BUILDING SUSTAINABLE EDUCATION IN NIGERIA THROUGH TECHNOLOGY

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Abstract
The education system of Nigeria has continually faced numerous challenges and continues to grapple with issues such as inadequate infrastructure, limited access to learning materials, a shortage of qualified professionals, and an outdated education system that fails to accommodate the demands of the digital era and rapid technological advancement. Addressing these challenges is crucial for creating a sustainable system and reimagining education to meet the needs of a changing society. This paper seeks to promote sustainable education in Nigeria through the use of various technological systems, including AI-driven learning, smart classrooms, and virtual platforms, to bridge educational gaps and enhance learning outcomes. Investing in digital literacy can help the country build a resilient and forward-looking education system capable of competing with global standards. This can be achieved by improving digital infrastructure, training teachers in digital tools, and encouraging e-learning policies. Such efforts will enable Nigeria's education system to keep pace with global advancement and equip graduates with the skills and knowledge to succeed anywhere in the world.

Keywords: Sustainable Education, Tech-driven, Digital, Development, Teachers

Introduction
This paper examines how sustainable education can be established through various technological advancements in response to society's rapid digital transformation, and outlines strategies to bridge existing gaps and ensure long-term sustainability. In today's dynamic world, it is increasingly evident that the global education landscape has shifted from traditional teaching models to blended or tech-driven approaches in order to meet modern societal demands. These innovations are vital in the education sector, as education is the bedrock of any society that seeks development. During the award ceremony of the 2023 Egbin Power Scholarship Programme, where 14 pupils were awarded scholarships, the Chief Executive Officer of Egbin Power Plc., Mokhtar Bounour, stated that the foundation of development in any community, society, or nation is education because it fosters sustainability, drives progress, and raises future leaders for a more prosperous society. He emphasized that education remains the cornerstone of societal transformation, socio-economic growth, and human capital development. This assertion is evident, as many developed and developing nations have prioritized education by making substantial investments, recognizing it as a necessity. In comparison, Nigeria's 2025 national budget stands at ₦54.99 trillion (approximately $36.6 billion at today's exchange rate), which is notably lower than Harvard University's 2024 endowment, valued at $53.2 billion. Out of the Nigerian national budget, only ₦3.52 trillion representing less than 7% was allocated to education. This is not only lower than the 13% allocated in the 2008 budget, but also falls short of the 15–20% benchmark recommended by UNESCO, the World Bank, and Nigeria's National Policy on Education.

As society continues to undergo rapid digital transformation, traditional education models are increasingly inadequate in meeting the needs of an evolving world. Adapting to new technologies through investments in digital infrastructure, development of a digitally integrated curriculum and pedagogical content, implementation of supportive policies, improved incentives for teachers, teacher training in digital literacy, and robust evaluation and monitoring systems can bridge existing gaps. These efforts will make teaching and learning more effective, and equip our students to become worthy ambassadors of Nigeria's education system.

Current Challenges in Nigeria's Education System

Teacher Shortages: Poor remuneration has always been a discouraging factor for current and aspiring teachers. Available data from the National Centre for Education Statistics (NCES) highlights the disparity between teachers in Nigeria and the United States. An average high school teacher in the U.S. earns about $72,000 per year, whereas their counterparts in Nigeria can hardly earn the same amount in 30 years of service. Bearing this in mind, people who are passionate about teaching tend to lose interest in the profession and may not even have the financial capacity to acquire the necessary training for effective pedagogical skills.

Limited Access to Quality Education: In Nigeria today, many students have limited access to quality education. This can be attributed to several factors such as corruption, geographic location, religion, or even personal beliefs. However, these reasons do not justify the situation, even though they are often overlooked. Education is a human rights issue, and the delivery of quality education is crucial (Olugbenga & Yakubu, 2021). Every Nigerian citizen should have access to quality education, regardless of financial status or any other limiting factors.

Outdated Curriculum: Just like language, the curriculum is dynamic and must be subject to reform in order to remain relevant in today's world. Many schools in Nigeria still follow traditional, theory-based learning models that do not align with modern industry needs. There is also the issue of curriculum inconsistency, as some schools operate Quranic curricula while others follow the Montessori model (Chinwendu, 2018). As the saying goes, necessity is the mother of invention, and it has become necessary to effect meaningful changes in the curriculum.

Digital Divide: Unequal access to technology continues to widen the educational gap. This disparity creates a digital divide between those with financial resources and marginalized groups often including women and girls due to socio-cultural norms (Mariscal et al., 2019). This inequality is also evident in rural communities, where government attention is often minimal, possibly due to their distance from urban centers, lack of media coverage, or security concerns.

Role of Technology in Bridging Gaps

Bridging the Urban-Rural Divide: Platforms such as those provided by the Nigerian Educational Research and Development Council offer learning programs through television and radio. Additionally, students can access a wide range of educational content using smartphones to browse the internet or watch videos on platforms like YouTube. This access helps reduce marginalization in rural communities, allowing students to access the same information as their urban counterparts and compete effectively.

Improving Quality of Education: Smart classrooms equipped with interactive whiteboards, digital projectors, and virtual reality tools make learning more engaging, practical, and enjoyable. Online platforms like Udemy and Coursera enable learners to gain additional skills. According to Jusuf (2016), the development of ICT has transformed the educational

landscape, encouraging educators to be more creative in designing learning experiences. Internship opportunities and coding programs available on platforms like X (formerly Twitter) and LinkedIn also help students develop their cognitive and psychomotor skills.

Expanding Access to Education: E-learning platforms such as Google Classroom, Zoom, and other virtual classrooms provide opportunities to access educational materials remotely. For example, one does not need to physically attend Oxford University to earn a degree from Oxford. Through technology, students can apply, get admitted, take lectures, and earn degrees from institutions anywhere in the world. Technology ensures global connectivity and access to educational resources, thereby improving literacy rates and supporting sustainable education.

Enhancing Inclusivity in Education: Assistive technologies such as screen readers and voice-to-text tools enable learners with disabilities to access education. Additionally, language learning platforms like High Dictionary and Nkenne, an African language application that help users translate texts and learn new languages, fostering better understanding and breaking down learning barriers. Technological tools also provide access to scholarships, research funding, and academic grants that would otherwise be inaccessible without digital platforms.

Fostering Lifelong Learning and Research: Technology allows students and teachers to collaborate on global projects and research efforts. Tools like AI tutors and chatbots enable personalized learning at one's own pace. According to educational psychologist Benjamin Bloom, an average student in a tutoring setting performs better than 98% of students in a conventional classroom, emphasizing the effectiveness of personalized instruction. This is where technology plays a vital role, empowering students to learn more effectively and adopt a positive academic mindset regardless of societal limitations.

Long-term Benefits of Tech-Driven Education Systems

Enhanced Quality of Learning: Tech-driven education systems such as AI tutors and virtual labs help personalize the learning experience to meet the individual needs of each learner. This personalization supports the development of cognitive, psychomotor, and affective domains. It also provides teachers and students with access to a variety of instructional materials, making learning more engaging and easier to understand. This approach can encourage students who may have previously withdrawn due to cultural beliefs or other barriers to embrace education and acquire the skills necessary for societal development. According to Marban & Mulenga (2019), the integration of technology in schools aims to transform how teachers and students gather, access, analyze, present, and share information. This improves access to learning in the classroom and helps differentiate instruction, particularly for students with special needs.

Reducing Inefficiencies in Education: Technology has helped reduce examination malpractice to a minimal level, as observed in advanced countries like the UK, USA, and Canada. In Nigeria, the introduction of Computer-Based Testing (CBT) by JAMB has significantly reduced examination malpractice, and many higher institutions have since followed suit by introducing CBT for some of their semester examinations. Similarly, technology has been used to identify and eliminate ghost teachers. For instance, the current Governor of Abia State, Dr. Alex Chioma Otti, employed digital verification processes to eliminate ghost workers from the state civil service. Workers were required to undergo an online verification process, which helped the government save millions of naira and repay outstanding debts, especially those owed to pensioners. This example highlights the importance of using digital systems and automated recordkeeping to reduce mismanagement of education funds through greater transparency.

Encouraging STEM and Innovation: Tech-driven education encourages the growth of Science, Technology, Engineering, and Mathematics (STEM). Several studies have shown that many students avoid science-related subjects due to a fear of mathematics. Anito & Morales (2019) emphasize the need to enhance mathematical literacy, creative problem-solving skills, and knowledge acquisition for students to succeed in the evolving job market. By encouraging tech-based learning especially among Gen Z and Gen Alpha learners, students become more comfortable using their devices for learning and may begin to see STEM subjects as less intimidating. Over time, consistent engagement can help them gain confidence and mastery. Furthermore, tech-focused education produces graduates with marketable digital skills, enabling them to participate effectively in the digital economy and contribute innovations, as seen in the work of renowned Nigerians such as Philip Emeagwali, Dr. Samuel Achilefu, Dr. Olufunmilayo Olopade, Dr. Ndubuisi Ekekwe, and Sikiru Salamu, among others.

Cost-Effective and Scalable Education: Building traditional schools is expensive and often time-consuming. Technology offers a cost-effective and scalable alternative for expanding access to education. E-learning has made teaching and learning more efficient, even in overcrowded schools that lack adequate lecture halls. For example, during the COVID-19 pandemic in 2020, schools that had already adopted e-learning systems continued classes without major disruption, while others were significantly affected. In Abia State, the then-governor, who was also a former university lecturer leveraged radio stations to teach senior secondary students and ensure academic continuity. Similarly, churches adapted by utilizing digital platforms. Pastor Jerry Eze of Streams of Joy International used social media to hold prayer sessions titled NSPPD, which continue to this day. Blended learning which combines traditional and digital approaches offers an effective way to reach more learners and improve literacy rates. During the 11th Distinguished Public Lecture at Federal University Lokoja, Prof. Yakubu Aboki Ochefu emphasized the need for a hybrid educational approach that leverages technology to close educational gaps in Nigeria.

1. **Improved Assessment and Data-Driven Education:**

With the integration of technology, student progress can now be tracked using data analytics, allowing educators to make informed decisions and tailor their teaching strategies. Platforms such as Moodle and Google Classroom can monitor attendance, quiz scores, participation, and assignment submissions. Learning Management Systems (LMS) like Canvas can also track student engagement. For instance, if a student consistently misses multiple assignments, the system can send alerts, prompting timely interventions from educators. This data-driven approach enhances accountability, improves student performance, and ensures no learner is left behind.

Conclusion

Tech-driven education is not an alternative but the future of education in Nigeria Investing in digital infrastructure, training teachers in digital tools and promoting e-learning policies will make the Nigeria evolve to keep up with digital transformation shaping modern economies as well as make our education more sustainable, accessible and keep pace with global advancements.

Suggestions

Teacher Training on Digital Literacy: The teacher which happens to be to be the instructor of learning is the focal point of tech-driven education in any society. It is therefore pertinent

that these instructors are well rooted on the needs and processes involved in technology. TET-Fund and other educational financial institutions should provide platforms where teacher training programs like Google Classroom, Zoom, and other AI- driven tutoring platforms can be exercised as well as create networks for these teachers where they can connect with other persons around the world.

Certifications should also be awarded in these workshops that would build the professional profiles of these teachers and encourage them to participate more in future and by so doing provide more teachers with digital literacy which would end up affecting the students positively. Information and Communication Technology should be made a necessary prerequisite for teacher certifications like TRCN in Nigeria. This would encourage teachers to acquire the needed skills for recruitment so that the government digital illiteracy of these teachers would not be a stumbling block to improving that of the students in future. Overall, the lack of teaching materials, proficiency in using technology and desire in utilizing technological tools along with a dearth of competent teachers and a lack of training and retraining can hinder the progress of technology-driven education for sustainable development in Nigeria (Osaat, 2015)

Improved Incentives for Teachers: Providing sustainable incentives should be a core concern for our leaders as the teaching profession which is seen as the mother of all profession is not getting the respect it deserves because they are being underpaid at all levels of the educational ladder. This is one of the reasons The Academic Staff Union of Universities (ASUU) always embark on industrial action thereby affecting the academic calendar as well as extending the years whereby a student should spend in school. A survey was done recently where a few students were asked the number of years it would take them to complete their degree programs and a lot of them said 4+ n, n which serves as the unknown in this context is to accommodate all the uncertainties the Nigerian academic sector could bring.

Providing Digital Infrastructure, Equity and Innovation: As of late 1890s, American homes already had electricity. In 2025, many homes in some parts of Nigeria still don't have access to electricity. This shows how much we are behind when it comes to the journey to provide sustainability in every sector in Nigeria. If we have basic amenities like steady electricity, access to internet and WIFI connectivity, computers, improved broadband coverage, subsidized tablets and data plans, tech- driven classroom activity would be definitely improve. There is a saying that practice makes perfect and when students are exposed to all these on a regular basis, they get access to more information as well as learn things effectively even without face to face classroom experience. Recently, one of the telecommunication networks in Nigeria increased their data sales to exorbitant prices rising to more than 100%. I hypothesize that if this inflation is being overlooked, it'll pose a serious concern to digital literacy which would in turn affect the sustainability of our education sector as not only content creators but also to the academic professionals are affected. Teaching and learning is a process which would definitely need assistance from Google search, You tube or even other internet sites to access data and gain knowledge and the increment in the cost of accessing these sites is a huge disadvantage to so many students. Policies should be implemented that would help subsidize or provide low cost of internet access to students and teachers as well as provide stable internet connectivity for those in rural areas. Addressing the affordability and accessibility of technology is crucial for empowering youths (Masimbe, 2019).Assistive technologies like screen readers or speech to text software can also help support students and teachers with disabilities and this creates equity in teaching and learning.

Developing a Digital Based Curriculum and Pedagogical Content: Curriculum planners in our educational sphere should endeavor to explore the dynamics of curriculum planning by

integrating the necessary contents that would perfectly align with the needs of the current time and age. Regular curriculum updates for computer related programs are essential to ensure graduates possess relevant digital skillsets (Uduafemhe, Ewim, &Karfe, 2023) and as a result, our curriculum should accommodate coding, digital literacy and artificial intelligence(AI). Today, a lecturer at a university still uses the same lecture note he used 15 years ago to teach his present students not minding the massive influx of digital age. We should understand that change is a constant event. Many scientists made their own propositions before Charles Darwin and even today, his laws are still being tested under different conditions and more findings have been made. Robert Hooke is the father of cell but Felix Dujardin, Theordor Schwann and even Mathias Schleiden made notable contributions. This is to show that knowledge is inexhaustible. In our AI- driven society today, our curriculum should be able to reflect the impact and necessity of having a digital and tech-based teaching and learning environment. These contents should also be available in major Nigerian languages (Igbo, Hausa, Yoruba) for better accessibility and more reachable to its audience. It is worthy of note that today Mazi Ogbonnaya Okoro, a renowned Nigerian Physicist have successfully published a Physics textbook in Igbo language and we need more people in the academic sphere to follow in similar trajectory.

Policy and Government Support: It is highly imperative that the government implement policies that integrate technology into the Primary and Secondary education systems just the way they have introduced entrepreneurial subjects in Unity Schools and Tertiary Institutions.(Ocharo et al 2015) found that ineffective use of technologies in school can be attributed to inadequate policies governing their usage and recognizing the fact that tech is the new normal is not a topic for later discussion. There is a popular saying that destroying a nation is not by the use of nuclear bomb or missiles but by lowering the level of education and this entails that we need leaders who understands the intricacies of these things and makes good judgment and supporting tech companies by lowering tax or providing grants would also play a vital role. Just the way so many things are being subsidized, tech innovations should as well benefit so that people would be able to afford the cost of learning thereby reaching a larger audience and by so doing improve digital literacy which is a prerequisite for sustainable education.

Monitoring and Evaluation: According to the teaching and learning process, evaluation is the process of assessing how well teachers and students are performing, it helps give feedback, surveys or reviews about the attainment of specific objectives through projects, assignments or other classroom activities. As a teacher, tracking students' progress helps us make better decisions in our teaching methods and techniques. When new technologies are introduced, it's important we test with a small sample first before proceeding to a larger population of learners. This is because of the fact that we recognize that these technological equipments has its own side effects and we cannot draw conclusion of what they are until we test them. For instance, though the Joint Admission and Matriculation Board (JAMB) introduced the use of CBT in 2013, it was not made compulsory until 2015 when all the 1.47milion candidates took the UTME via CBT. On the other hand, the National Youth Service Corps (NYSC) introduced the monthly biometric clearance in 2015 but it wasn't implemented in all states in same year. Nevertheless, today it is a compulsory exercise in all states that has helped to checkmate ghost corps members. This highlights the importance of test running before full implementation as this helps tackle challenges that would come in future. When we evaluate students using these tech- related activities, it encourages them to practice and get better overtime which has already laid a foundation towards sustaining our education system through technology.

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