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REFORMING LEGAL FRAMEWORKS FOR SCIENCE AND TECHNOLOGY EDUCATION IN NIGERIA: A PATHWAY TO INNOVATION IN TIMES OF NATIONAL CRISIS

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Abstract

The advancement of science and technology education is vital to Nigeria's sustainable development and global competitiveness. However, persistent insecurity and economic crises have disrupted science teaching, exposed institutional weaknesses, and revealed the inadequacy of existing legal frameworks to support a resilient education system. The central problem this research addresses is the insufficiency of Nigeria's current legal and policy structures to effectively safeguard and promote science and technology education, particularly in crisis-prone and underserved regions. This raises key research questions: To what extent do Nigeria's legal instruments provide enforceable and adaptable support for science education? What legal reforms are necessary to make the system inclusive, resilient, and future-proof? The purpose of this study is to critically evaluate the legal and policy environment governing science and technology education in Nigeria, identify systemic gaps, and propose reformative measures aligned with international best practices. Drawing on a rights-based approach to education and the innovation systems theory, this paper employs qualitative legal analysis to review key statutes, including the Constitution, the National Policy on Education, the Universal Basic Education Act, and the National Science, Technology and Innovation Policy. Comparative models from Kenya, India, and South Africa are also examined to derive best-practice insights. The findings reveal that although Nigerian laws acknowledge the importance of science education, they lack comprehensive, enforceable, and context-sensitive provisions necessary for effective implementation. The results show that the absence of digital infrastructure mandates, legal protections for virtual learning, and institutional coordination mechanisms undermines the delivery of science education, especially during national emergencies. The study recommends the enactment of a Science and Technology Education Reform Act, the inclusion of mandatory digital infrastructure provisions in relevant laws, and the development of legal protections for e-learning platforms to safeguard educational continuity. It further advocates for integrating adaptive learning frameworks and strengthening inter-agency collaboration.

Keywords: Education Reform, Legal Framework, Nigeria, Science and Technology Education

Introduction

In Nigeria, the nexus between legal frameworks and science and technology education is pivotal in fostering innovation and addressing national challenges. However, the prevailing legal structures have exhibited significant gaps in effectively supporting science education, particularly in the face of recurring insecurity and economic downturns. These persistent challenges have not only disrupted educational delivery but also exposed structural and

institutional weaknesses in Nigeria's science and technology education system. The core problem this research addresses is the inadequacy of Nigeria's current legal and policy frameworks to provide enforceable, inclusive, and crisis-responsive mechanisms for the sustainable development of science and technology education. This study seeks to answer the following research questions: (1) To what extent do existing Nigerian laws support the implementation of science and technology education? (2) What are the key legal and policy gaps inhibiting its integration, especially in underserved and crisis-affected areas? (3) What legislative and institutional reforms are necessary to establish a more adaptive and inclusive framework for science and technology education?

The primary purpose of this research is to critically evaluate Nigeria's existing legal instruments on science and technology education—namely the Constitution, the National Policy on Education (2013), the Universal Basic Education Act (2004), and the National Science, Technology and Innovation Policy (2012)—and to propose actionable legal reforms that can enhance their effectiveness.

Section 18 of the 1999 Constitution mandates the government to ensure equal and adequate educational opportunities at all levels, yet it provides no targeted provisions for science and technology education. Similarly, while the National Policy on Education acknowledges the value of science learning, it lacks enforceable strategies for its nationwide implementation. The Universal Basic Education Act, despite its aim to provide free and compulsory education, fails to explicitly mandate the inclusion of science and technology in the curriculum. The National STI Policy outlines broader development objectives but does not offer legal guarantees or implementation tools for embedding science and technology into educational structures.

Using a rights-based approach to education and the innovation systems theory as the guiding framework, this study employs qualitative legal analysis to assess these instruments and identify the gaps that hinder science and technology education across the country. Comparative case studies from Kenya, India, and South Africa offer valuable insights into more effective legal models, which help contextualize Nigeria's legal deficiencies and highlight viable reform pathways. Findings from this study reveal that although existing legal frameworks recognize the importance of science and technology education, they fall short in providing binding, inclusive, and crisis-resilient provisions to support effective implementation.

The results show that the absence of dedicated funding, insufficient legal mandates for digital infrastructure, and lack of coordination among relevant institutions have significantly hampered the delivery of quality science education, particularly during national emergencies and in marginalized regions. To address these challenges and reposition science education as a national development priority, this study recommends the enactment of a comprehensive Science and Technology Education Act. This proposed legislation would provide a strong legal foundation for integrating science and technology into the national curriculum, establishing implementation agencies at all levels of government, mandating specific budgetary allocations, and harmonizing educational and technological policies. The paper also proposes the inclusion of enforceable provisions for digital infrastructure, teacher training, and protective regulations for virtual learning environments.

This study underscores the urgent need for a coherent, enforceable, and future-proof legal regime to transform Nigeria's science and technology education landscape. Without targeted legal reforms, the country risks falling behind in global competitiveness and missing critical opportunities for sustainable development through innovation and human capital development.

1. Conceptual Clarifications

To effectively analyze the legal frameworks governing science and technology education in Nigeria, it is essential to define key concepts:

1.1.1 **Science and Technology Education**: This refers to the structured instruction and learning processes aimed at imparting knowledge and skills in scientific and technological disciplines. It encompasses both theoretical understanding and practical application, preparing individuals to contribute to innovation and technological advancement.

1.1.2 **Legal Frameworks**: These are the systems of laws, regulations, policies, and institutional structures that govern and guide the implementation of science and technology education. They provide the legal basis for decision-making, resource allocation, and accountability in educational practices.

1.1.3 **Crisis-Resilient Education Systems**: These are educational systems designed to withstand and adapt to challenges such as insecurity and economic downturns. They emphasize flexibility, inclusivity, and sustainability, ensuring the continuity and quality of education during crises.

1.2 Theoretical Framework

1.2.1 Human Rights-Based Approach to Education: This approach asserts that education is a fundamental human right (Universal Declaration of Human Rights, 1948; and the International Covenant on Economic, Social and Cultural Rights, 1966). This approach emphasizes the obligation of states to provide accessible, equitable, and quality education for all individuals, including during emergencies.

1.2.2 Innovation Systems Theory: This theory provides a framework for understanding how various elements of a national system—such as policies, institutions, and actors—interact to promote innovation. It highlights the importance of a coherent legal and institutional framework in facilitating the development and application of scientific and technological knowledge.

In Nigeria, the existing legal frameworks for science and technology education, including the Constitution, National Policy on Education, and Universal Basic Education Act, provide a foundation but lacks specific provisions to address the challenges posed by insecurity and economic downturns. For instance, the Universal Basic Education Act of 2004 mandates free and compulsory education but does not explicitly incorporate science and technology education or provisions for crisis situations. Furthermore, the National Policy on Education (2004) acknowledges the importance of science education but lacks detailed strategies and legal mandates for its integration and delivery during crises. The absence of a comprehensive legal framework that addresses the integration of science and technology education into the national curriculum and provides mechanisms for its delivery during emergencies underscores the need for targeted legal reforms.

3. Current Legal Frameworks Governing Science and Technology Education in Nigeria

3.1 Constitution of the Federal Republic of Nigeria, 1999

Section 18 of the Constitution of the Federal Republic of Nigeria (1999) mandates the State to direct its policy towards ensuring that there are equal and adequate educational opportunities at all levels. However, it does not provide specific provisions for science and technology education, leading to a lack of targeted legal support for these critical areas.

3.2 National Policy on Education (NPE), 2013

The National Policy on Education (2013) outlines the goals and objectives for education in Nigeria, emphasizing the development of the individual into a morally sound, patriotic, and effective citizen. While the policy acknowledges the importance of science education, it lacks

detailed strategies and legal basis to effectively integrate science and technology into the Nigerian educational system.

3.3 Universal Basic Education Act, 2004

The Act aims to provide free, compulsory, and universal basic education for every child of primary and junior secondary school age. Despite its commendable objectives, the Act does not explicitly address the integration of science and technology education, nor does it provide mechanisms to ensure the delivery of quality science education across the country.

3.4 National Policy on Science, Technology, and Innovation (STI), 2012

The National Policy on Science, Technology, and Innovation (2012) policy provides a framework to leverage science and technology in various sectors. While the policy outlines strategic objectives for STI development, it does not establish a comprehensive legal framework to ensure the integration of science and technology education into the national curriculum or provide legal mandates for its implementation.

1. Challenges in the Current Legal Frameworks

The existing legal frameworks in Nigeria provide a foundation for education but fall short in effectively promoting science and technology education. As such the existing legal frameworks have numerous limitations militating against the effective promotion of science and technology education in Nigeria. These include:

4.1 Lack of Specific Provisions: Section 18 of the Constitution of the Federal Republic of Nigeria (1999); and the National Policy on Education (2013) provide general guidelines but lack specific provisions for science and technology education, leading to inadequate focus and resources for these areas.

4.2 Inadequate Implementation Mechanisms: The Universal Basic Education Act and the National Policy on Science, Technology and Innovation lack robust implementation mechanisms to ensure the integration of science and technology education into the curriculum and its delivery across the country.

4.3 Insufficient Funding: Despite the recognition of the importance of science and technology education, there is a lack of dedicated and specific funding and resources to support its development and implementation.

4.4 Policy Inconsistencies: The existence of multiple policies without a cohesive legal framework leads to inconsistencies and overlaps, hindering the effective coordination and implementation of science and technology education initiatives.

5. Impact of Insecurity and Economic Downturn on Implementation

5.1 School Closures Due to Insecurity

The escalating insecurity in Nigeria has led to widespread school closures, particularly in the northern regions. Between December 2020 and March 2021, over 600 children were abducted from schools in three separate incidents Adeniran & Castradori (2021), highlighting the severity of the threat to educational institutions.

In response to these threats, authorities in states like Katsina and Zamfara have closed several schools. For instance, in December 2020, both states closed multiple schools following the abduction of students in Kankara.

These closures disrupt the academic calendar, hinder access to education, and contribute to an increase in the number of out-of-school children.

5.2 Disruption of Science, Technology, Engineering, and Mathematics (STEM) Programs

Insecurity has also disrupted Science, Technology, Engineering, and Mathematics (STEM) programs in schools. The fear of abductions and attacks has led to a decline in student enrollment in STEM subjects, particularly among girls.

The disruption of STEM education hampers the development of critical skills necessary for technological advancement and economic growth.

5.3 Legal Silence or Inadequacy in Emergency Responses

The legal framework governing education in Nigeria has been inadequate in addressing the challenges posed by insecurity. While the Universal Basic Education Act mandates the provision of free and compulsory education, it lacks provisions for emergency responses to situations like school attacks and kidnappings.

This legal gap leaves schools vulnerable and without clear guidelines on how to operate during periods of insecurity, further exacerbating the education crisis.

5.4 Funding Cuts and Policy Inconsistency

The economic downturn in Nigeria has led to funding cuts in the education sector. For example, in Kaduna State, over 200,000 fewer primary school pupils were recorded in the 2022/2023 academic session compared to the previous year, largely attributed to insecurity.

Policy inconsistency, including the suspension of school programs and lack of coordinated responses, has further undermined efforts to provide quality education.

The combined effects of insecurity and economic challenges have severely impacted the implementation of science and technology education in Nigeria. School closures,

disruption of STEM programs, legal inadequacies, and funding cuts have created a crisis that requires urgent legal and policy reforms to ensure the continuity and quality of education.

6. Comparative Jurisprudence and Legal Models

6.1 Kenya

Kenya's legal framework supports the integration of Information and Communication Technology (ICT) in education through several key legislative instruments:

For instance, section 95(3)(k) of the Basic Education Act (2013) mandates the promotion, development, management, and governance of education through ICT integration and the establishment of an Education Management Information System (EMIS). This provision aims to enhance the efficiency and effectiveness of educational administration and delivery.

Again, the Science, Technology and Innovation Act (2013) establishes the National Commission for Science, Technology, and Innovation (NACOSTI), which is responsible for regulating and assuring quality in the science and technology sector. It provides for the promotion of research, innovation, and entrepreneurship to meet the ICT needs of learners and trainees. Specifically, NACOSTI advises on science education and innovation at both basic and advanced levels.

Furthermore, ICT in Education and Training Policy (2021) outlines strategies for integrating ICT into education, training, and research. It emphasizes the need for infrastructure development, capacity building, and the adaptation of digital content for learners and trainees with special needs. The policy also addresses issues related to access, security, and ethical considerations in the use of ICT in education.

These legal frameworks collectively aim to transform Kenya's education system by leveraging ICT to improve access, quality, and relevance of education.

6.2 India

India's legal and policy frameworks facilitate public-private partnerships (PPPs) in education, particularly in the context of technological advancements.

For example, the India's Right to Education Act, 2009 (Section 3(1)) mandates free and compulsory education for children aged 6 to 14 years in a neighbourhood school till completion of elementary education. It allows for the establishment of private schools and encourages collaboration between the public and private sectors to improve educational access and quality.

More so, the National Education Policy (2020) envisions a transformative approach to education, emphasizing the integration of technology to enhance teaching and learning processes.

It encourages the development of digital infrastructure and the use of online platforms to facilitate education, especially in remote areas. The policy also promotes partnerships with private entities to bring innovation and efficiency into the education sector.

These frameworks provide a conducive environment for Public Private Partnerships (PPPs) in education, enabling the incorporation of technology to address educational challenges and improve outcomes.

6.3 South Africa

The Constitution of South Africa, for instance ensures the right to education, with specific provisions addressing challenges in rural and unsafe areas. Section 29 (Constitution of South Africa) guarantees the right to education, including adult basic education. It imposes an obligation on the State to take reasonable measures to make further education progressively available and accessible.

Again, the National Education Policy emphasizes the need to address disparities in education, particularly in rural and underserved areas. It advocates for the provision of adequate resources, infrastructure, and support to ensure equitable access to quality education for all learners.

These legal provisions aim to overcome barriers to education in rural and unsafe areas, ensuring that all children have the opportunity to receive quality education.

The comparative analysis of Kenya, India, and South Africa reveals diverse approaches to integrating technology into education through legal frameworks. While Kenya emphasizes the integration of ICT through specific legislative provisions and policies aimed at enhancing educational management and delivery; India facilitates public-private partnerships to infuse technology into education, supported by legal mandates and policy encouragement. On the other hand, South Africa focuses on constitutional guarantees and legal enforcement to ensure equitable access to education, particularly in rural and unsafe areas.

These models offer valuable insights for Nigeria in reforming its legal frameworks to support science and technology education, particularly in the context of insecurity and economic challenges.

7. Strategic Legal Reforms for Nigeria

7.1 Enactment of a Science and Technology Education Reform Bill

A proposed Science and Technology Education Reform Bill aims to overhaul Nigeria's legal framework governing STEM education. This bill seeks to establish a comprehensive legal basis for integrating science and technology into the educational system, ensuring that policies

are aligned with contemporary technological advancements and educational needs. While the specific details of the bill are still under discussion, its introduction signifies a commitment to reforming the education sector to meet the challenges of the 21st century.

7.2 Legal Mandates for STEM-Focused Teacher Training

The National Commission for Colleges of Education (NCCE) is responsible for formulating and implementing policies for teacher education in Nigeria. Established by Decree No. 13 of 1989, the NCCE defines minimum standards for all programs of teacher education and accredits their certificates and other academic awards. This mandate ensures that teacher training programs are aligned with national educational goals, including the emphasis on science and technology education.

7.3 Legal Mandates for Digital Infrastructure in Secondary Schools

The National Senior Secondary Education Commission (NSSEC), established in 2021, is tasked with regulating and intervening in Nigeria's senior secondary education sector. One of its mandates is to promote the integration of technology into teaching in secondary schools. This includes the establishment of e-libraries and the provision of digital resources to enhance the learning experience. The NSSEC's efforts aim to bridge the digital divide and ensure that students have access to modern educational tools.

7.4 Legal Mandates for Curriculum Modernization *via* Legislative Approval

Curriculum development in Nigeria is overseen by the National Council on Education (NCE), which comprises federal and state commissioners of education. The NCE formulates policies and guidelines for curriculum implementation at all levels of education. Any significant changes to the curriculum, especially those involving the integration of new subjects or teaching methods, require approval from the NCE. This ensures that curriculum reforms are standardized and align with national educational objectives.

7.5 Framework for Federal-State Coordination during Crises

The Universal Basic Education Commission (UBEC) is responsible for coordinating the implementation of the Universal Basic Education (UBE) program throughout Nigeria. Established by the UBE Act of 2004, UBEC works closely with state governments to ensure the effective delivery of basic education. In times of crises, such as insurgencies or economic downturns, UBEC collaborates with state education boards to adapt and implement emergency education strategies, ensuring continuity in education delivery.

7.6 Protection Laws for Online Learning

The Nigerian government has enacted various laws to protect online learning environments. For instance, the Nigerian Communications Commission (NCC) regulates internet services to ensure that online platforms are secure and accessible. Additionally, the National Information Technology Development Agency (NITDA) oversees the development and implementation of policies to promote the use of information technology in education. These agencies work together to create a safe and conducive environment for online learning, addressing issues such as data privacy, cyber security, and equitable access to digital resources.

8. Institutional and Stakeholder Roles in Legal Reform

This section examines the roles of key institutions and stakeholders in driving legal reforms for science and technology education in Nigeria.

8.1 Role of the National Assembly

The National Assembly plays a pivotal role in shaping Nigeria's educational landscape through legislative actions. Recent initiatives include:

- **Almajiri and Out-of-School Children Act (2023):** This legislation mandates free and compulsory education for all children, including the Almajiri and other out-of-school children. It establishes a national database to track and monitor out-of-school children, sets up rehabilitation centers, and criminalizes sending children to beg or engage in child labor. The Act aims to ensure that all children have access to quality education.
- **Secondary Education Commission Act (2023):** This Act regulates and oversees senior secondary education in Nigeria, setting standards and curricula, accrediting and monitoring institutions, and conducting assessments and examinations. It seeks to enhance the quality and relevance of secondary education.
- **House Committee on Basic Education and Services:** This standing committee provides legislative oversight on basic education policies and programs. It works alongside the Universal Basic Education Commission (UBEC) and the Federal Ministry of Education to ensure effective implementation of educational reforms.

8.2 Role of the Federal Ministry of Education

The Federal Ministry of Education is instrumental in implementing and coordinating educational policies and reforms. Some of its key initiatives in this regard include but are not limited to Six-Point Initiatives for Education Reform which prioritize STEMM (Science, Technology, Engineering, Mathematics, and Medical Sciences) education, reducing the

number of out-of-school children, enhancing Technical and Vocational Education and Training (TVET), advancing girl-child education, harnessing data and digitalization, and strengthening quality assurance mechanisms. These priorities align with the Renewed Hope Agenda of President Bola Ahmed Tinubu's administration. The 3 Million Technical Talent (3MTT) Programme, is another initiative aimed at training three million Nigerians in technical and digital skills by 2027.

8.3 Role of the Judiciary

The judiciary plays a critical role in interpreting and enforcing education rights, especially during emergencies. For instance, the judiciary has intervened in cases where education rights were threatened, ensuring that policies and actions align with constitutional provisions. Courts have also mandated the government to provide adequate facilities and resources to schools, emphasizing the right to quality education. Court decisions have again set precedents that influence educational policies, such as rulings on the rights of children with disabilities to access education and the obligation of the government to provide inclusive education.

8.4 Role of Universities and Legal Clinics

Academic institutions conduct research on education policies, providing evidence-based recommendations for reforms. They engage in policy advocacy to influence legislative and executive actions. More so, university-based legal clinics offer legal assistance to underserved communities, raising awareness about education rights and advocating for policy changes.

8.5 Role of Civil Society Organizations (CSOs) and Non-Governmental Organizations (NGOs)

CSOs and NGOs are vital in promoting educational reforms. These organizations advocate for policy changes, mobilize communities, and raise awareness about educational issues, including the need for legal reforms. They also monitor the implementation of educational policies and programs, holding the government accountable for commitments to education rights and quality.

8.6 Role of the Tech Industry

Tech companies collaborate with the government to provide digital tools and platforms that enhance learning experiences, such as e-learning platforms and digital classrooms. Again, the tech industry offers training programs to equip students and educators with digital skills, preparing them for the demands of the digital economy.

9. Conclusion

This section synthesizes the findings from previous discussions and proposes actionable steps to reform Nigeria's legal frameworks for science and technology education, aiming to foster innovation and resilience amidst current crises.

The Nigerian education system faces several challenges that hinder the effective delivery of science and technology education: inadequate Infrastructure; outdated curriculum, insufficient teacher training; and limited access to technology.

10. Recommendations

To address these challenges, the following legal reforms are proposed:

- **Enactment of a Science and Technology Education Reform Bill**: This bill would provide a comprehensive legal framework for integrating science and technology into the education system.
- **Curriculum Modernization:** Legislation should mandate the periodic review and updating of the curriculum to ensure it aligns with current technological advancements and industry needs.
- **Teacher Training and Development:** Laws should be enacted to establish continuous professional development programs for teachers, focusing on science and technology education.
- **Digital Infrastructure Investment:** Legal provisions should be made to allocate funds for the development and maintenance of digital infrastructure in schools.
- **Public-Private Partnerships:** Encourage collaborations between the government and private sector to invest in educational technology and innovation.
- **Rights-Based, Innovation-Driven, and Legally Protected Science Education System**

It is imperative to recognize education as a fundamental human right, as enshrined in international conventions and national constitutions. A rights-based approach ensures that all individuals have access to quality education, irrespective of their socio-economic status. Furthermore, fostering an innovation-driven education system will equip students with the skills necessary to thrive in a rapidly evolving technological landscape. By implementing these legal reforms, Nigeria can build a resilient and forward-looking education system that meets the challenges of the 21st century.

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