Issues with STEM Education in Nigeria

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Abstract

Science, Technology, Engineering and Mathematics (STEM forthwith) Education is a planned education meant for the development of science-inclined programmes globally. STEM Education is integrated into the Nigerian education system. The implementation of the STEM Education is facing a lot of problems in Nigerian educational institutions. This paper examined the various problems militating against the implementation of STEM education in educational institutions. Secondary data were used in this paper. Content analysis was employed to reduce the size of the literature. Resources were collected from print resources and online publications. Poor funding, inadequate science teachers, shortage of infrastructure facilities, shortage of instructional resources, insecurity, corruption and brain drain were identified as major problems facing the implementation of education in Nigerian educational institutions. Based on these problems identified, the paper put forward the following measures; the Government should increase the funding of education in the educational institutions; the Government should employ more professional science teachers and deploy them to the schools across the country. The government should provide modern infrastructure facilities in all educational institutions. The government should provide adequate instructional resources to all schools. The government should increase the salaries of teachers in all educational institutions.

Keywords: Corruption, STEM-Education, Schools, Science, Technology

Introduction:

STEM Education is an organized science education programme designed to produce manpower for the 21st-century industrial and information technology communication-driving world. The objectives of the STEM programme include inculcating in the learners' practical education that is meaningful to society; providing industrial education that will make the learners fit into the industrial revolution of the 21st century; providing innovative education that will make learners problem solvers; providing experiential education to the learners; and to provide a transformative education through scientific methods (Olamoyegun et al., 2021).

STEM is an acronym for Science, Technology, Engineering and Mathematics. According to Olorundare (2010), the inclusion of engineering into STEM Education can be justified by the mere fact that young children tend to be engineers first; building, making and doing projects long before they can explore scientific principles that allow their buildings to stand or “canals” between puddles to carry water.

STEM helps people to think and reason in a logical manner, solve problems encountered on a day-to-day basis, develop social skills through proper handling of objects and equipment, develop social skills by establishing friendships while working cooperatively in groups and helps satisfy curiosity through opportunities in carrying out investigations (TESSA, 2011 & STAN, 2019).

STEM education is used in research, policy issues, teaching for innovation, problem-solving and prospects. STEM is needed towards globalization demands. The complexity of today's world requires all people to be engaged with a new set of core knowledge and skills, to solve difficult problems like the novel coronavirus pandemic, gather and evaluate evidence and make sense of the information they receive from varied print and increasingly digital media. It is therefore clear that the learning and doing of STEM helps develop skills and prepare students for a workforce where success results not just from what one knows but what one can do with the knowledge (Sulai & Sulai, 2020; David et al., 2018).

STEM education is the bedrock of innovative and highly productive future workforces, integral to the economic development of the continent. In line with this, the African Union Agenda 2063, identifies one of its goals as raising well-educated citizens and skills revolution underpinned by Science, Technology, and Innovation. Nigeria's government has initiated many arrangements and has done many collaborative programs with the objectives of drawing from the technological experience of many developed countries to build its STEM education program for its teeming youths across the country especially those in the educational institutions (Ogunode 2020). Sulai & Sulai (2020) and Olorundare (2010) submitted that the inclusion of engineering into STEM Education can be justified by the mere fact that young children tend to be engineers first; building, making and doing projects long before they can explore scientific principles that allow their buildings to stand or "canals" between puddles to carry water.

The relevance of STEM education to social, economic and technological advancement cannot be underestimated. The knowledge of science, technology, engineering and mathematics combined lends to economic and national development. The knowledge is used to harness the forces of nature and to transform the raw resources with which nature endows man into goods and services for a better quality of life. The knowledge, skills and competencies in STEM affect people's lifestyles. It affects the way people eat, drink, travel, work, lead, play and sleep. It also carries along environmental implications such as pollution (Sulai & Sulai, 2020). STEM Education is a planned education meant for the development of science-inclined programmes globally. STEM Education is integrated into the Nigerian education system. The implementation of the STEM Education is facing a lot of problems in Nigerian educational institutions. This paper examined the various problems militating against the implementation of STEM education in educational institutions.

Problems facing STEM Education in Nigeria:

There are many problems facing the implementation of STEM education programmes in Nigerian schools. Some of these problems include; poor funding, inadequate science teachers, infrastructure facilities, insecurity, corruption and brain-drain. A brief about everyone is as follows:

Poor funding: Poor funding is a major problem militating against the effective implementation of STEM education in Nigerian schools. The budgetary allocation to the programme annually is not adequate to implement the programme. There are also poor financial contributions from the private sector and international institutions toward the execution of the STEM education programme. The inability of the government to faithfully implement the 15%-20% of annual total GDP UNESCO recommendations to education has negatively affected the implementation of the programme of STEM Education.

Inadequate science teachers: Another problem hindering the effective implementation of education in Nigerian schools is the problem of inadequate science teachers. Ajemba et al. (2021) defined science teachers are professionals trained to teach science-inclined subjects in schools. These professionals are specialists in the fields of Biology, Chemistry, Physics and Mathematics. Unfortunately, these science teachers are short in supply in most Nigerian educational institutions. At the tertiary institutions, observing their inadequacies while at the secondary schools education, Ajemba et al. (2021) maintained that science teachers are not enough. Olamoyegun et al. (2021) claimed that the shortage of science teachers is a problem affecting the implementation of the science curriculum in basic education schools.

Shortage of Infrastructure Facilities: Shortage of infrastructure facilities is another big problem in the implementation of STEM education in schools in Nigeria. Lawinsider (2020), infrastructure facilities are defined as any works, structures, or improvements on land or water, excluding Ancillary Project Area Infrastructure. These facilities, whether directly or indirectly, provide services or other benefits to the general public, the Island community, offices, depots, and staff housing for or on behalf of the Commonwealth of Australia, the State, any local government, statutory authority, or government-owned corporation, electricity generation, distribution, or transmission facilities, public education facilities, public health facilities, police facilities, emergency facilities, transport facilities such as pedestrian paths, cycle ways, transfer facilities, freight storage and logistics areas, bus stops and layovers, ferry stops, taxi stops, sewage pump stations and sewerage treatment facilities, solid waste transfer and treatment facilities, water supply pump stations, raw water storage, clear water storage, dams, weirs, bore field infrastructure, items listed in section 24KA(2) of the Native Title Act to the extent that they are not Ancillary Project Area Infrastructure and any IBIS Store. However, this definition excludes Social Housing.

The importance of infrastructural facilities in educational institutions according to Ogunode & Agwor (2021) includes aiding the effective delivery of administrative functions in schools; making the delivery of services fast and reliable; enabling teachers to deliver lessons fast; infrastructural facilities provide conducive working environment for both teachers and students; infrastructural facilities enable learners to learn at ease and learn well; infrastructural facilities enable the teachers to teach well, prepare their lessons, and deliver them online (ICT). The importance of school infrastructural facilities in the realization of educational goals cannot be underestimated. School facilities aid the delivery of the teaching and learning process in the schools. The school offices provide a conducive working environment for teachers, the classrooms help the learners to learn while the school fence protects students, the teachers, and school administrators from criminals. The school plant protects the entire human resources from the sun, rain, heat cold, and snow (Ogunode & Agwor, 2021; Ogunode & Jegede, 2021). Unfortunately, these facilities aiding the implementation of STEM education in schools are not adequate in supply. Ugo & Akpoghol (2016) observed that some experiments in science require electricity.

Generally, power supply from the national grid is epileptic. Unfortunately, most secondary schools are in rural areas and have no stand-by generators. Hence, electricity as a topic may not be adequately covered so external examination questions set in this area and other related areas might be difficult for the students to answer. Ezeudu (2013) opined that most schools in Nigeria have no laboratory personnel to assist in the process of teaching and learning science. Where they are not available the work of the science teacher is doubled and highly demanding so the teaching and learning of any science subject may be hindered.

There are several challenges arising from the lack of infrastructure according to (Echono, 2023). These include:

i. **Inadequate laboratory facilities**. Research, especially in fields such as science, engineering, and medicine, heavily relies on well-equipped laboratories. The absence of state-of-the-art laboratory facilities limits researchers' ability to conduct experiments, analyze data, and make breakthroughs. Second,
ii. **Limited access to information**. The lack of modern libraries and online resources limits researchers' access to up-to-date information, hindering their ability to review existing literature, build upon previous studies, and remain at the forefront of their fields.
iii. **Unreliable electricity supply**. Frequent power outages disrupt research activities and pose challenges for running experiments, storing sensitive samples, and maintaining essential equipment.
iv. **Inadequate internet connectivity**. Access to high-speed internet is crucial for collaboration, data sharing, and communication with the global scientific community. Slow or unreliable internet connections hinder researchers' ability to engage in international research networks.
v. **Poor transportation systems**. Poor transportation systems make it difficult for researchers to travel to conferences, workshops, and collaborative meetings. This isolation limits exposure to new ideas and impedes knowledge exchange (Echono, 2023).

Shortage of Instructional Resources: Instructional materials are educational resources assembled by the teachers to implement teaching programmes in the classroom. Instructional materials are special educational resources that aid the teachers in delivering the lesson (Ogunode, & Josiah, 2023). Instructional materials as objects or devices that assist teachers in presenting their lessons logically and sequentially to the learners (Isola, 2010). Ogunode et al. (2023) observed that instructional materials are used in all forms of educational institutions. The resources are influencing the implementation of teaching, research and community service in the various tertiary institutions. In secondary schools, instructional materials are supporting teaching and learning. Teachers in educational institutions teach well with the deployment of instructional materials. Instructional materials serve as a channel between the teacher and the students in delivering instructions. They may also serve as the motivation for the teaching-learning process. Resources are regarded as those facilities or materials that are used to enhance effective teaching and learning of STEM. Resources are the total of everything used directly or indirectly for educational training to support facilities or encourage the acquisition of knowledge, competence, skill and know-how (Okonkwo, 2009). It is used to get the attention of the students and eliminate boredom. Lecturers used instructional resources for the implementation of teaching programmes in tertiary institutions.

Okonkwo (2009) noted that most science teachers teach their subjects without teaching aids. Most secondary schools lack basic laboratory apparatus, such as magnetic boards, resonance kits, iron filling, bar magnetic, projectors and accumulators. The science laboratories across the country are inadequately furnished, where they exist. Resource utilization is another factor that affects students' performance in STEM subjects.

Insecurity: Insecurity in Nigeria has affected the implementation of science education in Nigerian schools. Insecurity in Nigeria has led to school closures (Ogunode, & Ukozor 2022; Ogunode et al. 2021a). This school closure has affected all forms of educational institutions in Nigeria. Insecurity has led to the death of teachers, students and school administrators. This insecurity also affected the implementation of curriculum and STEM education in schools across Nigeria (Ogunode, Umeora, & Olatunde-Aiyedun, 2022; Ogunode, & Chijindu, 2022).

Corruption: Corruption in the management of education in Nigeria has affected the implementation of education programmes such as education, girl-child education and gender-education programmes. Adebanjo (2014) opined that corruption is an immoral and criminal act, a mindset to do wrong and a disposition to exhibit dishonest behaviour by committing an offence against morality, the law and the ethical norms of the society. Accordingly, UNCAC noted that corruption undermines the rule of law, quality of life and democratic principles, leads to violation of human rights, threatens human security and distortion of markets. Corruption in the educational institutions has hindered the development of education programmes in Nigeria (Nwankwo & Nweke, 2016; Ogunode & Johnson, 2021). Corruption has led to the diversion of funds meant for the execution of education programmes and corruption has led to a shortage of facilities that directly slow down the implementation of programmes (Ololube, 2016; Madaki, 2019; Ogunode & Johnson, 2021; Ogunode & Stephen, 2021). Suleman (2005) and Ogunode et al. (2021b) also notes that corruption coupled with economic and political mismanagement has led to instability and gross abuse of power, led to decaying infrastructure, inadequate staffing, poor and failing education standards, the disappearance of grants, trust funds, loans and entire project without a trace.

Brain-drain: Brain-drain is another challenge to the development of STEM education in Nigerian schools. Brain drain is the massive migration of professionals from one sector of the economy to another sector of the economy or movement to developed countries for a better offer. Due to poor motivation of science teachers in educational institutions, many science-inclined teachers are moving out to other institutions offering better welfare and salaries. Olatunde-Aiyedun and Ogunode (2021) identified brain drain as a problem affecting the implementation of science education in Nigerian education institutions.

Conclusion:

This paper examined the various problems militating against the implementation of STEM education in educational institutions. Poor funding, inadequate science teachers, shortage of infrastructure facilities, shortage of instructional resources, insecurity, corruption and brain drain were identified as major problems facing the implementation of education in Nigerian educational institutions.

Recommendations:

Based on these problems identified, the paper put forward the following measures;

i. The government should increase the funding of STEM education in educational institutions;
ii. The government should employ more professional science teachers and deploy them to schools across the country;
iii. The government should provide modern infrastructure facilities in all educational institutions;
iv. The government should provide adequate instructional resources to all schools;
v. The government should increase the salaries of teachers in all educational institutions;
vi. The government should address all issues breeding insecurities in the country and deploy technologies and infrastructure facilities to curb corruption practices in education management.

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