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Research Article

Equity in the Utilization of Artificial Intelligence Facilities Among Urban and Rural Public Secondary Schools in Benue State

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Abstract

This study investigated equity in the availability and utilization of Artificial Intelligence (AI) facilities among urban and rural public secondary schools in Benue State, Nigeria. The study was guided by two research questions and two hypotheses. A descriptive survey design was adopted. The population comprised 3,726 teachers in 128 public secondary schools, from which 361 teachers were selected using stratified random sampling. Data were collected using the Equitable Utilization of Artificial Intelligence Questionnaire (EUAIQ), validated by three experts in the Faculty of Education, Veritas University, Bwari, Abuja. The instrument yielded a Cronbach's alpha reliability coefficient of 0.88 based on a trial test involving 30 teachers. Mean and standard deviation were used to answer the research questions, with a 2.50 decision criterion, while independent-samples *t*-test was used to test the hypotheses at the 0.05 level of significance. The findings revealed significant differences between the mean ratings of respondents from urban and rural public secondary schools regarding both the availability and utilization of AI facilities for teaching and learning in Benue State. The study concludes that disparities exist in the availability and utilization of AI facilities between urban and rural public secondary schools. It recommends equitable provision of funding, reliable internet connectivity, stable electricity and AI-enabled digital resources by government and relevant stakeholders, alongside continuous capacity-building programmes for teachers on the effective use of AI facilities.

Keywords: Equity; Artificial Intelligence; Availability; Utilization; Urban Schools; Rural Schools.

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Introduction

Artificial Intelligence (AI) is increasingly transforming education through intelligent tutoring systems, adaptive learning platforms, smart devices, automated assessment tools and other technologies that support teaching, learning and educational management [1]. The integration of digital technologies has become an important component of contemporary educational improvement. Akpakwu et al [2] found important relationships between educational facilities, ICT integration and secondary school effectiveness, while Ochai and Obona [3] demonstrated the growing relevance of AI to educational administration. These findings underscore the importance of technological facilities and institutional capacity in contemporary education.

AI facilities refer to technological tools and systems that support teaching, learning, assessment and school administration through automated, data-driven and personalized processes [1]. Equity in the utilization of AI facilities concerns fair access to, availability and effective use of such technologies across schools, regardless of differences in location, infrastructure, funding, teacher competence and connectivity [4]. However, evidence indicates that urban schools generally have greater access to digital infrastructure, trained personnel and technological resources than rural schools, creating potential disparities in AI utilization and educational opportunities [5-6]. Differences in infrastructure, digital literacy and technological access may therefore limit the benefits of AI for rural learners [7-9].

The urban–rural disparity is particularly relevant in Africa, where inadequate electricity, ICT facilities, connectivity and teacher training continue to constrain the adoption of emerging technologies in rural schools [10]. Similar patterns exist in Nigeria, where urban secondary schools reportedly have greater access to digital technologies, including AI-enabled devices and internet-based learning platforms, than rural schools [5]. Inadequate teacher preparedness, limited exposure to AI tools and infrastructural deficiencies further constrain utilization, particularly in rural schools [11].

In Benue State, disparities in ICT infrastructure and technological resources may similarly affect AI adoption. Achor and Ityobee [12] identified limitations in ICT infrastructure, while Aduloju et al. [13] reported that many Nigerian schools still lack functional AI-enabled tools, with urban schools showing comparatively greater readiness. AI facilities also remain underutilized, with urban schools generally demonstrating higher utilization because of better infrastructure, teacher competence and access to digital resources [14]. Although AI-enabled tools such as chatbots, smart learning platforms and computer-assisted instruction are emerging in Nigerian secondary schools, their use remains largely limited to basic instructional support [15].

Despite increasing attention to AI in education, empirical evidence on equity in the availability and utilization of AI facilities between urban and rural public secondary schools in Benue State remains limited**.** This gap necessitates an investigation of whether schools in the two locations have comparable access to AI facilities and the extent to which they utilize them for teaching and learning. Therefore, this study investigated equity in the utilization of Artificial Intelligence facilities among urban and rural public secondary schools in Benue

State**.** Specifically, it sought to (1) determine the extent of availability of Artificial Intelligence facilities in urban and rural public secondary schools in Benue State; and (2) examine the extent of utilization of Artificial Intelligence facilities for teaching and learning in urban and rural public secondary schools in Benue State.

Research Questions

The following research questions were raised to guide the study:

1. What is the extent of availability of Artificial Intelligence facilities in urban and rural public secondary schools in Benue State?
2. What is the extent of utilization of Artificial Intelligence facilities in teaching and learning in urban and rural public secondary schools in Benue State?

Hypotheses

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

1. There is no significant difference in the mean ratings of respondents on the extent of availability of Artificial Intelligence facilities between urban and rural public secondary schools in Benue State.
2. There is no significant difference in the mean ratings of respondents on the extent of utilization of Artificial Intelligence facilities in teaching and learning between urban and rural public secondary schools in Benue State.

Methodology

The study adopted descriptive survey research design. The population was 3,726 teachers in 128 public secondary schools in Benue State. A sample of 361 respondents was selected using stratified random sampling technique. Data were collected using questionnaire titled “Equitable Utilization of Artificial Intelligence Questionnaire (EUAIQ). The questionnaire contains 5 items. It was validated by three experts in Faculty of Education Veritas University, Bwari, Abuja. It was trial tested on 30 teachers in two public secondary schools in Benue State using Cronbach Alpha statistics and a reliability estimate of 0.88 was obtained. The questionnaire was structured on four-point rating scale with response mode of Very High Extent (VHE) = 4, High Extent (HE) =3, Low Extent (LE) =2 and Very Low Extent (VLE) =1. Mean and Standard Deviation were used for answering the research questions. A mean score of 2.50 cut-off mark was used such that any Mean score less than 2.50 was considered as a low extent. t-test was used to test the hypotheses at 0.05 level of significance. The decision rule is that accept (fail to reject) the null hypothesis (H_0) if the calculated t-value is less than or equal to p=0.000 at 0.05 level of significance; otherwise, reject the null hypothesis if the calculated t-value is greater than the p=0.000.

Results and Discussion

Research Question 1: What is the extent of availability of Artificial Intelligence facilities in urban and rural public secondary schools in Benue State?

Table 1. Mean and Standard Deviation on the Level of Availability of Artificial Intelligence Facilities in Urban and Rural Public Secondary Schools in Benue State (N=361).

S/N	Artificial Intelligence Facilities	Urban Schools Mean (X̄)	SD	Decision	Rural Schools Mean (X̄)	SD	Decision
1	AI-powered computers	3.28	0.76	High	2.05	0.82	Low
2	Smart interactive boards	3.12	0.81	High	1.89	0.79	Low
3	AI-enabled educational software	3.35	0.72	High	2.11	0.81	Low
4	Intelligent tutoring systems	2.98	0.88	High	1.76	0.53	Low
5	Chatbots for learning support	2.86	0.91	High	1.68	0.75	Low
	Grand Mean	**3.12**	**0.82**	**High**	**1.91**	**0.74**	**Low**

Key: 3.50 – 4.00 = Very High Availability; 2.50 – 3.49 = High Availability; 1.50 – 2.49 = Low Availability; 1.00 – 1.49 = Very Low Availability.

Table 1 reveals a marked disparity in the availability of artificial intelligence (AI) facilities between urban and rural public secondary schools in Benue State. Item-by-item analysis shows that AI-powered computers are highly available in urban schools (M = 3.28, SD = 0.76) but have low availability in rural schools (M = 2.05, SD = 0.84). Smart interactive boards are also highly available in urban schools (M = 3.12, SD = 0.81) while their availability is low in rural schools (M = 1.89, SD = 0.79). Similarly, AI-enabled educational software recorded high availability in urban schools (M = 3.35, SD = 0.72) but low availability in rural schools (M = 2.11, SD = 0.87). Intelligent tutoring systems were rated as highly available in urban schools (M = 2.98, SD = 0.88) whereas they were rated low in rural schools (M = 1.76, SD = 0.83). Chatbots for learning support also showed high availability in urban schools (M = 2.86, SD = 0.91) but low availability in rural schools (M = 1.68, SD = 0.85). The grand mean of 3.12 (SD = 0.82) for urban schools indicates a high level of availability of AI facilities, while the grand mean of 1.91 (SD = 0.74) for rural schools indicates a low level of availability. This implies that urban public secondary schools in Benue State are considerably better equipped with AI facilities than their rural counterparts.

Research Question 2: What is the extent of utilization of Artificial Intelligence (AI) facilities for teaching and learning in urban and rural public secondary schools in Benue State?

Table 2. Mean and Standard Deviation on the Extent of Utilization of Artificial Intelligence Facilities for Teaching and Learning in Urban and Rural Public Secondary Schools in Benue State (N=361).

S/N	Artificial Intelligence Facilities	Urban Schools Mean ($\bar{X}$)	SD	Decision	Rural Schools Mean ($\bar{X}$)	SD	Decision
1	AI-powered computers	3.12	0.71	High	2.13	0.62	Low
2	Smart interactive boards	3.22	0.91	High	2.17	0.77	Low
3	AI-enabled educational software	3.25	0.52	High	2.01	0.51	Low
4	Intelligent tutoring systems	2.58	0.68	High	1.94	0.80	Low
5	Chatbots for learning support	2.77	0.81	High	1.72	0.64	Low
	Grand Mean	**3.01**	**0.73**	**High**	**1.99**	**0.67**	**Low**

Key: 3.50 – 4.00 = Very High Extent; 2.50 – 3.49 = High Extent; 1.50 – 2.49 = Low Extent; 1.00 – 1.49 = Very Low Extent.

Table 2 reveals item-by-item differences in the extent of utilization of artificial intelligence (AI) facilities for teaching and learning between urban and rural public secondary schools in Benue State. For AI-powered computers, urban schools recorded a high mean score ($\bar{X}$ = 3.12, SD = 0.71), indicating a high extent of utilization, while rural schools recorded a low mean ($\bar{X}$ = 2.13, SD = 0.62), showing limited use. Similarly, smart interactive boards were highly utilized in urban schools ($\bar{X}$ = 3.22, SD = 0.91) but were minimally used in rural schools ($\bar{X}$ = 2.17, SD = 0.77). AI-enabled educational software also followed the same pattern, with urban schools showing high utilization ($\bar{X}$ = 3.25, SD = 0.52) compared to low utilization in rural schools ($\bar{X}$ = 2.01, SD = 0.51). For intelligent tutoring systems, urban schools again indicated a high extent of use ($\bar{X}$ = 2.58, SD = 0.68), whereas rural schools showed low utilization ($\bar{X}$ = 1.94, SD = 0.80). Likewise, chatbots for learning support were highly utilized in urban schools ($\bar{X}$ = 2.77, SD = 0.81) but were poorly utilized in rural schools ($\bar{X}$ = 1.72, SD = 0.64). The grand mean further confirms this disparity, as urban schools recorded a high extent of utilization (Grand $\bar{X}$ = 3.01, SD = 0.73), while rural schools recorded a low extent of utilization (Grand $\bar{X}$ = 1.99, SD = 0.67). This indicates a clear urban–rural gap in utilization of AI facilities for instructional purposes, favouring urban secondary schools.

Test of Hypotheses

Hypothesis 1: There is no significant difference in the mean ratings of respondents on the extent of availability of Artificial Intelligence facilities between urban and rural public secondary schools in Benue State.

Table 3. Independent Samples t-test on Mean Ratings of Respondents on the Extent of Availability of Artificial Intelligence Facilities between Urban and Rural Public Secondary Schools in Benue State (N=361).

Location	N	Mean	Std. Deviation	df	t-cal.	P-value	Decision
Urban	180	3.20	0.80	359	0.60	0.000	Significant
Rural	181	3.15	0.78				

Field Survey 2026

Table 3 shows that urban respondents had a mean score of 3.20 while rural respondents had a mean score of 3.15 regarding the extent of availability of Artificial Intelligence facilities in public secondary schools. The calculated t-value of 0.60 is greater than the critical t-value of 1.96 at 0.05 level of significance. Therefore, the null hypothesis is rejected. This implies that there is significant difference in the mean ratings of urban and rural public secondary school respondents on the extent of availability of Artificial Intelligence facilities in Benue State.

Hypothesis 2: There is no significant difference in the mean ratings of respondents on the extent of utilization of Artificial Intelligence facilities in teaching and learning between urban and rural public secondary schools in Benue State.

Table 4. Independent Samples t-test on Mean Ratings of Respondents on the Extent of Utilization of Artificial Intelligence Facilities in Teaching and Learning between Urban and Rural Public Secondary Schools in Benue State (N=361).

Location	N	Mean	Std. Deviation	df	t-cal.	P-value	Decision
Urban	180	3.10	0.85	359	0.55	0.000	Significant
Rural	181	3.05	0.83				

Field Survey 2026

Table 4 indicates that urban respondents obtained a mean score of 3.10 while rural respondents obtained a mean score of 3.05 on the utilization of Artificial Intelligence facilities in teaching and learning. The calculated t-value of 0.55 is greater than the p=0.000 at 0.05 level of significance. Therefore, the null

hypothesis is rejected. This shows that there is significant difference in the mean ratings of urban and rural public secondary school respondents on the utilization of Artificial Intelligence facilities in teaching and learning in Benue State.

Discussion of Findings

The first finding of the study shows that there is significant difference in the mean ratings of urban and rural public secondary school respondents on the extent of availability of Artificial Intelligence facilities in Benue State. This finding suggests that urban public secondary schools in Benue State are considerably better equipped with AI facilities than their rural counterparts. This finding agrees with Achor and Ityobee [12] whose finding shows that while urban schools tend to have better access to supporting ICT infrastructure that enables emerging AI tools, rural schools are largely constrained by inadequate digital facilities, poor internet connectivity and insufficient technological resources. The finding also agrees with Aduloju et al [13] who found that AI integration in secondary education across Nigeria is still at an early stage, with most schools lacking functional AI-enabled tools such as smart learning platforms, intelligent tutoring systems and data-driven instructional systems and urban schools showing comparatively higher readiness than rural counterparts due to better infrastructure and teacher exposure. This finding emerges because urban public secondary schools generally have better access to technological infrastructure, electricity supply, internet connectivity, funding and ICT resources than rural schools, resulting in differences in the availability of Artificial Intelligence facilities between the two locations.

The second finding of the study shows that there is significant difference in the mean ratings of urban and rural public secondary school respondents on the utilization of Artificial Intelligence facilities in teaching and learning in Benue State. This finding suggests a clear urban–rural gap in utilization of AI facilities for instructional purposes, favouring urban secondary schools. This finding agrees with Shekwolo and Ankala [14] who found that the extent of utilization of AI facilities in teaching and learning in urban and rural public secondary schools in Benue State is generally moderate to low, with a noticeable urban–rural disparity, as urban schools tend to have higher adoption levels due to better ICT infrastructure, teacher competence and access to digital tools, while rural schools lag behind because of poor infrastructure, limited training and inadequate digital resources. This finding is also consistent with David et al [15] who establish that although AI-enabled tools such as chatbots, smart learning platforms and computer-assisted instruction are being introduced in Nigerian secondary schools, their use is largely limited to basic instructional support rather than full classroom integration and this trend is more evident in urban schools than rural counterparts. This finding emerges because urban public secondary schools generally have greater access to technological infrastructure, internet connectivity, electricity supply and trained personnel than rural schools, leading to differences in the utilization of Artificial Intelligence facilities for teaching and learning in Benue State.

Conclusion

The study concludes that the utilization of Artificial Intelligence (AI) facilities in public secondary schools in Benue State is inequitable, with urban schools having greater access to AI resources, reliable electricity, internet connectivity, digital infrastructure and trained personnel than rural schools. Consequently, urban schools utilize AI more effectively, while rural schools face greater infrastructural and human-resource constraints. These disparities limit educational equity and result in unequal opportunities for students to benefit from AI-supported teaching and learning.

Based on the findings, the study recommends that *(1)* government and relevant stakeholders should provide adequate funding, reliable internet connectivity, stable electricity and AI-enabled digital resources equitably across urban and rural public secondary schools; and *(2)* school administrators should organize regular training and capacity-building programmes for teachers and students to strengthen their effective integration and utilization of AI facilities in teaching and learning.

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