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# Advancing Education through Technology: The Nigerian Context

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## ABSTRACT

The use of computers in Nigerian education has been influenced by policies like the National Policy on Computer Education and the Universal Basic Education (UBE) Programme. It has been applied in various areas such as student learning achievement, teacher education, curriculum implementation, access and equity, facilities, e-learning, assessment and evaluation, parents and communities, and issues and concerns. Computer integration in schools has improved students' academic performance, technological literacy, analytical ability, and creative thinking. Government frameworks, private sectors, and academic institutions support technology integration by training teachers and providing professional development activities. Different subjects now incorporate curriculum integration and teaching methods that foster hands-on skills, problem-solving skills, and teamwork. Access and equity issues arise due to differential access to technology between urban and rural schools, requiring intervention. COVID-19 has boosted e-learning and remote education, with stakeholders training teachers, providing devices, and enhancing internet connectivity. The review examines advancing Education through Technology: The Nigerian Context. Technological innovations in teaching and learning processes provide teachers with real-time formative assessment, differentiated instruction, and information on students' achievements. Of particular relevance is the role of parents and communities play a particularly important role in encouraging the use of technology in learning, requesting appropriate resources, and encouraging digital competence in the home environment. We utilized relevant published data (2004–2014) from diverse, reliable databases. The study suggests that using computers in Nigerian education has the potential to create positive changes for students as well as improve their computer use skills. To achieve the best results from the use of technology in education in Nigeria, there is a need for sustainable investment in infrastructure, continued teacher training, aligned instructional objectives, and policy backing.

**Keywords:** computer education, technology integration, teacher training, e-learning remote education, digital literacy.

## INTRODUCTION

The use of computers in Nigerian education started in the late 1980s and continued until the early 1990s, but it was slow due to factors such as high costs, inadequate facilities, and a lack of skilled personnel [1]. Realizing the importance of ICT in education, the Nigerian government implemented several policies, including the 1988 National Policy on Computer Education, to integrate computer literacy into all school levels. Established in 2001, the National Information Technology Development Agency (NITDA) oversees the implementation of the National IT Policy, promotes the use of ICT in education, and enhances computer literacy among

Nigerian citizens. Launched in 1999, the Universal Basic Education (UBE) Programme aims to provide free and compulsory education up to junior secondary level. Similarly, the Nigerian Education Sector Reform Programme (ESRP), launched in the early 2000s, stressed the need for education sector modernization, including the integration of ICT in teaching and learning processes [2]. The 2006 National Policy on ICT in Education set objectives in the areas of infrastructure, teacher professional development, curriculum, and digital resource development, as well as guidelines for integrating ICT into the education system. In mid-2000, the

One Laptop per Child (OLPC) initiative emerged to raise awareness about the transformative power of technology in education. There are disparities in computer technology penetration in schools according to area of residence, whether urban or rural [3]. In this case, the likelihood of accessing computers is higher in urban areas than in rural areas due to more infrastructure, increased electricity availability, and increased funding. Challenges experienced in rural schools include a lack of computers, an erratic power supply, and limited funds. The government and private sectors are making efforts to enhance ICT access in schools through programmes such as School Net Nigeria, which not only connects schools to the internet but also provides teachers with ICT training [4]. Currently, telecommunications companies such as MTN and Airtel have embarked on some corporate social responsibilities to support the enhancement of ICT education through the provision of computers and setting up ICT training centres. However, there are still a considerable number of teachers with little or no training in ICT, hence the need for professional development and training. The pandemic became a catalyst for embracing digital technologies in education, resulting in the shift to online learning platforms and remote learning.

#### **Impact on Student Learning Outcomes**

The use of computers in schools has greatly enhanced performance and achievement, as well as mastery of technology [5]. This is because the current learning environment presents students with vast resources, communication, motivation, and feedback through online quizzes. Digital literacy encompasses fundamental skills that involve specific operations on a computer, operating system, and software programmes, along with sophisticated ICT capabilities such as coding, data analysis, and multimedia production [6]. Students also acquire research and information skills through activities that involve internet research, distinguishing between reliable and unreliable sources, and using proper citation. These include using interactive content, implementing a personalized approach to learning, and incorporating game elements. Technology platforms also facilitate self-paced learning, instant rewards, and foster a creative disposition. Applications that require analytics, coding, and problem-solving also develop critical thinking and problem-solving skills. Education projects that use digital materials help students develop independent critical thinking about information, bias recognition, and the ability to integrate different points of view. Teaching strategies, such as the use of simulations and models

in subjects such as science and math, can enable students to use hypothetical scenarios to explore the consequences and make practical deductions about different ideas. PBL methods applied throughout the course, like PBL, online collaboration, and coding and programming, help students solve real-life problems as a team. These tools foster collaboration and effective interpersonal communication, which are valuable in solving team tasks, as well as cultivating simple problem-solving abilities like analytical thinking, following steps, and critical problem-solving. In sum, the use of computers in education has shown potential that supports the enhancement of academic accomplishment and computer competence.

#### **Teacher training and professional development**

Teacher training is first and foremost important when it comes to the effective implementation of technology in learning processes [7]. Faculty plays an important role in helping students better understand their digital literacy and integrate it into the learning process. They will also be able to incorporate technology into their courses, making the course content more engaging. Nigeria has government and NGO frameworks to support teacher training, for example, the Nigerian National ICT Policies and Teacher Development Programmes, school-based training, and the Nigerian private sectors such as Microsoft, Google, and MTN. Sources of funding for the private sector are corporate training programmes, partnerships with EdTech firms, and higher education associations and professional bodies. Nigerian universities provide educational technology courses and degrees, while professional organisations such as the Nigeria Computer Society (NCS) and the Teachers Registration Council of Nigeria (TRCN) sponsor workshops, conferences, and materials regarding the use of ICT in education. However, teachers faced challenges when implementing technology in education due to infrastructure and resource constraints. These challenges included access to the technologies, upgrades and technical support, a lack of professional development on how to integrate the technologies appropriately and effectively, time constraints, and psychological and attitudinal barriers. This is because technology may hardly be available in rural schools, and if it is, its operation, maintenance, and support can be a challenge. Professional development is limited by a lack of well-coordinated and comprehensive training, time limitations, and attitudinal or psychological factors. Some of the factors that may hinder the implementation of change management in an organisation are: teachers are most likely to resist

change; hence, they may not embrace new technologies as they prefer conventional methods of teaching. Teachers who are particularly disadvantaged by low levels of confidence in their technical competencies should be offered supportive training programs that would enable the development of self-efficacy [8]. Curriculum and policy issues include complex curriculum development that requires careful thought and alignment with curriculum goals, and poorly executed policies that can lead to confusion regarding their integration. It is therefore important for schools and policymakers to provide clear policy and administrative support for such teachers, given the dynamic nature of the field.

#### **Curriculum integration and teaching methods**

Computer integration in the classroom shifts the focus from the teacher to the students, thus making it student-centred [9]. Teachers now teach and consider ICT competencies as core learning outcomes in each subject area and at different grade levels, equipping students with technology skills in addition to content knowledge. This is a cross-curricular approach whereby the children gain real-life experience with the use of technology and, at the same time, learn more in different subjects. The curriculum describes the developmental goals of learning ICT skills: from using the computer to using productivity tools, programming languages, multimedia, and information searching [10]. Spiral curriculum refers to the gradual teaching and repetition of ICT concepts and skills at various levels of learning to increase the subject's understanding and mastery. Some of the effective uses of ICT in learning include project-oriented learning, in which students use computers to address real-life issues, develop research, and prepare multimedia projects. These practical activities promote problem-solving, imagination, and teamwork skills. Teachers also use them to test various real-life scenarios and conduct virtual experiments in fields such as science and mathematics [11]. Technology has transformed the way teachers teach, moving from a teacher-directed approach to a student-based approach. This is made possible by encouraging students to engage in self-directed learning activities while teachers act as coordinators and monitors rather than tutors. The use of technology in the teaching and learning process gives the students the opportunity to learn in a way that they prefer and that best suits their learning preferences and styles. This is why active learning techniques involve the use of multimedia teaching tools, role plays, simulations, and educational games, allowing for better

comprehension and information absorption [12]. Group work enhances the students' cooperation, interactivity, and task-accomplishment abilities. In order to enhance flexibility and individualised learning, teachers also use a type of delivery that combines both face-to-face and online methods. Interactive and multimedia resources play a crucial role in education, tailoring vision and interactivity, individual approaches, and meaningful and effective knowledge to students. We can make them accessible for various categories of learners, including those with disabilities or learning difficulties. Rote learning enables students to learn at their own pace, revisit any challenging topics, and receive guidance to seek supplementary help or content as needed.

#### **Access and equity issues**

Factors such as infrastructure, funding, and gender roles contribute to the differences in computer technology acquisition between urban and rural schools [13]. This article argues that the infrastructure for incorporating technology into teaching and learning is more developed in urban schools compared to rural schools because of the limited resources in the latter. Efforts aimed at tackling these gaps are in the form of mobile ICT units, community centres, and PPPs. Gender divides also manifest in the use of computers and other technologies, as cultural and resource allocations constrain girls. Limited resources and budgets in ICT lead to gender bias and discrimination, causing girls and women to lag behind men in terms of education, literacy, and ICT proficiency. Possible variables that have been associated with gender differences in digital literacy include household income and parents' level of education [14]. To address the gender disparity, it may be useful to implement measures such as gender-sensitive curriculum, girls' education, and community sensitization. We aim to enhance ICT accessibility and utilisation in needy regions through ICT infrastructure development, digital inclusion policies, and partnerships with the private sector. Other sources that can help address this issue include private sector engagements like CSR, where companies can supplement efforts to address the digital divide. Both the private sector and NGOs can combine their resources and knowledge to develop digital inclusion strategies and programmes aimed at reaching out to the needy in society. For instance, through community-based centres, people in the community require access to computers, connectivity to the internet, and training in the use of technology and digital skills. The skill development programmes and training workshops

offer opportunities for individuals to become digitally literate, enabling them to access educational, economic, and social facilities and services in today's digital world [15].

#### **Infrastructure and resources**

In Nigerian schools, the technologies range from simple hardware and software resources to assist students. These assets include computer laboratories, mobile computing devices, ICT resources, educational software, and productivity assets [16]. Urban centres and better-endowed institutions often house computer labs, while mobile devices are more portable for classroom use or home learning. General educational software refers to a variety of classes with different levels that make learning a joyful experience. Information technology improves students' ability to use tools that promote productivity and mutual cooperation. Physical facilities available in schools in Nigeria include limited accessibility and connectivity to the internet and other learning materials because of a lack of support structure, geographical location, and poor network [17]. This also affects the speed and reliability of the internet connection, particularly in terms of bandwidth, which is crucial for using online resources and taking online classes. Some of the key programs highlighted include the National Broadband Plan, which seeks to enhance the broadband base and facilitate increased connectivity in the country. School connectivity programmes can be defined as financial assistance offerings that address school broadband and other ICT infrastructure upgrades to support e-learning efforts. Some of the private sector's initiatives include telecom investments, corporate social responsibility (CSR), and community networks [18]. These include measures that seek to increase broadband subscriptions, bridge the gap between urban and rural areas, and ensure that schools and other centres obtain affordable and reliable connectivity. Community networks rely exclusively on local resources, infrastructure, and stakeholder collaborations to overcome barriers that contribute to digital marginalisation.

#### **E-learning and remote education**

Today, e-learning platforms have developed into a popular educational tool, providing students with numerous opportunities for improving their knowledge across different subjects and levels [19]. These platforms are convenient and portable, as students can learn on their own schedules and at their own convenience, anywhere they are, through computers, tablets, or mobile phones. Computer-based classrooms allow face-to-face communication with instructors and fellow learners via collaborative

live video conferencing systems. E-learning systems provide content in various formats, such as video tutorials, tests, books, and forums, where students can exchange questions and ideas. Many platforms include features such as progress tracking, assessments, and certification to acknowledge students' progress. Virtual classrooms provide opportunities for effective teaching practices that involve the use of shared screens, drawing tools, and breakout sessions to improve learning activities' engagement and involvement. Global trends such as the COVID-19 pandemic have led to increased uptake of e-learning and other forms of remote education, including in Nigeria [20]. Various stakeholders, including governments, educational institutions, and technology providers, have committed their values and resources to e-learning, including training teachers, distributing digital devices, and enhancing internet connections. Some considerations include digital inequality, teacher training and development, and equality. The benefits of remote education also involve flexibility and access, lifetime learning, and globalization. People can continue education and professional development while studying at their own pace and preferences through such technologies as e-learning facilities.

#### **Assessment and evaluation**

Technology has emerged as a significant tool in the process of assessing and evaluating students [21]. Web-based quizzes, tests, assessment applications, digital portfolios, games, and virtual simulations offer teachers the opportunity to give feedback and help students. These tools allow teachers to recognise students' misunderstandings, clear common mistakes, and facilitate learning at the same time. Formative assessments comprise instant feedback, peer assessment, cooperative boards, tests, rubrics, and data analysis. The technology application also allows for controlled question selection, time limits for testing, and measures against cheating to maintain the credibility of the summative assessments. Summative assessment has created digital rubrics with clear criteria and standards that a teacher can use depending on the learning activities and objectives. Teachers can use DMS to evaluate assessment results and monitor changes in student learning patterns, strengths and weaknesses, or performance tendencies over time. It informs instruction and interventions [22]. New technologies help to provide timely and relevant feedback, thereby improving the assessment process. One of the major benefits of implementing immediate feedback is that students are able to learn from their mistakes and correct them in real time,

thereby improving their learning outcomes. Automated formative functions in CBA help teachers save time on grading and providing feedback, while the emphasis is on the quality of the feedback given to the learners. Tracking students' progress is another area of technology. Technology allows the teachers to track their achievement trends over several assessments, assignments, and even learning activities. Learning analytics dashboards and reports are summaries of students' data that provide graphical representations that the teacher can use to analyse the learners' performance patterns, all in order to inform data-intervention strategies [23].

#### **Parental and community involvement**

Parents and the community have a responsibility to support the use of technology in educational institutions [24]. Computers, internet connections, and other digital devices and equipment enable students to access online material and complete assigned digital works from home. Parents can also support their children's development of digital literacy through the use of technology, both by modelling positive uses of the technology, showing how to safely use the internet, and engaging in learning activities that include the use of technology in the home. It is also crucial for parents and community members to embrace the use of technology in schools, as they can be involved in school boards, membership in the PTA, and the formulation of school policies. They can concentrate their advocacy efforts on financing technological advancements and ensuring that schools are adequately prepared for digital learning. Residents can contribute their time, skills, and other resources, such as technical assistance, computers, software, and so on. As for technology-related activities in schools, they can be involved as guest speakers or mentors. Parents' knowledge of the significance of technology education determines their perceptions and encouragement of technology in schools. Parents can also receive updates on their children's schools' technology plans and other related policies and resources through other forms of communication [25]. Culture in relation to technology and education may differ between or within certain cultures, which may affect the acceptance of technology in education.

Community engagement is one of the strategies that can assist in developing and maintaining support for technology projects. Schools can form partnerships

The use of computers in Nigerian education dates back to the late 1980s and early 1990s, but progress was slow due to the following factors: high computer costs and a lack of facilities. However, after realizing

with local businesses, non-profit organisations, governmental agencies, and community groups to provide resources, knowledge, and support for technology acquisition. Parental engagement increases ownership and participation in the care and usage of education and technology for their children. The community events and activities include organising technology fairs or expos, providing parents and community members with workshops and training sessions on areas of concern such as digital literacy, safety, and technology skills, and providing the community with related activities and events.

#### **Challenges and barriers**

Some of the technical factors that affect the schools include reliability of equipment, technical support, security, and finance. Maintenance concerns refer to problems with the physical structures and computer systems that can affect the teaching and learning process [26]. Schools may encounter difficulties in obtaining technical support and troubleshooting assistance for maintenance issues. Cybersecurity issues entail safeguarding student and school information from unauthorized access, hacking, and other malicious activities. Schools should install various measures, such as firewalls, anti-virus and antispyware, encryption tools, and user authentication measures, to prevent unauthorised access and loss of data. Financial constraints and funding issues pose another challenge. Constraints such as low funds and the cost of the technology can be a burden to the financial budgets of schools and thus may hamper the expansion and continuation of the technological interventions. Technology integration initiatives may receive unsteady or inadequate government funding. You can also seek sponsorship, grants, donations, and corporate partnerships from other sources within the private sector. Possible causes of resistance to change among educators and administrators include familiarity with conventional processes, preferred teaching approaches, and concerns about the unfamiliar [27]. It entails extensive training for educators, such as workshops and coaching sessions, to enhance their ability and confidence to integrate and use IT in teaching and learning. Therefore, when facing such resistance to change, it is viable to track change management practices that include stakeholder engagement, communication plans, and incentives for innovative change in the schools.

#### **CONCLUSION**

the importance of ICT in education, the Nigerian government implemented policies and measures to ensure computer literacy at various levels of learning. Bodies such as the National Information

Technology Development Agency (NITDA) and programmes such as the Universal Basic Education (UBE) Programme have played a significant role in promoting ICT usage in schools. Accessibility to computer technologies remains a problem because urban schools have more funding and better facilities than rural schools. SchoolNet Nigeria and corporate social responsibility projects from telecommunication companies. However, challenges like a lack of teacher training and technology support continue to persist. Despite these challenges, computer usage in student learning outcomes has been very influential. School learners have demonstrated improved academic results, information technology competence, analytical ability, and creativity in task handling. Educationists have the responsibility of ensuring that this learning takes place through the use of technology in teaching and course content. Nigerian education appears to have a bright future for technology adoption, with innovative technologies like AI, VR, and blockchain poised to transform teaching and learning. Sustainability considerations include proper infrastructure development, continuing education for teachers, and curriculum matching. Stakeholders, policymakers, and educators need to work together to think about issues like poor funding, organisational resistance, and access liberations. As a result, the implementation of computers in the Nigerian education system may have a positive impact on students' performance, as well as develop their skills in the use of information and communication technologies. By addressing these challenges and seizing these opportunities, Nigeria can achieve significant progress. Nigeria can harness the positive force of technology to provide better opportunities for everyone in education.

### Recommendations

Such technologies as AI and machine learning are rapidly changing the education sector by offering personalised learning, improving academic performance, and facilitating visualization. Virtual Learning Environment (VLE) and Virtual Classroom are VR and AR applications that provide engaging and interactive learning environments,

while blockchain can provide a secure solution for academic records, certifications, and credit systems such as badges. The use of decentralized learning platforms and peer-to-peer networks allows for the direct exchange of knowledge between learners and tutors without the involvement of middlemen.

It is imperative to undertake infrastructure planning, long-term planning for computer technology, staff development, curriculum, and innovation in pedagogy in order to achieve effective computer technology in schools in the long term. There is a need for schools to efficiently invest in a good and sustainable ICT framework, such as reliable internet connections, sufficient bandwidth, and current technology devices and systems. Teacher training programmes and technology integration specialists can also help support the integration of technology through guidance and modelling for educators. The integration of instructional goals and learning outcomes ensures the effective application of technology to enhance learning and achieve student outcomes. Teaching and learning innovation aims at the use of new methods in teaching and learning to foster motivation, originality, and problem-solving skills. In order to implement technology integration in schools, make technology available and accessible to all learners, integrate policies that support digital literacy, and support innovation in education, policymakers should ensure the provision of adequate funding and other resources. Teachers should continue their professional development in order to become more digitally competent and to develop better practices in the use of technology within their classrooms. Consult and engage parents, community members, and industry partners in dialogue and other processes related to the adoption and use of technology in learning institutions. Stakeholders should promote advocacy and awareness on the use of technology, particularly in education, in order to gather support, commitment, and resources towards the promotion and support of the proper use and implementation of technology.

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