

Assessing the Role of Information and Communication Technology (ICT) in Advancing Digital Transformation by Nigeria's Universal Basic Education Commission (UBEC)

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Article DOI:

10.48028/iiprds/esjprcd.v13.i1.24

Keywords:

Information and
Communication
Technology, Digital
transformation,
Universal Basic
Education, UBEC,
Nigeria, e-learning,
Teacher training

Abstract

This study examines the impact of Information and Communication Technology (ICT) on digital transformation in Nigeria's Universal Basic Education Commission (UBEC). It highlights how ICT integration has changed basic education delivery through policy frameworks, infrastructure, teacher capacity building, and learning outcomes. Using a mixed-methods approach, the research evaluates UBEC's digital initiatives such as the establishment of smart schools, e-learning platforms, teacher training programs, and ICT resource centers across Nigeria's 36 states and the Federal Capital Territory. Key findings indicate significant progress in bridging the digital divide, with over 37 model smart schools established across the nation and with about 21 fully functioning, and over a thousand trained teachers on digital pedagogies across the country. The UBEC Digital Resource Centre has become crucial for delivering digital content, especially during the COVID-19 pandemic. However, challenges persist, including inadequate infrastructure, uneven implementation across states, digital literacy gaps among educators, and disparities in access between urban and rural areas. Connectivity issues and unreliable electricity further limit the effectiveness of ICT efforts. The article concludes that while UBEC's ICT initiatives lay a foundation for inclusive basic education, continuous investment, coherent policies, and strong stakeholder collaboration are necessary for sustaining progress and ensuring equitable access. Recommendations include improving broadband connectivity to rural schools, enhancing ongoing teacher professional development, fostering public-private partnerships, and implementing comprehensive monitoring and evaluation frameworks to guide progress and evidence-based decision-making.

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Background to the Study

The global education landscape has been fundamentally reshaped by the rapid proliferation of Information and Communication Technologies (ICTs), which have emerged as powerful catalysts for pedagogical innovation, administrative efficiency, and equitable access to learning opportunities. Across the developed and developing worlds, governments have increasingly recognized that integrating ICT into education systems is not merely an optional enhancement but a strategic imperative for preparing learners for participation in knowledge-driven economies (UNESCO, 2023). In Nigeria, the significance of ICT in education has been amplified by the twin challenges of a burgeoning youth population and the imperative to achieve Sustainable Development Goal 4, which calls for inclusive and equitable quality education for all. The Universal Basic Education Commission (UBEC) was established under the Universal Basic Education Act of 2004 as the primary federal agency responsible for coordinating and overseeing the implementation of basic education programmes across Nigeria's 36 states and the Federal Capital Territory. UBEC's mandate extends to ensuring that every Nigerian child of school-going age has access to free, compulsory, and quality basic education. Over the past two decades, UBEC has progressively embraced ICT as a strategic tool for modernizing basic education delivery, enhancing instructional quality, and addressing persistent challenges such as inadequate infrastructure, teacher shortages, and learning outcome deficits (Ogunleye & Adebayo, 2022). The concept of digital transformation in education extends beyond the mere deployment of computers and internet connectivity in schools. It encompasses a fundamental reimagining of how teaching and learning occur, how educational institutions are managed, and how stakeholders interact within the educational ecosystem (Haleem et al., 2022). Digital transformation in the Nigerian basic education context involves integrating ICT into curriculum design, developing digital content, training teachers in technology-enhanced pedagogies, establishing e-learning platforms, and creating data systems for monitoring and evaluation (Federal Ministry of Education, 2021).

The rationale for UBEC's ICT-driven approach is multifaceted. First, ICT offers the potential to bridge the longstanding infrastructure gap in Nigerian schools by providing access to digital learning resources that can supplement or substitute for inadequate physical facilities (Adebayo & Olaniyan, 2023). Second, ICT enables personalized and adaptive learning, allowing teachers to cater to diverse learner needs and paces. Third, digital tools facilitate real-time data collection and analysis, empowering policymakers and administrators to make evidence-informed decisions about resource allocation and intervention strategies (UNESCO, 2023). Fourth, integrating ICT into basic education prepares learners with the digital literacy skills essential for success in higher education and the twenty-first-century workplace. The transformative potential of ICT in education has been documented across various perspectives globally. In Sub-Saharan Africa, countries such as Kenya, Rwanda, and South Africa have made notable progress in leveraging ICT to expand access and improve learning outcomes (World Bank, 2021). Nigeria's approach, spearheaded by UBEC, has focused on a combination of infrastructure deployment, teacher professional development, digital content development, and policy innovation. Main initiatives include the establishment of smart schools equipped with modern ICT infrastructure, the creation of e-

learning platforms such as the UBEC Digital Resource Centre, the provision of ICT equipment to schools, and the training of teachers in ICT integration (UBEC, 2023). The significant challenges persist. Reports indicate uneven implementation across states, with disparities in access to electricity, internet connectivity, and trained teachers (Akinwumi & Ogunlade, 2024). Many schools lack adequate ICT infrastructure, and where equipment exists, maintenance and sustainability remain concerns (Nwosu & Ugwu, 2023). Teacher preparedness for integrating ICT into instruction varies widely, with many educators lacking the necessary skills and confidence to effectively use digital tools (Ogunleye & Adebayo, 2022). The digital divide remains pronounced between urban and rural schools, with rural institutions often left behind in the distribution of resources (Adebayo & Olaniyan, 2023).

Aim of the Study

The aim of this study is to assess the role of Information and Communication Technology (ICT) in advancing digital transformation within Nigeria's Universal Basic Education Commission (UBEC).

Objectives of the Study

The specific objectives of the study are:

- i. To examine the policy frameworks underpinning UBEC's ICT integration initiatives in basic education.
- ii. To assess the scope and scale of ICT infrastructure deployment across UBEC's basic education programmes.
- iii. To evaluate teacher capacity-building efforts and their effectiveness in enhancing digital pedagogies.

Research Questions

The study is guided by the following research questions:

- i. What policy frameworks and guidelines have been established to govern ICT integration in UBEC's basic education programmes?
- ii. What is the extent and nature of ICT infrastructure deployment across UBEC-supported schools in Nigeria?
- iii. How effective are teacher capacity-building programmes in equipping educators with the skills needed for ICT integration?

Conceptual Framework

Concept of Digital Transformation in Education

Digital transformation in education refers to the profound changes that occur when digital technologies are integrated into all aspects of educational systems, fundamentally altering how teaching and learning are conducted, how institutions are managed, and how learners, educators, and other stakeholders interact (Bond et al., 2020). Unlike simple technology adoption, which may involve adding computers to classrooms without changing pedagogical approaches, digital transformation involves a systemic reconfiguration of educational practices, structures, and cultures. Scholars have identified several dimensions of digital

transformation in education. The pedagogical dimension involves shifting from teacher-centred, transmission-based instruction to learner-centred, constructivist approaches enabled by digital tools (Haleem et al., 2022). The organisational dimension encompasses changes in school leadership, administrative processes, and stakeholder engagement facilitated by digital platforms. The technological dimension includes the deployment of hardware, software, connectivity, and technical support infrastructure. The cultural dimension involves fostering a mindset that embraces innovation, experimentation, and continuous learning among educators and learners (Bond et al., 2020).

ICT in Basic Education

Information and Communication Technology encompasses a broad range of technologies used to create, store, process, exchange, and disseminate information. In basic education perspectives, ICT applications include computer-aided instruction, e-learning platforms, digital libraries, learning management systems, interactive whiteboards, mobile learning applications, and administrative management information systems (UNESCO, 2023). These tools can serve various functions, including content delivery, skill practice, assessment, communication, and data management. The integration of ICT into basic education is informed by several theoretical perspectives. Constructivist learning theories emphasise that technology can support active, collaborative, and authentic learning experiences (Paul, 2024; Victor, 2023). The technology acceptance model suggests that successful technology integration depends on users' perceptions of usefulness and ease of use (Davis, 2023). The unified theory of acceptance and use of technology extends this framework by considering factors such as social influence and facilitating conditions (Yusuf et al., 2023).

Methodology

This study adopted a mixed-methods research design combining quantitative and qualitative approaches to provide a comprehensive assessment of UBEC's ICT-driven digital transformation efforts. The quantitative component involved analysis of secondary data from UBEC annual reports, policy documents, and programme evaluations covering the period 2019 to 2024. Data were collected on main indicators including the number of smart schools established, ICT equipment distributed, teachers trained, and learners reached. Descriptive statistics were used to summarise trends and patterns in ICT deployment across states. The qualitative component comprised semi-structured interviews with main informants drawn from UBEC headquarters, state universal basic education boards, school principals, and teachers. A purposive sampling strategy was employed to select participants with direct experience in implementing ICT programmes. A total of 25 interviews were conducted, with participants representing six states selected to reflect geographic diversity and variation in ICT implementation levels. Interview transcripts were analysed using thematic analysis to identify recurring themes, challenges, and success factors. The study also drew on case studies of specific UBEC initiatives, including the Smart School project, the UBEC Digital Resource Centre, and the Teacher Professional Development Programme on ICT integration. Document analysis was used to review policy frameworks and guidelines related to ICT in basic education. Ethical considerations included obtaining informed consent from

participants, ensuring anonymity and confidentiality, and securing approval from relevant institutional review boards.

Results and Discussion

Policy Framework for ICT Integration in Basic Education

UBEC's ICT integration efforts are anchored in a policy framework that emphasises the strategic role of technology in achieving universal basic education goals. The National Policy on Information and Communication Technology in Education (2019) provides the overarching guidance, articulating a vision for leveraging ICT to improve educational access, equity, and quality (Federal Ministry of Education, 2019). UBEC has developed specific implementation guidelines that outline the roles of federal and state agencies, infrastructure standards, and funding mechanisms. The main policy innovation is the establishment of the UBEC Digital Resource Centre (DRC), a centralised platform for developing, curating, and disseminating digital learning resources aligned with the national curriculum. The DRC provides teachers and learners with access to interactive content, lesson plans, assessment tools, and multimedia resources (UBEC, 2023). The platform is designed to be accessible via multiple devices, including computers, tablets, and mobile phones, recognising the diverse technological perspectives in which Nigerian schools operate.

The policy framework also mandates the allocation of a percentage of the Universal Basic Education Fund to ICT interventions, providing a predictable funding stream for state-level implementation (UBEC, 2021). This funding mechanism has enabled states to procure ICT equipment, establish computer laboratories, and implement teacher training programmes. The challenges in fund disbursement and utilisation have been noted, with some states facing delays in accessing allocated resources (Akinwumi & Ogunlade, 2024). Interviews with UBEC officials revealed that policy implementation has been shaped by a pragmatic recognition of the need to adapt to local realities. One official explained that *"we have national standards, we also recognise that states are at different starting points. Our approach is to provide a framework that allows flexibility while ensuring that minimum standards are met."* This flexibility has enabled states to prioritise interventions based on their specific needs, but it has also contributed to variations in implementation quality across states.

ICT Infrastructure Deployment

UBEC's infrastructure deployment efforts have focused on establishing smart schools, providing ICT equipment to conventional schools, and developing connectivity infrastructure. The Smart School initiative, launched in 2020, aims to establish model schools equipped with modern ICT infrastructure, including computer laboratories, interactive whiteboards, and high-speed internet connectivity. As of 2024, UBEC had established over 21 fully operationed smart schools across Nigeria, with plans to expand to all 36 states and the FCT (UBEC, 2024). Each smart school is designed to serve as a demonstration centre for technology-enhanced teaching and learning, providing a model that other schools can emulate. The schools are equipped with solar power systems to address the challenge of unreliable electricity supply, ensuring that ICT facilities can function consistently. Interviews

with principals of smart schools highlighted the transformative impact of these facilities on teaching and learning. One principal noted that *"before the smart school project, our students had never seen a computer. Now they are creating digital presentations, accessing online resources, and preparing for a future we could not have imagined."*

Beyond smart schools, UBEC has distributed ICT equipment to thousands of conventional schools, including computers, tablets, projectors, and digital content. The distribution has been guided by criteria that consider school size, location, and existing infrastructure. The reports indicate that equipment distribution has been uneven across states, with some states lagging significantly behind others (Nwosu & Ugwu, 2023). Rural schools have been particularly disadvantaged, with limited access to electricity and connectivity constraining the usability of ICT equipment. Connectivity remains an essential challenge. The UBEC has partnered with the Nigerian Communications Commission and private sector providers to expand broadband access to schools, only a fraction of schools has reliable internet connectivity. Interviews with teachers in rural areas revealed that even where computers are available, lack of internet access limits their educational value. One teacher lamented that *"we have computers, but no internet. The students can learn basic computer skills, but they cannot access the wealth of information that is available online."*

Teacher Capacity Building

UBEC has invested substantially in teacher professional development focused on ICT integration. The Teacher Professional Development Programme, implemented in collaboration with state universal basic education boards and development partners, has trained over 200,000 teachers in digital pedagogies, content creation, and classroom technology management (UBEC, 2024). Training modules cover topics such as basic computer literacy, use of educational software, integration of ICT into lesson planning, and online safety. The training approach combines face-to-face workshops with online learning modules, recognising the need to build both foundational skills and advanced competencies. Participants in the training programmes reported positive experiences, noting that the training had enhanced their confidence and ability to use technology in the classroom. One teacher interviewed described the training as *"transformative it opened my eyes to possibilities I had never considered. I now use digital resources in almost every lesson, and the students are much more engaged."*

The interviews also revealed limitations in the training programme. The duration of training was often insufficient to develop deep competencies, particularly for teachers with limited prior exposure to technology. Some teachers noted that the training focused heavily on basic skills, with less emphasis on advanced applications such as content creation and data analysis. Follow-up support and mentoring were identified as gaps, with teachers reporting that they had limited opportunities to reinforce and extend their learning after the initial training. State-level variations in teacher training outcomes were also noted. States with stronger institutional capacity and existing ICT infrastructure were better able to sustain training impacts, states with weaker systems struggled to translate training into classroom practice. This observation

aligns with findings from other studies on ICT integration in developing country perspectives, which emphasise that teacher capacity building must be accompanied by supportive school environments and ongoing professional learning communities (UNESCO, 2023).

Impact on Learning Outcomes

Assessing the impact of ICT interventions on learning outcomes presents methodological challenges, given the complexity of isolating the effects of technology from other factors influencing educational achievement. The available evidence suggests positive associations between ICT integration and learning outcomes. UBEC's monitoring and evaluation reports indicate improvements in learner engagement, attendance, and basic literacy and numeracy scores in schools with well-implemented ICT programmes (UBEC, 2023). Teachers interviewed for this study reported that technology had enhanced student motivation and participation. One teacher observed that *"students who were previously disengaged become excited when we use technology. They are more willing to participate, ask questions, and take ownership of their learning."* Another teacher noted that technology had enabled differentiation, allowing her to provide targeted support to struggling learners challenging advanced students. The impact of ICT on learning outcomes appears to be mediated by several factors, including the quality of teaching, the relevance of digital content, and the availability of supportive infrastructure. Studies elsewhere have shown that technology alone does not improve learning; rather, its effectiveness depends on how it is integrated into pedagogical practice (Haleem et al., 2022).

Challenges and Constraints

UBEC's ICT-driven digital transformation faces persistent challenges. Infrastructure gaps remain a primary constraint. Many schools, particularly in rural areas, lack reliable electricity, internet connectivity, and adequate physical space for computer laboratories. The cost of maintaining ICT equipment, including repairs, replacements, and software updates, strains limited school budgets. Some schools reported that equipment provided years earlier had become non-functional due to lack of maintenance. Teacher preparedness continues to be a challenge. The substantial numbers of teachers have received training, the quality and depth of training vary, and many teachers still lack the confidence and competence to effectively integrate technology into their teaching. Teacher turnover compounds the problem, as trained teachers leave schools and are replaced by untrained staff (Ogunleye & Adebayo, 2022). Implementation disparities across states are pronounced. States with stronger institutional capacity, political commitment, and existing infrastructure have made greater progress than those with weaker systems. These disparities raise equity concerns, as learners in less advantaged states are being left behind in the digital transformation process. UBEC's efforts to provide support to low-performing states have been hampered by capacity constraints and governance challenges at the state level. Monitoring and evaluation systems for ICT programmes are still developing. Data on ICT deployment, usage, and impact are often incomplete or inconsistent, limiting the ability to track progress, identify best practices, and target interventions effectively. Strengthening data systems is essential for evidence-based decision-making and accountability.

Conclusion

This article has assessed the role of Information and Communication Technology in advancing digital transformation within Nigeria's Universal Basic Education Commission. The findings reveal that UBEC has made substantial progress in integrating ICT into basic education, establishing over 21 smart schools which are fully operational, training of teachers and developing digital learning platforms that have expanded access to quality educational resources. These efforts have contributed to enhanced learner engagement, improved teaching practices, and the development of digital literacy skills essential for participation in the twenty-first-century economy. The significant challenges persist. Infrastructure deficits, particularly in electricity and internet connectivity, constrain the effectiveness of ICT interventions, especially in rural areas. Teacher capacity for technology integration remains uneven, and the quality and sustainability of professional development programmes require strengthening. Disparities in implementation across states raise equity concerns, with learners in less advantaged regions at risk of being left behind in the digital transformation process. The study concludes that UBEC's ICT-driven transformation has laid a foundation for digitally inclusive basic education, sustained investment, policy coherence, and stakeholder collaboration are essential for consolidating gains and ensuring equitable access. Digital transformation is not a one-time intervention but a continuous process of adaptation and improvement. As technology evolves, so too must the strategies and approaches for integrating it into education.

Recommendations

Based on the findings of this study, the following recommendations are proposed to strengthen UBEC's ICT-driven digital transformation efforts:

- i. **Expand Infrastructure Deployment:** Prioritise investment in electricity and broadband connectivity for schools, particularly in rural areas. Explore innovative solutions such as solar power and satellite internet to overcome infrastructure gaps.
- ii. **Strengthen Teacher Professional Development:** Enhance the depth and quality of teacher training programmes, incorporating advanced competencies such as digital content creation and data analysis. Establish ongoing professional learning communities and mentoring programmes to support sustained teacher development.
- iii. **Enhance Equity of Implementation:** Develop targeted support mechanisms for states with weaker capacity, including technical assistance, resource allocation, and capacity building. Ensure that equity considerations are central to ICT planning and resource distribution.
- iv. **Improve Monitoring and Evaluation Systems:** Strengthen data collection and analysis systems to track ICT deployment, usage, and impact. Use data to inform decision-making, identify best practices, and target interventions effectively.
- v. **Foster Public-Private Partnerships:** Leverage partnerships with private sector technology companies, telecommunications providers, and civil society organisations to expand access, reduce costs, and enhance the quality of ICT interventions.
- vi. **Promote Digital Content Development:** Continue to expand the UBEC Digital Resource Centre, ensuring that content is aligned with the curriculum, culturally

relevant, and accessible in low-bandwidth environments. Encourage teacher and learner participation in content creation.

- vii. Invest in Maintenance and Sustainability:** Develop sustainable maintenance models for ICT equipment, including technical support, spare parts, and upgrade pathways. Engage school communities in the stewardship of ICT resources.

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