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Integrating Emerging Technologies into Electrical and Electronics Technology in TVET Curriculum: A Need for Employability and Future-Ready Skills

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ABSTRACT

Purpose: The rapid advancement of emerging technologies has reshaped the global workforce, making it imperative for Technical and Vocational Education and Training (TVET) institutions to adapt their curricula. This study explores the necessity of integrating these emerging technologies into electrical technology program within the TVET curriculum to enhance employability and equip learners with future ready skills. **Methods:** A descriptive survey design was used in the investigation. The survey included 120 participants comprising 25 teaching staff and 95 students from two purposively sampled TVET institutions who enrolled students in the Electrical Electronics Technology program. The entire population was purposively used for the study due to the limited number of student enrolment. A well-structured questionnaire was developed for the study as the instrument on the Integration of Emerging Technologies in Electrical Electronics program. The reliability of the instrument was tested and calculated using the Cronbach's Alpha Correlation statistical analysis which yielded a reliability coefficient of 0.83, indicating that the instrument was considered reliable. **Findings:** The findings showed that some emerging technologies such Artificial Intelligence (AI), the Internet of Things (IoT), robotics and renewable energy systems are currently missing from the TVET curriculum in Electrical Electronics Technology program. The study further revealed the potential benefits of incorporating these technologies into the TVET curriculum in Ekiti State. **Implications for Research and Practice**: the study recommends that TVET education should align their curriculum with these emerging technologies so as to better prepare students for evolving labour market, where technical proficiency in these technologies in modern innovations is critical. Further research needs to be done to assess the strategic approaches for effective incorporation of these technologies, to ensure that TVET graduates remain competitive and adaptable in the Fourth Industrial Revolution.

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Introduction

One of the most significant challenges TVET institutions face is the rapid pace of technological change. According to a report by the World Economic Forum (Subrahmanyam & Elson-Rogers, 2022). over 60% of the jobs of the future will be based on skills and technologies that are yet to be developed. TVET institutions, which are traditionally slower in updating curricula compared to the pace of change in industries, find it challenging to keep up (Jagannathan et al., 2019). This fast-paced evolution requires frequent revisions of curricula, which can be time-consuming and costly. Moreover, predicting which technologies will have a lasting impact and therefore should be included in the curricula adds an additional layer of complexity. Institutions must constantly monitor technological trends and adapt accordingly, a process that is both resource-intensive and requires forward-thinking leadership. Another challenge is ensuring that the curricula align with current and future industry needs. TVET institutions aim to produce graduates who are ready for the workforce, but the disconnect between education and industry often results in skills mismatches.

Several TVET graduates struggle to find employment because their skills do not align with industry requirements. This misalignment is partly due to the slow process of curriculum development and approval, which often lags behind industry advancements. Incorporating emerging technologies into TVET curricula requires substantial financial investment. New technologies often come with high costs, not only for the initial purchase of equipment but also for maintenance, software updates, and training of staff (Dixit & Ravichandran, 2023). For many TVET institutions, particularly in developing countries, these costs are prohibitive. Reports of International Labor Organization (ILO) in 2023 found that 75% of TVET institutions in low-income countries including Nigeria lack the financial resources needed to invest in new technologies (Winny & Ezenekwe, 2024). Consequently, these institutions continue to rely on outdated equipment and teaching methods, which do not prepare students adequately for the current job market. Even in more affluent regions, budget constraints can lead to difficult decisions about which technologies to prioritize in the curriculum, often resulting in compromises that dilute the quality of education. The successful integration of emerging technologies into TVET curricula also depends heavily on the preparedness and competence of the faculty. However, many educators in TVET institutions lack the necessary skills and knowledge to teach these new technologies effectively (Sriboonruang & Somsaman, 2025).

A recent literature survey involving international organization like OECD revealed that 60% of TVET teachers feel inadequately prepared to teach emerging technologies such as AI and IoT (Klassen, 2024). Continuous professional development is essential for teachers to stay updated with technological advancements. However, opportunities for such training are often limited, especially in underfunded institutions and developing countries. Moreover, there is often a lack of incentive for teachers to engage in professional development, particularly when it requires them to invest their own time and resources. This gap in faculty preparedness can result in poor-quality instruction, which ultimately affects the students' ability to gain relevant skills. Integrating emerging technologies into TVET curricula also places significant demands on infrastructure. Modern technologies often require specialized facilities, such as laboratories equipped with the latest software and hardware, which many TVET institutions do not have (Admiraal et al., 2023). For

example, the integration of IoT in the curriculum necessitates a robust IT infrastructure, including high-speed internet, servers, and cybersecurity measures, all of which require substantial investment. Additionally, the maintenance of such infrastructure poses ongoing challenges. Regular updates, repairs, and upgrades are necessary to keep the facilities up-to-date, which can be both costly and logistically challenging.

Various initiatives have been taken by the Asian Development Bank (ADB) for the upliftment of TVET institutions in Southeast Asia, which often struggle with inadequate infrastructure, education and training of TVET teachers and skills development for graduate employability, offering training in cutting-edge technologies (Alam & Sharmin, 2023; Panth et al., 2022). In regions where basic infrastructure such as electricity and internet access are unreliable, the challenges are even more pronounced. Another challenge is the resistance to change within institutions. Curriculum reforms often require a shift in mindset among both faculty and administration. However, there is often resistance to adopting new technologies due to fears of obsolescence, the perceived complexity of new systems, or the additional workload involved in learning and implementing new teaching methods (Moon & Choi, 2024). This resistance can slow down the process of curriculum reform and hinder the institution's ability to stay current with technological trends.

Previous studies conducted revealed there are emerging technologies in engineering education (Klaassen et al., 2017), teaching, learning and instructional strategies (Edeh et al., 2020). Some studies have also focused on general impact and awareness of emerging technologies on TVET education (Salleh & Sulaiman, 2020). a few have assessed the curriculum of Electrical Electronics Technology in TVET (Mukhtar et al., 2020). The rapid evolution of emerging technologies, such as Artificial Intelligence (AI), Internet of Things (IoT), automation, robotics, and renewable energy systems, is reshaping industries worldwide, including the electrical and electronics sector (Osuagwu et al., 2013). For Technical and Vocational Education and Training (TVET) programs to remain relevant, it is crucial to integrate these emerging technologies into their curriculum. This integration is not only necessary to meet the demands of modern industries but also to equip students with quality training and future-ready skills that enhance their employability (Awolola & Sanni, 2021).

Integrating emerging technologies into Electrical and Electronics Technology in the TVET curriculum is no longer optional but a necessity. It ensures that students are not only employable but also equipped with the skills required to thrive in a rapidly changing technological landscape. This approach will future-proof both the workforce and industries, fostering sustainable development and economic resilience. Therefore, a dire need is felt to focus on the integration of emerging technologies in TVET curriculum, particularly in Electrical and Electronics Technology program and the region where this study was conducted. This study fills this gap and further delves into the benefits of integration of emerging technologies for future employability skills of Electrical Electronics TVET graduates. The following research questions were formulated to guide the study.

1. What are the current technologies in the electrical electronics technology program in TVET institutions in Ekiti State?
2. What emerging technologies in the field of electrical and electronic technology are not included in the curriculum of TVET institutions in Ekiti State?

3. What are the potential benefits of integrating emerging technologies into the electrical electronics technology program in TVET institutions in terms of workforce development for industry?

Literature Review

The integration of emerging technologies into TVET curricula, particularly in the field of Electrical and Electronics (EE) Technology, has garnered significant attention in educational research. This shift is seen as crucial in aligning with industry demands, enhancing employability, and equipping students with future-ready skills.

The Need for Curriculum Reform in TVET

Several studies have emphasized the need for TVET curriculum reform to align with technological advancements. Tuenpusa et al. (2021) assert that TVET programs must evolve to meet the changing needs of the labor market, particularly the need to redefine workforce skill development policy and strategy to support 4th industrial revolution due to disruptive technology. The growing relevance of AI, IoT, and automation in the workplace necessitates that TVET students particularly in EE technology develop proficiency in these areas to remain competitive (Kana & Letaba, 2024; Parua & Yang, 2024). Research by Okoye (2021) on TVET in Nigeria highlights that graduates are often ill-prepared for modern industry demands, largely due to outdated curricula. The study calls for the integration of modern technological skills, particularly in engineering-related fields such as EE Technology. This view is echoed by a recent study conducted which underscores the necessity of fostering a synergistic approach to curriculum development and TVET-engineering qualifications to bridge the skills gap and prepare students for the future workforce (Affandi et al., 2024).

Emerging Technologies in Electrical and Electronics (EE) Technology

EE Technology has seen a transformation due to the rise of smart technologies, automation, and renewable energy systems. A study by Haque et al. (2023) examines how the adoption of IoT and automation in EE Technology courses has positively impacted student learning outcomes in higher education. The study found that students exposed to emerging technologies showed higher competency in applying theoretical knowledge to practical, real-world problems. This research suggests that integrating such technologies into the TVET curriculum could lead to improved problem-solving abilities, a key skill sought after by modern industries. Similarly, a study conducted by Adamu (2024) on digitalization and the integration of renewable energy technologies in Ethiopian TVET programs revealed that students trained in solar and wind energy systems were more employable than those without such skills. Employers increasingly seek candidates with expertise in these emerging areas, reinforcing the idea that updated curricula enhance both the technical expertise and employability of TVET graduates.

The field of EE technology is crucial for national and international development and growth, manufacturing, transportation, and telecommunications are just a few of the industries that depend on it for survival. In the twenty-first century, the advancement of technology has a major impact on how a nation is categorized internationally. There are

different ways to classify a country's level of technology development, but one commonly used classification is based on the technology readiness index (TRI) which measures a country's ability to fully leverage technology to drive economic growth and well-being. According to the World Economic Forum's Global Competitiveness Index (GCI) which utilizes the TRI, Nigeria was ranked as a "low technology readiness" country in 2021 (Udo & Augustine, 2021). This is mainly due to the country's lower scores in areas such as technological adoption, quality of scientific research institutions, and availability of venture capital (Nalli et al., 2025).

Technical and Vocational Education and Training (TVET)

Technical and Vocational Education and Training (TVET) plays a pivotal role in preparing the workforce for the rapidly evolving landscape of EE technology and contributes to the growth and development of a nation. As emerging technologies continue to reshape industries, it becomes imperative for TVET institutions to adapt their curricula to ensure graduates possess the requisite skills to thrive in dynamic workplaces. New technologies and advancements in EE technology fields are constantly emerging, and the education system must keep pace with these changes. According to a study by the International Labor Organization (ILO), TVET programs have been found to play a crucial role in education–employment linkage at different stages of development and equipping individuals with the necessary skills and knowledge to succeed in the job market (Caves et al., 2021).

Given this, according to research on TVET programs, it is believed that the curriculum should be regularly updated to align with the current industry standards and needs of the job market. However, it has been argued that the curriculum for TVET programs in Nigeria may not be fully equipped to incorporate the most recent advancements in the electrical and electronic technology field (Okolie et al., 2020). The National Centre for Technology Management (NACETEM) in Nigeria revealed that graduates of TVET programs may not be adequately equipped for the current job market due to a lack of exposure to emerging technologies (Adelowo et al., 2023).

It is important to identify which specific emerging technologies in the field of electrical and electronic technology are not currently included in the TVET curriculum in Nigeria in order to address this gap. EE is a field that generally deals with the study and application of electricity, electronics, and electromagnetism (Okoye & Okwelle, 2013). EE technology has continued to evolve over the years and now encompasses all spheres of life. EE courses included electronics, digital electronics, power electricity, telecommunication, control systems, radio-frequency, signal processing, instrumentation, microelectronics, etc. Some common technologies used in electrical and electronics technology programs include circuit design and analysis, microcontrollers and microprocessors, power electronics, communications systems, and digital signal processing. These programs also often include hands-on training with equipment such as oscilloscopes, multimeters, and soldering stations.

TVET institutions in Nigeria

Emerging technologies in the field of EE technology are constantly evolving and TVET institutions in Nigeria need to stay up to date with these developments in order to prepare their students for the workforce (Ngor & Tambari, 2017; Okoye & Okwelle, 2013). Identifying which specific emerging technologies are not currently included in the TVET curriculum in Nigeria is crucial for addressing this gap and bridging the gap between policy document and implementation, to ensure that students are equipped with the necessary skills to meet the demands of the industry (Akanbi, 2017).

Incorporating emerging EE technology in TVET course content in Nigeria can provide several benefits. As of 2020, some of the most significant benefits include:

1. Keeping students up to date with the latest technology: By including emerging technologies in the curriculum, students can learn about the latest developments and advancements in their field, which can make them more competitive in the job market (Omovigho Igberaharha, 2021).
2. Preparing students for the future: As technology continues to advance, it's essential to ensure that students are prepared to work with the latest tools and equipment. Including emerging technologies in the curriculum can help students to be better prepared for their future careers. This requires repositioning TVET specifically for youth empowerment and entrepreneurship (Kwami, 2024).
3. Improving the quality of education: By incorporating new technologies, teachers can create more engaging and interactive learning experiences for their students, which can improve the overall quality of TVET for sustainable growth and development of Nigeria (Omovigho Igberaharha, 2021).
4. Fostering innovation: By exposing students to emerging technologies and models like the Kirkpatrick Model, which can inspire them to become innovators and entrepreneurs, and become the key contributors for Nigeria's economic development (Makinde & Bamiro, 2024).
5. Helping Nigeria to be globally competitive: By including emerging technologies in the curriculum, Nigeria can ensure that its students are well-prepared to compete in the global economy (Omovigho Igberaharha, 2021).

The material taught by the teacher, including knowledge and teaching, is referred to as the course content. This is what the learners or students will absorb and understand as the information conveyed to them in a classroom, workshop, or any other suitable learning environment. However, for the program to operate properly and the EE teachers to properly engage their jobs, there should be high level of participation. EE teachers are not exempted from the development of the TVET program.

There are a number of factors, which has impeded the smooth implementation of TVET programs in the country. According to the NBTE, the underlying challenges of TVET include; Low Societal Recognition – which translates to Low Enrolment and Shortage of Skilled Workforce, Obsolete Instructional Facilities, Inadequate Funding, Poor Staffing, Poor Linkages with Industry, and General Deficiency in Quality (Ayonmike et al., 2015).

Employability and Skills Development

The connection between technology integration in TVET and employability is well-documented. Empirical studies show that TVET graduates equipped with emerging technology skills have better employment prospects. A comprehensive review by McGrath (2023) concluded that students who engage with new technologies such as AI and robotics are more likely to be employed in high-demand sectors. This aligns with findings from various studies including Subrahmanyam and Elson-Rogers (2022) who advocated to raise the digital capacities of TVET teaching staff; with Jagannathan et al. (2019) and Dixit and Ravichandran (2023), which have examined the impact of vocational education on economic growth and development across the G20 countries. The importance of aligning TVET curricula with industry needs is further reinforced by a study by Caves et al. (2021), which emphasized on education–employment linkage at different stages of development, knowing that employers prioritize candidates who possess not only technical skills but also soft skills such as critical thinking, problem-solving, and adaptability.

Integrating emerging technologies into the curriculum facilitates the development of these soft skills by encouraging students to engage in complex, technology-driven problem-solving tasks. For instance, in Germany, One-third go on to pursue a single-track, school-based TVET and two-thirds apply for the dual-track counterpart. In Germany, approximately 68% of the latter system's graduates enter the workforce in the company where they were trained immediately after their TVET program. More so, about 51% of Germany's workers are skilled in TVET. A further 11% of workers are master craftsmen and vocational and technical college graduates. Germany's vocational school's partner with around 430,000 companies and more than 80% of large companies hire apprentices. As a result, every year there are more than 500,000 apprenticeship positions available across all sectors of the German economy (Bünning, 2022; Hommel, 2024).

Germany's success with TVET helps us realize that TVET is an important instrument for economic development, although our reality in Nigeria reveals that very few youths opt for technical education. As of 2020, out of the 2 million students who applied for tertiary education, only 612,557 were admitted. The admission data released by the Joint Admissions and Matriculations Board (JAMB) shows that the nation's universities admitted a total of 444,947 students; polytechnics and monotechnic had about 96,423 students; colleges of education had 69,810 students; and innovation enterprise institutions admitted 1,377 students (Yusuf & Mohd, 2021). It is therefore necessary that TVET becomes and is seen as a viable career pathway for our youths.

Global Initiatives and Best Practices

Several global initiatives have been aimed at integrating emerging technologies into TVET. The European Commission's "Digital Education Action Plan" emphasizes the importance of digital skills for employability and promotes the incorporation of technology into vocational education (Redecker, 2020). An evaluation of the initiative by Redecker (2020) shows promising results, with students in participating countries showing increased digital literacy and enhanced employment outcomes. Furthermore, a study by Hassan et al. (2015) multidisciplinary PBL robot control model in automation and electronic engineering, integrating robotics and automation into EE Technology curricula. This study

indicates that students exposed to hands-on, technology-driven learning experiences develop critical thinking and adaptability, making them more attractive to employers. Similarly, Ayonmike et al. (2015) in their study of Nigerian TVET programs stress the need for strong industry partnerships to ensure that TVET curricula are aligned with technological advancements in the field.

Technology is dynamic and the field of EE technology is constantly evolving, with new technologies and advancements emerging regularly. However, the curriculum for TVET in Nigeria may not always be updated to include these new technologies. This lack of inclusion of evolving technologies may result in graduates of TVET programs in Nigeria not being fully prepared for the current job market, as they may not have knowledge or skills in these emerging technologies. This research aims to identify which specific emerging technologies in the field of EE technology are not currently included in the TVET curriculum in Nigeria Kalogiannakis and Papadakis (2020).

Methodology

Research Design

The research utilized a descriptive survey design as it allowed for the collection of data from a representative sample of the target population, where it was not feasible to ensure a completely randomized sample. This design facilitated a meticulous examination of each variable involved in the study, without any form of manipulation. The population of the study consists of the staff and students of EE Technology program in TVET institutions in Ekiti State. This includes both the teaching staff and the students who are currently studying in the program.

Sampling

The total population for the 2021/2022 academic session in TVET institutions is One hundred and Twenty (120). Due to the limited population of students who enrolled for EE Technology program in the TVET institutions in the State, the sample size purposively selected for the study was the entire population which consists of all the 25-teaching staff and 95 students.

Research Instrument

A structured questionnaire was developed as the instrument for the study on the Integration of Emerging Technologies in EE program in TVET institutions. The instrument was face and content validated by experts in the TVET program. The instrument was designed to measure three basic variables in the study using a 4-point Likert scale, with one as strongly disagree and four as strongly agree. The first variable which assessed the existing technology content has seven questionnaire items, the second variable which measured the emerging technologies had eight items while the last variable which measured the benefits of integrating emerging technologies into EE technology program had eleven items. The reliability of the instrument was measured by subjecting it to test-retest method to test the internal consistency of the items, Cronbach's Alpha was used to

compute the reliability coefficient. A reliability coefficient value of 0.83 was realized which was considered a reliable value for the instrument.

Data Analysis

Statistical analysis of the data collated the responses of the participants and calculated mean and standard deviation. The mean score of above 2.5 was considered acceptable while any mean score below 2.5 was rejected.

Results

Research Question 1: What are the current technologies in the EE technology program in TVET institutions in Ekiti State?

Open Question: What are the technologies you are aware of that have been taught in EE technology program?

Table 1 displays various technologies that are being taught in the EE Technology program in TVET institutions within Ekiti State. The mean perception values range from 2.6 to 3.6 with corresponding standard deviation values ranging from 0.46 to 1.08. The items in the table were assessed using a Likert scale of 4 points, and the responses indicate that the majority of respondents agreed with the inclusion of these topics in the curriculum. The respondents agreed that *'Basic electronics principles, Electrical wiring, Digital electronics, Microcontrollers and Microprocessors, Power electronics, Communication Systems, and Renewable Energy Systems'* are already incorporated in the curriculum. An open question also identified *Introduction to Mechatronics* as one of the technologies that should be taught.

Table 1

Technologies taught in the EE Technology TVET program

S/N	ITEMS	SD	D	A	SA	MEAN	SD	DECISION
1	Basic electronics principles	0	0	48	72	3.6	0.50	Agreed
2	Electrical wiring	0	24	48	48	3.2	0.75	Agreed
3	Digital electronics	0	0	60	60	3.5	0.50	Agreed
4	Microcontrollers and microprocessors	24	12	48	36	2.8	1.08	Agreed
5	Power electronics	0	0	84	36	3.3	0.46	Agreed
6	Communication systems	0	0	72	48	3.4	0.49	Agreed
7	Renewable energy systems	0	48	72	0	2.6	0.49	Agreed

Research Question 2: What emerging technologies in the field of EE technology are not included in the curriculum of TVET institutions in Ekiti State?

Open Question: What are the technologies you are aware of that is not been taught EE technology program?

Table 2 displays a list of emerging technologies in the field of EE technology that are currently not included in the curriculum for technical and vocational education and training (TVET) institutions in Ekiti State. The mean perception values range from 2.9 to 3.4 with corresponding standard deviation values ranging from 0.49 to 0.74. The table also indicates that all the emerging technologies including *'Internet of Things (IoT), Artificial*

Intelligence (AI), Cybersecurity, Robotics, Nanotechnology, Renewable Energy, Solar Photovoltaic PV Systems and Augmented Reality (AR) and Virtual Reality (VR)', 3D Printing and Additive Manufacturing are not currently included in the TVET curriculum in Ekiti State, Nigeria. There was no answer to the open question from any respondent.

Table 2

Emerging technologies in the field of EE technology

S/N	ITEMS	SD	D	A	SA	MEAN	S.D	DECISION
1	Internet of Things (IoT)	0	0	72	48	3.4	0.49	Agreed
2	Artificial Intelligence (AI)	0	0	72	48	3.4	0.49	Agreed
3	Cyber security	0	24	72	12	3..0	0.63	Agreed
4	Robotics	0	24	84	12	2.9	0.54	Agreed
5	Nanotechnology	0	36	36	48	3.1	0.83	Agreed
6	Renewable Energy	0	24	24	72	3.4	0.80	Agreed
	Solar Photovoltaic PV Systems	0	24	72	24	3..0	0.63	Agreed
7	Augmented Reality (AR) And Virtual Reality (VR)	0	36	60	24	2.9	0.74	Agreed
8	3D Printing and Additive Manufacturing	0	24	72	24	3..0	0.63	Agreed

Research Question 3: What are the potential benefits of integrating emerging technologies into the EE technology program in TVET institutions in terms of workforce development for industry?

Table 3 indicates the benefits of incorporating emerging technologies into the EE technology program for students, industry, and society. The mean perception values range from 2.9 to 3.6 with corresponding standard deviation values ranging from 0.46 to 0.70. The responses were assessed using a Likert scale of 4 points, and it was found that the respondents agreed with all the items in the table. This indicates that there are immense benefits associated with incorporating emerging technologies into the EE technology program in TVET institutions for students, industry, and society.

Table 3

The potential benefits of integrating emerging technologies into the EE technology program.

S/N	Items	SD	D	A	SA	Mean	S.D	Decision
1	Student's engagement and motivation could change due to the introduction of emerging technologies	0	24	72	24	3.0	0.63	Agreed
2	Emerging technologies could impact the development of students' technical skills	0	0	84	36	3.3	0.46	Agreed
3	Students would be properly prepared to work with emerging technologies in the industry	0	0	72	48	3.4	0.49	Agreed
4	Incorporation of emerging technologies will make the program more relevant to industry needs	0	0	48	72	3.6	o.49	Agreed

Table 3(continued)

The potential benefits of integrating emerging technologies into the EE technology program.

S/N	Items	SD	D	A	SA	Mean	S.D	Decision
5	Integration of emerging technologies into the program can improve the quality of education offered to students	0	0	48	72	3.6	0.49	Agreed
6	Integration of emerging technologies into the program can contribute to the development of interdisciplinary skills and knowledge	0	36	60	24	2.9	0.70	Agreed
7	The program can adapt to accommodate emerging technologies, and positive changes would be possible	0	0	96	24	3.2	0.40	Agreed
8	Incorporating emerging technologies into the program can provide new opportunities for research and innovation	0	12	48	60	3.4	0.66	Agreed
9	Society as a whole would gain from the inclusion of emerging technologies in the curriculum	0	0	84	36	3.3	0.46	Agreed
10	It would lead to new job creation for TVET graduates	0	0	80	40	3.2	0.44	Agreed
11	The benefits of incorporating emerging technologies into the curriculum will outweigh the challenges associated with updating the curriculum	0	12	60	48	3.3	0.64	Agreed

Discussion

Based on the findings of the study, it is evident that there is a lack of inclusion of some identified emerging technologies in the field of EE technology in the curriculum for technical and vocational education and training (TVET) curriculum for the institutions in Ekiti State, and Nigeria as a developing nation. This finding is consistent with previous studies that have identified a gap between the skills acquired in TVET programs and the skills required by the industry; e.g., Edeh et al. (2020) and Okolie et al. (2020) which accepted that emerging technologies make impact on the job performance of educators. The rapid pace of technological advancements in the electrical and electronic technology field means that it is crucial for TVET programs to keep up with these changes to ensure that graduates are adequately prepared for the workforce, as also argued by Kwami (2024), a study which advocated repositioning technical vocational education and training (TVET) for youth empowerment and entrepreneurship.

Findings from Table 1 show that the current technologies being used in the EE technology program in TVET institutions in Ekiti State are mainly traditional technologies, such as electrical wiring and circuit analysis. This finding is consistent with other studies that have identified a lack of incorporation of emerging technologies into TVET curricula in Nigeria (Adelowo et al., 2023; Okoye, 2021). These studies emphasize the need for curriculum review and reform to incorporate emerging technologies, such as robotics and artificial intelligence and others, into TVET programs. Omovigho Igberaharha (2021) argued that emerging technologies are lacking in the TVET curriculum in Nigeria, ad

requires improving the quality of Technical Vocational Education and Training (TVET) for sustainable growth and development of Nigeria. This requires the attention of relevant stakeholders to incorporate the 21st-century emerging technologies in the curriculum.

Findings from Table 2 show that the emerging technologies that are required and are not currently included in the TVET institutional curriculum in Ekiti State, Nigeria are augmented reality (AR), virtual reality (VR), internet of things (IoT), artificial intelligence (AI), cybersecurity, nanotechnology, and renewable energy among others. This finding aligns with the findings of Olabiyi and Chinedu (2018) who emphasised that the present TVET programmes in Nigeria lack incorporation of emerging technologies into the TVET curriculum and as a result fail to prepare competent skilled and semi-skilled workforce on the emerging technology and the development of its associated skills to satisfy the needs of the Nigeria workforce. This finding differs from the findings of Jabarullah and Iqbal Hussain (2019), which studied the effectiveness of problem-based learning in technical and vocational education in Malaysia. Denhere and Moloi (2021) further argue that, for TVET graduates to fit into the current technological workplace requirements, they need to be exposed to relevant technologies and equipped with the appropriate technological skills embodied by the relevant curriculum. This finding highlights the need for curriculum development that incorporates these technologies to ensure that graduates have the skills required by the industry.

Findings from Table 3 show that integrating emerging technologies into the EE technology program has potential benefits for students, industry, and society. These benefits include improving students' employability, promoting innovation and competitiveness in the industry, and contributing to sustainable development. These findings are consistent with other studies showing the importance of incorporating emerging technologies into TVET programs including Ayonmike et al. (2015) and Ayonmike and Okeke (2017), which emphasized on quality of TVET Programmes in Nigeria and producing competent graduates in the 21st Century.; and Osuagwu et al. (2013), which recommended to utilize emerging technologies and the Internet of all Things in Nigeria's higher education.

In general, the findings of this study highlight the need for curriculum review and reform in the TVET sector in Ekiti State, and Nigeria as a developing nation. Incorporating emerging technologies into TVET curricula is crucial for preparing graduates for the workforce and promoting innovation and competitiveness in the industry. This study contributes to the body of knowledge on TVET curriculum development and provides valuable insights for policymakers, educators, and industry professionals.

Conclusion

The purpose of this study was to find out emerging technology and content that would enhance the skills and product improvement needs of EE technology program in TVET institutions in Ekiti State. After conducting a descriptive survey among staff and students of EE Technology programs in TVET institutions in Ekiti State, Nigeria, it was concluded that the TVET curriculum in Nigeria needs to be updated to include emerging technologies in the field of EE technology. The study revealed that there is a significant gap between the current curriculum and the emerging technologies that are necessary for graduates to be

competitive in the current job market. The inclusion of these technologies in the curriculum can enhance the graduates' knowledge and skills, making them better equipped to meet industry demands and improve the quality of products produced in the field.

Summarily, the findings show that some emerging technologies such Artificial Intelligence (AI), the Internet of Things (IoT), robotics and renewable energy systems are currently missing from the TVET curriculum in EE Technology program. The study further reveals the potential benefits of incorporating these technologies into the TVET curriculum in Ekiti State. While updating TVET curricula to encompass emerging technologies is crucial for preparing students for the future workforce, it may be fraught with challenges. The rapid pace of technological advancements, the need for alignment with industry, financial constraints, faculty preparedness, infrastructural demands, and resistance to change all pose significant barriers. To overcome these challenges, a multifaceted approach is required. This approach should include increased investment in TVET institutions, stronger industry partnerships by the aid of government, continuous professional development for faculty, and a more agile curriculum development process. Addressing these challenges will ensure that TVET institutions can equip students with the skills they need to thrive in a rapidly changing technological landscape.

Findings from the study underscores the necessity of integrating emerging technologies into EE Technology in TVET curricula. This integration will not only enhance employability but also equip students with future-ready skills that align with the demands of modern industries. Addressing these gaps in TVET program will require coordinated efforts from educational institutions, governments, and industry stakeholders to ensure that TVET programs continue to produce graduates who are competitive and capable of thriving in a technology-driven future.

Further research could gain insights from the findings of this study by conducting researches to assess the effectiveness of integrating emerging technologies into the TVET curriculum in Nigeria. Further studies can also be conducted on the perceived challenges and barriers faced by TVET institutions in integrating emerging technologies into the EE curriculum, how industry-academia collaborations can facilitate the integration of emerging technologies into the TVET curriculum for EE technology, the effective strategies and best practices for integrating emerging technologies into the EE TVET curriculum, as perceived by curriculum developers and industry experts.

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