actively construct knowledge by connecting new information with prior understanding through hands-on interaction with instructional resources. Engaging both the mind and senses allows students to develop a more thorough conceptual understanding, encourages curiosity, and sustains motivation. By transforming abstract Physics concepts into concrete experiences, instructional materials make learning more interactive, enjoyable, and effective.

The findings in Tables 2 and 4 indicate no significant difference in the academic performance of male and female students taught using instructional materials. This suggests that both genders derive equal benefit from the use of these resources. These results align with those of Oguche and Yahaya (2026), Jafar et al. (2025), and Enohuan (2015), who established that gender does not significantly influence academic outcomes when instructional materials are integrated into teaching. The results underscore the inclusive nature of instructional materials, highlighting their ability to promote equity in learning achievements. These findings have several important implications. First, teacher education programs should include training on designing, selecting, and effectively using instructional materials. Educators need both pedagogical knowledge and technological skills to integrate these resources successfully into classroom practice. Second, education authorities should ensure adequate provision of high-quality, context-appropriate instructional materials to facilitate effective Physics teaching. Third, policymakers should formulate and implement guidelines that promote and standardize the use of instructional materials in schools, emphasizing innovation, inclusivity, and evidence-based teaching practices to enhance student outcomes. Despite these positive outcomes, the study has limitations. The intervention period was relatively brief, which may not capture the long-term effects of instructional materials on student achievement. Additionally, the sample size was limited, which restricts the generalizability of the findings to other populations or subjects beyond Physics. Future studies should consider longer intervention periods, larger and more diverse student samples, and other science disciplines to gain a more comprehensive understanding of the impact of instructional materials on learning. In summary, this study confirms that instructional materials significantly improve students' academic performance in Physics compared to conventional lecture methods, and that gender does not affect achievement when such resources are employed. The findings highlight the value of multisensory, constructivist approaches to teaching and emphasize the need for well-trained teachers, sufficient instructional resources, and supportive policies to ensure effective, inclusive, and engaging science education.

Conclusions

The study revealed that integrating instructional materials into Physics teaching at the Senior Secondary School level markedly enhances students' academic performance and information retention. Learners who engaged with instructional resources consistently outperformed their peers who experienced only traditional lecture-based instruction. Furthermore, the findings showed that gender does not significantly affect achievement when such materials are used, indicating that both male and female students benefit equally. These results suggest that instructional materials help clarify complex



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Physics concepts, make learning more engaging, and improve understanding and long-term retention. In summary, the study highlights the essential role of instructional materials in improving the quality of Physics education and fostering meaningful learning outcomes for all students.

Recommendations

Based on the findings, the following recommendations are made:

1. The Ministry of Education and school authorities in Benue state, particularly in the study area should ensure that secondary schools are adequately equipped with instructional materials to support effective teaching and learning in Physics.
2. Teachers should be trained and encouraged to integrate instructional materials into their teaching practices. This includes learning to improvise resources when standard materials are unavailable, as this learner-centered approach can enhance student interest, engagement, and academic performance.
3. Professional development programs should be organized to equip Physics teachers with skills in using and improvising both traditional and modern digital instructional tools
4. Subsequent studies should consider larger sample sizes, longer intervention periods, and the integration of modern digital instructional materials to provide a more comprehensive understanding of the long-term impact of instructional resources on students' achievement in Physics and other science subjects.

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