INTEGRATING ARTIFICIAL INTELLIGENCE COMPETENCIES INTO ELECTRICAL/ELECTRONIC TECHNOLOGY EDUCATION CURRICULA FOR GLOBAL COMPETITIVENESS: A FOCUS ON UNIVERSITIES IN SOUTHWEST NIGERIA

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Abstract
The rapid advancement of Artificial Intelligence (AI) is repositioning the skill demands of the global workforce in Nigeria. This shift necessitates a re-evaluation and restructuring of higher education curriculum. This paper examines the integration of AI competencies into Electrical/Electronic Technology Education programmes in universities in southwest Nigeria, with a view to enhancing global competitiveness. The paper identifies existing gaps in technology education curricula, limited infrastructure, inadequate training and many other factors that constitute the consequence of the lack of integration of AI into the curriculum of Technology Education in Nigerian universities, particularly, universities in southwest Nigeria. The paper also proposes strategic framework for curriculum reform, incorporating AI literacy, practical applications of AI in Electrical/Electronic context and industry collaboration. The paper affirms, that infusing AI competencies into Electrical/Electronic Technology Education curriculum is crucial for producing graduates, that will be capable of meeting evolving global technological standards, with a view to contributing to national development.

Key words: Artificial intelligence, electrical/electronic technology education, curriculum reform, global competitiveness, southwest Nigeria.

Introduction

The rapid development and breakthroughs in technology have reconceptualized global competitiveness, particularly in technical education and engineering. Artificial intelligence (AI) is no longer viewed as a concept of the future but as a significant driver of today's innovation and economic development across industries, including those in Nigeria. To ensure Nigeria remains globally competitive and continues to produce industry-ready graduates, it is imperative to align higher education curricula particularly in Electrical/Electronic Technology (EET) education with evolving global technological trends.

Higher institutions, especially universities in Southwest Nigeria, are known for their robust, theory-based curricula in technical and technology education as well as in engineering. The problem, however, as emphasized by Alabi and Arogundade (2020), is that these curricula largely rely on conventional methods, with little or no emphasis on contemporary innovations such as artificial intelligence and its integration into technology education. This gap has resulted in skill deficiencies, reduced employability, and limited awareness of global technological advancements thereby diminishing the potential

of Nigerian graduates to compete effectively in today's digital economy.

This paper, therefore, examines the importance, need, and strategies for integrating AI competencies into Electrical/Electronic Technology Education curricula in universities across Southwest Nigeria and, by extension, across the country. It highlights the challenges, global trends, and opportunities for curriculum reform and modernization that can position Nigerian graduates for excellence in the dynamic, AI-driven global economy of the 21st century.

Review of Related Literature

Artificial Intelligence was conceived in the 1950s, by Alan Turing, the term AI was first used as far back as 1956 at a conference in New Hapshire, USA. Initially it was just the use of machines for problem solving and symbolic reasoning. Today, AI encompasses a range of technologies that enable machines to simulate human intelligence, including machine learning, natural language processing, robotics, and computer vision (Russell & Norvig, 2021). In the context of Electrical Electronics Technology Education, Salami & Tijani (2021) pointed out that AI can now be used for automation, predictive maintenance, intelligent systems, and smart grids, metering and consumption, fault detection and diagnosis, renewable energy systems, signal processing and reduction, circuit design and simulation, automation and control systems, Intelligent tutoring, and other trending skills which are now demanded across industries.

Prominent Educational institutions all over the western world, have incorporated AI into Technology, Engineering, and many of their programs. Countries such as the United States, Germany, UK, China, among others, have developed national strategies in AI that highlight curriculum transformation, improvement, and workforce development (OECD) 2021. A good instance is the introduction of AI+X project, which was launched at the MIT (Massachusetts Institute of Technology), aimed at blending AI into all their courses, including education, engineering, and all other courses offered by the institution.

However, only very few universities offer AI related courses in Nigeria. These courses, when offered, are just treated as theory, neglecting or deliberately ignoring the practical aspect of AI. Majority of Electrical and Electronics programs in universities, still stick to analog systems and out of date technologies (Onyema et al 2022; Akinola &Arulogun 2021). In addition, there exist very limited academic literature, as regards teaching and integrating AI into educational curricula in Nigeria. All these aforementioned factors consequently results in the inability of Nigerian Universities incorporate AI into their curricula.

The NUC benchmark curriculum for EET makes minimal reference to emerging AI technologies. As a result, graduates are often unprepared for roles that require intelligent systems design, data analytics, or automation (Adegbite & Olayemi, 2020; NUC, 2018). Employers increasingly seek graduates with AI literacy, coding skills, and systems integration competencies (Okebukola, 2021; Ifijeh & Yusuf, 2020).

Theoretical Framework

This paper is based on the Competency-Based Education (CBE) model. CBE is based on learning outputs, that is, what students can do after completing a course. When it comes to integrating AI, such skills would include algorithmic thinking, the ethics of AI, and the use

of AI tools for problem solving. Another applicable structure is the Technological Pedagogical Content Knowledge (TPACK) model, which advocates for the integration of content with technological resources, and pedagogy with technology (Mishra & Koehler, 2006). This template emphasizes the importance for EET teachers to acquire new skills to deal with the AI-content. Integrating AI competencies into education is crucial for developing 21st century skills, such as critical thinking, collaboration, creativity and digital literacy. The UNESCO (2021) report on AI and education guidance for policy makers, assert that, embedding AI competencies in curricula prepares learners for the evolving world of work and lifelong learning, in a technology-driven economy. The lack or absence of these skills may lead to widening of the digital divide, reducing productivity, and stifling innovation. These will consequently lead to a serious hindrance in national development and global competitiveness.

Challenges facing the integration of artificial intelligence into the curricula of technology education in universities in southwest Nigeria.

There are many constraints and hindrances militating against the proper integration of AI into the curriculum of Technology Education in Nigerian Universities. Some of these challenges include; infrastructural limitations, shortage and even lack of qualified instructors, and policy gaps, lack of adequate laboratories in universities, slow or no internet connectivity, or computing resources (Olumide & Ige, 2022). Other limitations include; poor implementation of policies, erratic power supply, high cost of digital equipment, lack of sufficient funding, continued use of outdated curriculum, rural-urban divide, faculty resistance to change, among many others.

Benefits of integrating artificial intelligence into the curriculum of technology education in universities in southwest Nigeria.

There are numerous benefits that can be accrued, if AI is successfully implemented and integrated in the curriculum of Technology Education in Nigerian Universities. Some of these benefits include; improvement in teaching and learning, Learning experience that are personalized (individualized instruction), improved development of the curriculum, data driven decision making, grading and assessment tools that are AI powered, possibility of virtual teaching assistants (VTA), closing learning gaps in rural areas, adequate preparation of students for the labour market, It promotes innovation and creativity, upgrades teacher professional development, it can help in early diagnosis and detection of learning disabilities, monitoring students' performance in real time, as well as others. Online AI platforms like Coursera, Google AI, and IBM Watson Academy also offer free resources that can be integrated into teaching and learning. International partnerships can also provide funding, training, and content support (World Economic Forum, 2023).

Strategies for integrating AI into the curricula of technology education.

1. Curriculum Redesign: A total reform of the curriculum and redesigning, to make provisions for the fusion of AI into courses that are offered in the programs.
2. Faculty Capacity Building: Institutions should offer training programs, certifications, and industry exposure for

lecturers, to enable them be abreast with the current trends in Education and AI.

3. Institutional Policy Reforms: Stakeholders such as institutions and government should advocate for national policies that mandate AI literacy as a prerequisite for graduating students.
4. Student Engagement: students should be encouraged to create AI clubs, organize coding camps, and encourage innovation through competitions, seminars, (World Bank, 2025)
5. Public-Private Partnerships: Institutions, government parastatals, Federal ministry of Education, and other stakeholders should collaborate with tech companies and NGOs for curriculum support and funding

Conclusion

To thrive in an AI-powered world, universities in Southwest Nigeria must revise their Electrical/Electronics Technology curricula to incorporate AI competencies aligned with global demands. This includes interdisciplinary collaboration, capacity building, and updated policies. Graduates must be equipped with knowledge and skills that align with current trends in artificial intelligence to compete globally.

Recommendations

Based on the discussions above, the following recommendations are suggested;

1. Authorities and school owners should set up AI research and innovation centers in universities.
2. Educational policy makers should update national curriculum criteria to include AI competencies.
3. Lecturers should be totally retrained on AI fundamentals, applications, and pedagogy.
4. AI tools such as Python, TensorFlow, and MATLAB should be incorporated hands-on, into laboratories and workshops
5. Interdisciplinary collaboration between engineering and computer science departments should be encouraged.
6. Access to online AI courses and certification programs for students and faculty members should be provided at little or no cost.

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