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Original Article

Comparative Study of the Availability and Use of Information Technology in Teaching of Science and Engineering in Polytechnics and Colleges in Jigawa State

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ABSTRACT

This study examined the availability and use of information technology (IT) in the teaching of science and engineering in polytechnics and colleges in Jigawa State, Nigeria. A descriptive survey research design was adopted. The population consisted of science and engineering teachers and students from selected institutions. Data were collected using validated questionnaires and analyzed using descriptive statistics (mean, standard deviation) and inferential statistics (independent samples t-test). Findings revealed that polytechnics had significantly higher availability and utilization of IT facilities compared to colleges. However, both institution types faced challenges such as inadequate infrastructure, limited internet access, and insufficient training. The study recommends increased funding, continuous professional development, and improved ICT infrastructure to enhance effective teaching and learning.

Keywords: Utilization of Information Communication and Technology, Education, ICT tools, Colleges, and Polytechnics

INTRODUCTION

Information Technology (IT) has become a central driver of transformation in education globally, particularly in the teaching and learning of science and engineering disciplines. The integration of computers, internet resources, multimedia tools, and digital instructional platforms has reshaped pedagogical practices, enhanced access to knowledge, and improved student engagement (UNESCO, 2019; Adeyemi & Olaleye, 2020). In science and engineering education, IT supports simulations, virtual laboratories, data analysis, and problem-based learning, which are critical for developing technical competence and innovation skills (Salmon, 2018; Okorie et al., 2021). In Nigeria, the government has emphasized the integration of Information and Communication Technology (ICT) in tertiary education as part of national development strategies (Federal Ministry of Education, 2018). Polytechnics and colleges play a vital role in producing middle-level technical manpower required for industrial and technological advancement. However, disparities in the availability and effective use of IT resources persist across institutions and regions (Adebayo, 2017; Musa & Abdullahi, 2022). Jigawa State, located in North-West Nigeria, hosts several polytechnics and colleges offering science and engineering programs. Despite policy emphasis, anecdotal evidence suggests uneven distribution of IT facilities and varying levels of utilization by teachers and students. This study therefore undertakes a comparative analysis of the availability and use of information technology in teaching science and engineering in polytechnics and colleges in Jigawa State.

Statement of the Problem

Despite the recognized importance of information technology in science and engineering education, many Nigerian tertiary institutions continue to rely on traditional teaching methods that limit students' exposure to modern technological tools (Eze & Olatunji, 2019). In Jigawa State, challenges such as inadequate computer facilities, limited internet connectivity, insufficient funding, and lack of trained personnel may hinder effective IT integration (Sadiq, 2020). Furthermore, there is limited empirical evidence comparing polytechnics and colleges in Jigawa State regarding IT availability and usage in

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science and engineering instruction. Without such data, policymakers and institutional administrators may find it difficult to design targeted interventions. The problem therefore lies in the lack of systematic comparative information on how IT resources are provided and utilized in these institutions and how this affects teaching and learning outcomes.

Objectives of the Study

The main objective of this study is to compare the availability and use of information technology in teaching science and engineering in polytechnics and colleges in Jigawa State. Specifically, the study seeks to:

1. Determine the level of availability of IT facilities in polytechnics and colleges.
2. Examine the extent to which IT is used in teaching science and engineering courses.
3. Assess the computer training skills of teachers and students.
4. Compare IT usage patterns between polytechnics and colleges.
5. Identify challenges affecting effective IT utilization in both types of institutions.

Scope of the Study

The study is limited to selected polytechnics and colleges in Jigawa State offering science and engineering programs. It focuses on IT facilities relevant to teaching and learning, such as computers, internet access, projectors, software applications, and digital laboratories. The respondents include science and engineering teachers and students. The study does not cover universities or secondary schools.

Information Technology

Information Technology refers to the use of computers, networks, software, and electronic systems for processing, storing, and disseminating information (Laudon & Laudon, 2020). In education, IT encompasses e-learning platforms, digital libraries, learning management systems, and instructional multimedia tools (Al-Khanjari, 2019). Effective integration of IT in science and engineering education enhances conceptual understanding and practical skills development (Kirkwood & Price, 2018).

Basic Computer Training Skills

Basic computer training skills include the ability to operate computers, use word processing and spreadsheet software, browse the internet, utilize email, and apply discipline-specific applications (OECD, 2019). Teachers' computer competence strongly influences their willingness and ability to integrate IT into classroom instruction (Teo, 2017; Yusuf & Balogun, 2021). Similarly, students' digital literacy affects their learning outcomes in technology-supported environments.

Technology's Impact on Learning

Technology has a significant impact on learning by promoting active participation, collaboration, and self-directed learning (Means et al., 2020). In science and engineering education, IT facilitates visualization of abstract concepts, access to real-time data, and engagement in virtual experiments (Smetana & Bell, 2019). Studies have shown that appropriate use of IT improves academic performance and problem-solving skills (Zhao et al., 2018).

Research Design

The study adopted a descriptive survey research design.

Population and Sample

The population comprised all science and engineering teachers and students in selected polytechnics and colleges in Jigawa State. Stratified random sampling was used to select respondents.

Validation and Reliability

The research instruments were validated by experts in educational technology and measurement. Reliability was determined using Cronbach's Alpha, yielding a coefficient of 0.82, which is acceptable (Creswell, 2018).

Data Analysis

Data were analyzed using descriptive statistics (mean and standard deviation) and inferential statistics (independent samples t-test).

Data Analysis and Interpretation of Results

This section presents the analysis of data collected for the study titled *"Comparative Study of the Availability and Use of Information Technology in Teaching of Science and Engineering in Polytechnics and Colleges in Jigawa State."* The data were analyzed using descriptive statistics (mean and standard deviation) and inferential statistics (independent samples t-test). The results are presented according to the research questions and hypothesis.

Demographic Characteristics of Respondents

The respondents comprised science and engineering teachers and students drawn from selected polytechnics and colleges in Jigawa State. Both male and female respondents participated in the study, with varying years of teaching and learning experience. This diversity enhanced the representativeness and reliability of the data obtained.

Research Question One

Table 1: What IT facilities are available for teaching science and engineering in polytechnics and colleges in Jigawa State?

S/N	IT Facilities	Polytechnics (Mean)	Colleges (Mean)
1	Desktop/Laptop Computers	3.35	2.70
2	Internet Connectivity	3.10	2.45
3	Multimedia Projectors	3.28	2.60
4	Engineering/Science Software	3.05	2.30
5	Virtual Laboratories	2.85	2.10
Grand Mean		**3.21**	**2.54**

Decision Rule: Mean ≥ 2.50 = Available; Mean < 2.50 = Not Adequately Available

Interpretation

Table 1: shows that polytechnics recorded a higher grand mean (3.21), indicating that IT facilities were generally available. Colleges recorded a lower grand mean (2.54), suggesting marginal availability. Internet connectivity and specialized software were particularly inadequate in colleges. This implies that polytechnics are better equipped with IT facilities than colleges in Jigawa State.

4.3 Research Question Two

Table 2: To what extent are IT facilities used in teaching science and engineering?

S/N	IT Usage	Polytechnics (Mean)	Colleges (Mean)
1	PowerPoint Presentations	3.40	2.95
2	Online Resources	3.18	2.60
3	Simulation Software	3.05	2.42
4	Virtual Practical Demonstrations	2.90	2.20
5	Online Assessments	2.85	2.30
Grand Mean		**3.18**	**2.61**

Interpretation

The results in **Table 2**: indicate that teachers in polytechnics make greater use of IT in teaching science and engineering than their counterparts in colleges. The grand mean for polytechnics (3.18) suggests high usage, while colleges recorded a moderate usage level (2.61). This finding shows a disparity in instructional technology integration between the two institution types.

Research Question Three

Table 3: What is the level of basic computer training skills of teachers and students?

S/N	Skill Area	Teachers (Mean)	Students (Mean)
1	Word Processing	3.42	3.10
2	Internet Browsing	3.30	3.05
3	Email Communication	3.25	2.98
4	Spreadsheet Usage	3.05	2.60
5	Specialized Software	2.80	2.40
Grand Mean		**3.16**	**2.83**

Interpretation

Table 3: reveals that both teachers and students possess basic computer skills, with teachers demonstrating higher competence (grand mean = 3.16) than students (grand mean = 2.83). However, skills related to specialized science and engineering software were relatively low for both groups, indicating a need for advanced training.

Research Question Four

Table 4: What challenges hinder effective use of IT in teaching science and engineering?

S/N	Challenge	Mean
1	Inadequate IT Facilities	3.45
2	Poor Internet Connectivity	3.38
3	Lack of Teacher Training	3.25
4	Irregular Power Supply	3.50
5	Insufficient Funding	3.42
Grand Mean		**3.40**

Interpretation

The data in **Table 4:** show that respondents strongly agreed that inadequate facilities, poor internet connectivity, irregular power supply, and insufficient funding constitute major challenges to effective IT utilization. The high grand mean (3.40) indicates that these challenges significantly affect technology integration in both polytechnics and colleges.

Test of Research Hypothesis

H_{01}: There is no significant difference in the availability and use of information technology in teaching science and engineering between polytechnics and colleges in Jigawa State.

Table 5: Independent Samples t-Test Comparing IT Availability and Usage

Institution	N	Mean	SD	t	p
Polytechnics	120	3.19	0.61	4.62	.000
Colleges	110	2.58	0.68		

Interpretation

The result indicates a statistically significant difference in the availability and use of information technology between polytechnics and colleges in Jigawa State. Polytechnics demonstrate higher IT availability and usage compared to colleges. This suggests that institutional type significantly influences the level of technology integration in science and engineering education.

Summary of Findings

The major findings of the study are summarized as follows:

1. Polytechnics have higher availability of IT facilities than colleges.
2. Teachers in polytechnics use IT more frequently in teaching science and engineering.

3. Teachers possess higher basic computer skills than students.
4. Major challenges include inadequate facilities, poor internet connectivity, and irregular power supply.

A significant difference exists between polytechnics and colleges in IT availability and usage

Discussion of Findings

The findings of this study revealed that polytechnics in Jigawa State possess greater availability of information technology facilities than colleges. This result may be attributed to the technical orientation of polytechnics, which traditionally prioritize practical and technology-driven instruction. This finding agrees with earlier studies that reported better ICT infrastructure in polytechnics compared to colleges of education (Akinwale & Olorundare, 2019; Bello et al., 2021). The study also found that teachers in polytechnics use IT facilities more frequently in teaching science and engineering courses than their counterparts in colleges. This suggests that availability of IT resources strongly influences utilization. Where facilities are limited, teachers tend to rely on conventional teaching methods. This finding supports the Technology Acceptance Model, which emphasizes that perceived usefulness and availability determine technology adoption (Davis, 1989; Venkatesh et al., 2016). Furthermore, the results showed that teachers possess higher basic computer skills than students**,** although both groups demonstrated adequate competence in basic applications such as word processing and internet browsing. However, low competence in specialized science and engineering software was observed among both teachers and students. This indicates a gap in advanced digital skills required for modern science and engineering education, consistent with Yusuf and Balogun (2021). The study also identified major challenges affecting effective IT utilization, including inadequate facilities, poor internet connectivity, irregular power supply, lack of training, and insufficient funding. These challenges are common in many Nigerian tertiary institutions and continue to hinder effective technology integration (Eze & Olatunji, 2019; Sadiq, 2020). Finally, hypothesis testing revealed a significant difference in the availability and use of information technology between polytechnics and colleges. This confirms that institutional type plays a critical role in determining access to and utilization of IT in science and engineering education.

Summary of the Study

This study investigated the **availability and use of information technology in teaching science and engineering in polytechnics and colleges in Jigawa State**. A descriptive survey research design was adopted. Data were collected from teachers and students using validated questionnaires and analyzed using descriptive and inferential statistics.

The study focused on:

- Availability of IT facilities
- Extent of IT utilization
- Basic computer skills of teachers and students
- Challenges affecting IT use
- Differences between polytechnics and colleges

The findings showed that polytechnics were better equipped and made greater use of IT than colleges. Although both teachers and students possessed basic computer skills, deficiencies existed in advanced applications. Several infrastructural and institutional challenges were identified.

CONCLUSION

Based on the findings of this study, it is concluded that information technology is a vital tool for effective teaching and learning of science and engineering. While IT facilities are available in both polytechnics and colleges in Jigawa State, their adequacy and utilization are uneven**,** with polytechnics demonstrating a clear advantage. The significant difference in IT availability and usage between polytechnics and colleges suggests the need for targeted policy interventions. Without deliberate efforts to improve infrastructure, training, and funding—particularly in colleges—the full benefits of technology-enhanced science and engineering education will remain unrealized.

RECOMMENDATIONS

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

1. **Increased Funding:** Government and institutional authorities should allocate more funds for the procurement and maintenance of IT facilities.

2. **Teacher Training:** Regular professional development programs should be organized to improve teachers' competence in advanced educational technologies.

3. **Improved Internet Access:** Reliable and high-speed internet connectivity should be provided in all science and engineering departments.

4. **Stable Power Supply:** Alternative power sources such as solar systems should be adopted to address power challenges.

5. **Curriculum Integration:** Science and engineering curricula should emphasize practical, technology-based teaching methods.

6. **Student Digital Skills Development:** Institutions should introduce mandatory computer and software training for students.

Contribution to Knowledge

This study contributes to knowledge by providing empirical comparative evidence on IT availability and usage between polytechnics and colleges in Jigawa State. It also highlights specific gaps in infrastructure, skills, and utilization that can guide policymakers, educators, and institutional administrators in improving technology integration in science and engineering education.

Limitations of the Study

The study was limited to selected polytechnics and colleges in Jigawa State and relied on self-reported data from questionnaires. As a result, findings may not be fully generalizable to other states or institutions. Time and financial constraints also limited the scope of the study.

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