



Effectiveness of Computer-Assist (Maimalari, A. H. 2026) DOI: <https://doi.org/10.59479/jiaheri.v2i1.123>

Effectiveness of Computer-Assisted Instruction (CAI) on students' Learning Outcomes in Computer Studies

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Abstract

A quasi-experimental design was employed, involving 200 students randomly selected from both urban and rural schools. Data were collected using structured questionnaires and a standardized Computer Studies Achievement Test (CSAT). Findings revealed a statistically significant improvement in the performance of students exposed to CAI, irrespective of school location. The results underscore the potential of ICT-driven instruction in enhancing learning outcomes in secondary education, particularly in resource-constrained environments. A quasi-experimental design was employed, involving 200 students randomly selected from both urban and rural schools. Data were collected using structured questionnaires and a standardized Computer Studies Achievement Test (CSAT). Findings revealed a statistically significant improvement in the performance of students exposed to CAI, irrespective of school location. The chi-square test shows a significant relationship (p -value = 0.001) between the availability of Information and Communication Technology tools and students' academic performance. The study recommends broader integration of CAI tools in curriculum delivery and teacher training programs to foster digital competence and pedagogical innovation in Nigerian schools.

Keywords: Computer, Assisted Instruction, Students, Learning Outcomes

Introduction

Computer-Assisted Instruction (CAI) represents one of the most innovative educational strategies in the digital age. It involves using computers to deliver instruction, provide feedback, and assess learning. Through CAI, students can engage in interactive lessons, visual simulations, and self-paced exercises that strengthen comprehension and retention.

In secondary schools, particularly in Nigeria, CAI has been introduced as a supplement to conventional teaching methods in computer studies and other science-related subjects. However, its utilization remains limited due to infrastructural constraints and teachers' inadequate technological proficiency. Despite these challenges, evidence suggests that CAI significantly improves students' motivation, participation, and academic performance.

This study investigates the effectiveness of CAI on students' learning outcomes in computer studies, comparing its impact to that of traditional teaching methods.

in the context of secondary schools in Yobe State, Nigeria, it is crucial to evaluate how Information and Communication Technology tools influence students' academic performance in computer studies. Understanding the impact of Information and Communication Technology can help policymakers, educators, and stakeholders develop targeted interventions to enhance the quality of education and ensure that students are adequately prepared for the demands of a digital economy (Adebayo, 2023).



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Globally, the integration of ICT in education aims to enhance efficiency, improve students' engagement, and promote deeper understanding of concepts. In Nigeria, however, despite government policies promoting ICT adoption in schools, implementation remains inconsistent. Many secondary schools still rely heavily on traditional instructional methods, which limit students' exposure to digital learning environments. Consequently, the influence of ICT on students' academic performance has become an area of growing concern and research interest.

Significance of the Study

The study is relevant to education stakeholders as it highlights how CAI enhances students' cognitive, psychomotor, and affective learning outcomes. It provides data-driven evidence for educational planners to integrate CAI into the national curriculum. It helps teachers adopt learner-centered instructional methods. It empowers students to engage in independent and interactive learning environments.

Statement of the Problem

Traditional classroom teaching methods often limit student interaction, critical thinking, and practical exposure. Many schools lack sufficient resources and trained personnel to deliver engaging computer-based lessons. As a result, students' performance in computer studies remains below expectations. The absence of CAI integration also hinders students from developing self-learning and problem-solving skills. This study therefore examines whether the use of CAI can significantly improve academic performance and learner motivation.

Research Gap

While several studies have examined ICT in education, few have specifically focused on CAI's direct effect on academic performance in computer studies at the secondary school level. Most existing literature emphasizes theoretical aspects rather than empirical evidence. This study bridges that gap by conducting a comparative analysis of CAI-based and traditional instructional approaches.

Objectives of the Study

- i. To examine the effectiveness of CAI in improving students' performance in computer studies.
- ii. To compare learning outcomes of students taught with CAI and those taught using traditional methods.
- iii. To assess students' attitudes and motivation towards CAI-based learning.
- iv. To identify challenges associated with implementing CAI in schools.

Research Questions

1. Does CAI improve students' understanding and retention in computer studies?
2. How do students taught using CAI perform compared to those taught traditionally?
3. What are students' attitudes toward CAI-based learning?
4. What challenges limit the use of CAI in secondary schools?

Literature Review



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Despite the potential benefits of Information and Communication Technology in education, challenges such as limited access to infrastructure, inadequate funding, and a lack of digital literacy skills among students and teachers have hindered its full adoption in Nigerian secondary schools, particularly in rural areas such as Yobe State (Adebayo, 2023). Addressing these challenges requires a strategic approach involving all stakeholders in the education sector to ensure the sustainable integration of Information and Communication Technology into the curriculum.

However, the effectiveness of Information and Communication Technology in education depends on various factors, including students' digital literacy, teachers' competency in utilizing Information and Communication Technology tools, and the availability of reliable internet access and electricity (Eze, 2021). Inadequate funding and poor maintenance of Information and Communication Technology infrastructure have further exacerbated the digital divide, limiting the potential benefits of Information and Communication Technology in improving students' academic performance, particularly in rural areas such as Yobe State (Ogunniyi & Ojebisi, 2022).

Methodology

Research Design

The research design for this study is the two-by-two pre-test, post-test quasi-experimental control group. The quasi-experimental method involves the manipulation of one or more of the independent variables impacts of Information and Communication Technology on computer studies academic performance using computer-assisted instructions (A case study of SS2 students in Gashu'a educational zone, Yobe State, Nigeria. The pre-test-post-test equivalent group design involving four (4) cluster groups of intact classes having coeducational students was used.

Population

The population of the study comprises all senior secondary school students in year two (2) offering Computer studies in the Gashu'a Educational zone of Yobe State. Hence, the population comprises all year two (2) Senior Secondary School students offering Computer studies in some selected Public Secondary Schools of Gashu'a Educational zone in Yobe State which is one thousand, one hundred and nine students (1,179)

Yobe State which is made up of seventeen (17) Local Government Educational Areas (LGEAs) is divided into three (3) Educational Zones. The total population of Public Senior Secondary School two (2) students in Yobe State is twenty-three thousand four hundred and sixty students (23,460).



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Sample and Sampling Technique

A sample size of two hundred (200) students was drawn from the total population of one thousand, one hundred and nine students (1,179) Computer studies students in senior secondary schools two (2) in Gashu’a educational zone of Yobe State.

Methods of Data Analysis

The data collected for this study were analyzed using various statistical methods among which were summary statistics of means and standard deviations (descriptive statistics) used to answer the research questions.

Presentation of Data

Data collected from the respondents was presented in this section. The findings are categorized into different sections based on the research questions and variables of interest

- The study surveyed an equal number of male and female respondents (50% each).
- Most of the respondents are aged between 15 and 18 years (40%).
- A significant proportion of the students have received Information and Communication Technology training (60%).
- More respondents came from public schools (60%), indicating a wider representation of state-funded education.

1.1.Data Analysis

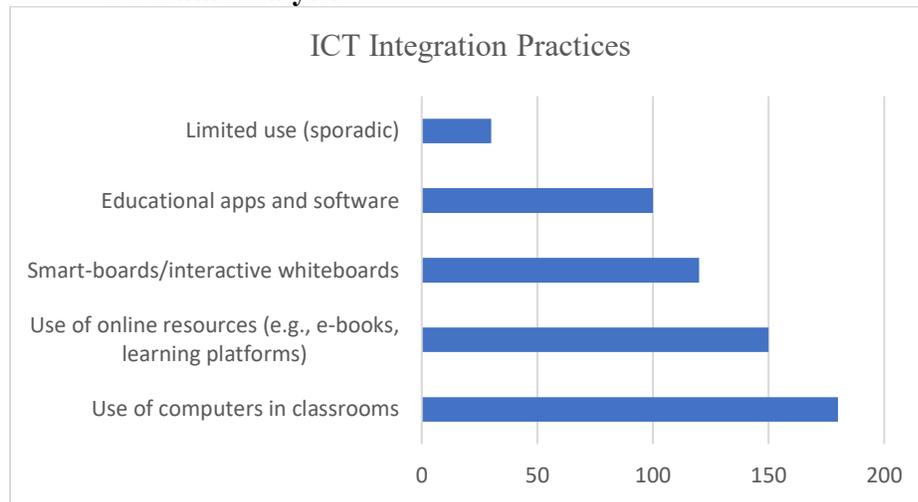


Fig 1. Information and Communication Technology Integration Practices

Source: field survey (2025)

The majority of respondents (90%) reported the use of computers in classrooms, suggesting that Information and Communication Technology tools are becoming a prominent feature in the learning environment. A high percentage (75%) also indicated the use of online resources, showing a positive trend toward the digitization of learning materials. The use of smart-boards (60%) and educational apps (50%) was relatively lower, highlighting areas where schools might improve infrastructure.



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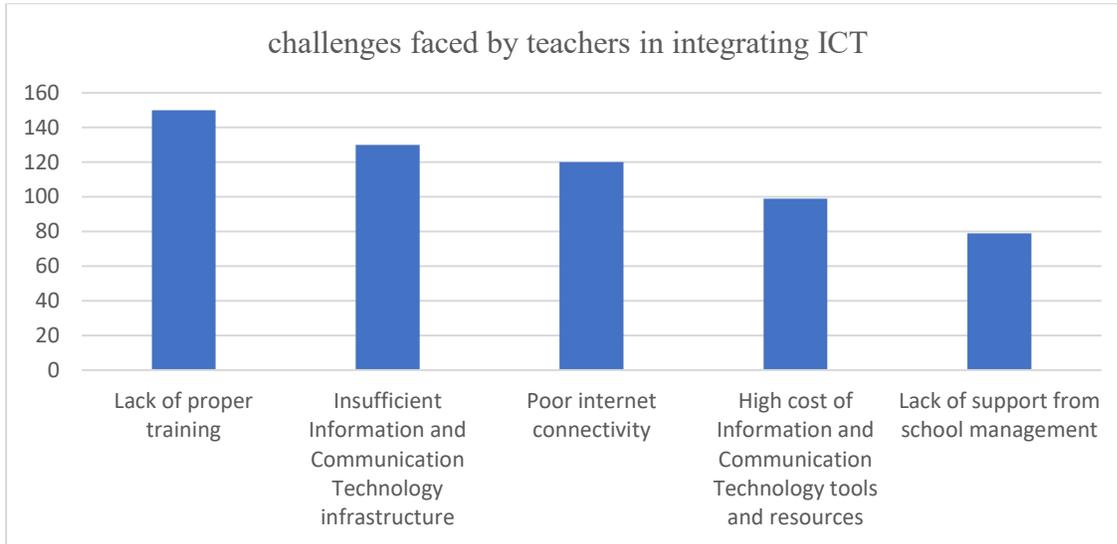


Fig 2. Showing the challenges faced by teachers in integrating Information and Communication Technology into their teaching

The most significant challenge reported by teachers was the **lack of proper training** (75%), which hindered their ability to effectively utilize Information and Communication Technology in the classroom. Insufficient Information and Communication Technology infrastructure (65%) and poor internet connectivity (60%) were also major barriers, with schools struggling to provide the necessary tools and reliable connectivity. Cost issues and lack of administrative support were also mentioned but to a lesser extent.

Table 4.1.: Chi-square Test Results:

Variable	Chi-Square Value (X ²)	Degree of Freedom (df)	P-value
Availability of Information and Communication Technology tools and academic performance	25.32	3	0.001

The chi-square test shows a significant relationship (p-value = 0.001) between the availability of Information and Communication Technology tools and students' academic performance, supporting the hypothesis that the use of Information and Communication Technology tools positively impacts academic outcomes.

Conclusion

Information and Communication Technology Integration is Beneficial: Information and Communication Technology tools, including computers, smart-boards, and online resources, significantly enhance the teaching and learning process. These tools help improve student engagement and academic performance, especially when effectively utilized by trained teachers.



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Based on the findings, it can be concluded that:

- **Teacher Training is Crucial:** Despite the advantages of Information and Communication Technology, many teachers lack the necessary training to use Information and Communication Technology tools effectively. This is a key barrier to successful integration, and addressing it is vital for maximizing the benefits of Information and Communication Technology in education.
- **Infrastructure Development is Needed:** The study also revealed that poor infrastructure, such as inadequate internet connectivity and lack of Information and Communication Technology devices, hinders the effective use of technology in schools. For Information and Communication Technology integration to succeed, schools must invest in reliable infrastructure.

Recommendation

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

- **Improve Teacher Training:** Schools should invest in professional development programs to enhance teachers' Information and Communication Technology skills. This will enable them to use technology effectively in their teaching and maximize the benefits for students. Ongoing training and workshops on the latest educational technologies should be made a priority to ensure that teachers remain up to date with new developments in Information and Communication Technology.
- **Increase Investment in Information and Communication Technology Infrastructure:** Governments and school administrators should allocate more resources to the development of Information and Communication Technology infrastructure in schools. This includes providing reliable internet access, computers, and smartboards. Schools in rural or underfunded areas should receive special attention in infrastructure development to ensure equal access to Information and Communication Technology tools.
- **Promote the Use of Educational Software and Platforms:** Schools should encourage the use of online learning platforms, e-books, and educational apps to complement traditional teaching methods. These tools provide students with a variety of learning resources and foster independent learning. Partnerships with tech companies or non-governmental organizations (NGOs) should be explored to provide schools with access to affordable or free educational software.
- **Government Policy Support:** Governments should create policies that promote the integration of Information and Communication Technology in secondary schools. These policies should include funding for Information and Communication Technology infrastructure, training programs for teachers, and a clear framework for the use of technology in classrooms

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