Towards a comparative education: **a wake-up call to developing quality STEM education in Nigerian public schools.**

Quality education is pivotal in developing a nation's economy, its citizenry, and the well-being of the people. Some of the mandates of the Federal Ministry of Education (FME) (2019) in Nigeria are to prescribe and maintain uniform standards of education throughout the country, control and monitor the quality of education and develop curricula and syllabuses at the national level. To understand the role of education and how the government provides quality education for students, we can look at it from the lens of comparative education. This can be between countries and within a country, however, this article would explore comparative education from the perspectives of the quality of education provided to children in public schools in Nigeria. The article will focus on science, technology, engineering and maths (STEM) education in public secondary schools in Nigeria and draw upon interviews with STEM teachers, school principals, university academics and STEM employers and experts.

Educational systems can be borrowed from other parts of the world and developed to form curricula contents that may enhance a country's educational system and identity. Nigeria may have borrowed from the British educational system and other parts of the world and through comparative education can reform and develop its educational provisions, especially opportunities to develop STEM education in public schools. Interviews with STEM teachers and principals from public schools show that education in private secondary schools in Nigeria is better than in public schools due to the availability of resources, infrastructures, and in some instances, qualified teachers with experience in international education systems. The science teachers from public schools affirm that teaching science practical and STEM subjects is very difficult due to the lack of relevant resources and laboratories despite the teachers being enthusiastic and willing to support students. My experience of training teachers in the UK and engaging in international work shows that teachers require the right environment to flourish and effectively utilise their subject and pedagogical content knowledge (PCK) to support the learning of students. This includes having the required training and development, resources and support of senior school leaders. But where school principals are not given due support to engage their leadership skills in transforming their workforce, this becomes an issue to contend with.

The richness of the quality of education should embrace a comparative perspective and how countries can develop their educational systems through reviewing, restructuring, redesigning and remedying existing curricula to make them fit for purpose but especially one that is inclusive and meets the needs of all children. Until this process is achieved, developing the future generation of STEM specialists in Nigeria will be in jeopardy as the majority of students attend public schools that cannot support STEM education experience. This does not take into consideration over 20 million children that are out of school in Nigeria (UNESCO, 2020). The majority of families educate their children in public schools because they cannot afford fee-paying private schools. In contrast to the UK where curricular provisions in some good public schools may be comparable to private schools and families may choose to educate their children in public schools despite having the means to educate them privately.

The current state of STEM education in public schools.

Extensive discussions with teachers and principals show that stakeholders need to do more to improve the standards and quality of education in Nigerian public schools as the conditions of learning, infrastructures, and science labs (when it is available) are in deplorable conditions, and many instances, basic teaching facilities are lacking. Due to the lack of resources and labs, most teachings that should involve practical work are done theoretically, and this lack of exposure to understanding how scientists work can have an impact on the type of skills students can develop even when they go on to higher education. For example, Aina (2022) states that most STEM graduates in Nigeria lack critical thinking, problem-solving, emotional intelligence, creativity, cognitive flexibility and service orientation. This prevents them from engaging in STEM careers due to the lack of technical knowledge and skills and may resort to taking up other jobs. The implication is that the country will lack qualified STEM experts to fill the workforce required for economic development.

Suggested actions to improve STEM education.

Based on my interviews with teachers, principals, university academics, government education officials and STEM experts, an effort is required by all stakeholders to develop quality STEM education in Nigerian schools. This is echoed by Aina (2022) who attributes this to inadequate funding, lack of creativity and employability skills and low research output. In the same vein, a university academic with a wealth of experience in the industry involving Science and Information Technology said '*STEM education in Nigeria is not properly developed'* suggesting that a lot more is needed to improve this area. He said that measures could be put in place so that universities can engage with schools and create opportunities for knowledge exchange between teachers and pupils and academics. However, government input in the form of funds to provide relevant infrastructures will be required to achieve this. This is corroborated by teachers who said that the *'government needs to step up'* to achieve the objective of the curriculum and this ties in with the mandate of the Federal Ministry of Education to provide quality education. The teachers unanimously echoed that *'we need resources, equipment and IT suites to teach students the expected practical to promote their investigative skills'.* The teachers suggest that if schools are provided with one equipped laboratory and a functional IT suite to serve the whole school population, they can take turns and teach students in these facilities. Creating such an opportunity may help to develop scientific knowledge and investigation, critical thinking skills and prepare both the teachers and students for the Fourth Industrial Revolution (4IR).

Teachers and principals are concerned about training and development because the majority of the teachers have not attended one. Continuing professional development (CPD) for teachers, especially in the aspect of pedagogy is lacking and may require improvement. In addition, efforts should be made by involving STEM organisations and employers to contribute towards developing the STEM provisions in the curriculum. For example, in the UK, organisations such as the Association for Science Education, the Institute of Physics, the Royal Society of Chemistry and London Mathematical Society all contribute to developing and supporting the subject and pedagogical knowledge of teachers and promoting the learning experience of students.

Stakeholders could provide funds to develop resources for teaching and learning and engage with schools, encouraging NGOs and STEM organisations to invest their resources and

expertise in supporting schools. For example, STEM employers in Nigeria have experts who can go into schools as 'STEM ambassadors' to deliver sessions to students as seen in England. Students can be allowed to go on school trips to STEM organisations/industries and observe how scientists work and learn from them and develop skills such as problem-solving, graphic design, coding, and scientific investigation. Some of the STEM experts I interviewed, such as the Information Technology (IT) specialist would be interested to work with schools and support students in developing the relevant knowledge and skills in the field of IT but they are not aware of how to engage with schools because they have not been approached. This study, therefore, creates an awareness that STEM experts can be involved in supporting schools, but stakeholders need to explore it.

Conclusion

Cowen (2000) suggests that the most important first step in the construction of a good comparative education is 'reading the world'. This implies understanding the political, economic and historical worlds in which we live and where education takes place. To drive this notion means that the government of any nation is responsible for providing quality and inclusive education for all children except where families opt to educate their children in fee-paying or private schools. Providing quality education fulfils the United Nation's Sustainable Development Goal 4 (UNSDG) (UN, 2022) and this can also have a positive impact on other UNSDG goals such as 1 (no poverty), 8 (decent work and economic growth) and 9 (industry, innovation and infrastructure). Therefore, this article is a wake-up call to all stakeholders to engage in developing STEM education in Nigerian public schools by comparing STEM provisions across the globe and re-assess curricula contents, supporting learning and creating opportunities for students to explore how working scientifically can be relevant to their aspirations in STEM careers. This includes developing the subject and pedagogical content knowledge of teachers (Shulman, 1986) so that they can promote students' learning and understanding of the nature of science.

The author would like to thank the Institute for Life course Development (ILD) for providing the funds to embark on this study which has created an opportunity to understand the current situation of STEM education in Nigeria and what can be done to improve. It will also pave the way for an extensive study of STEM in Sub-Saharan Africa.

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