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ENHANCEMENT OF DIGITAL SKILLS THROUGH LIFELONG LEARNING IN ELECTRICAL/ELECTRONICS TECHNOLOG EDUCATION AMONG TVET LECTURERS IN TERTIARY INSTITUTIONS IN ABIA STATE

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Abstract: *The study determined the techniques needed in enhancing digital skills through lifelong learning in electrical/electronics technology education among TVET lecturers in tertiary institutions in Abia State. The study answered two research questions and two hypotheses. Descriptive survey research was adopted for the study. The population of study was 43 respondents, comprising of 23 Electronical/Electronics Engineering Lecturers and 20 Electronical/Electronics Engineering Technology Lecturers from the state. All the population was used as sample due to its manageable size; total population sampling technique was used. A 17 – item structured questionnaire titled, 'Enhancement of digital skills through lifelong learning in electrical/electronics technology education' was used for data collection; which was validated by three experts. The reliability of the instrument was 0.82 established using Cronbach Alpha. The questionnaire items were generated from the review of the related literature; all the questionnaire administered were returned. Mean and standard deviation were used to answer the research questions and null hypotheses were tested at 0.05 level of significance using T-test. Mean of 3.50 or above was considered for the agreed items. Result of study revealed 10 digital skill needs of electrical/ electronics technology education TVET lecturers in tertiary institutions and 7 strategies of inculcation of digital skills in electrical / electronics technology education TVET lecturers in tertiary institutions through lifelong learning. In conclusion, electrical/ electronics technology education TVET lecturers' digital skills needs are in the area of basic computer literacy skills, information and communication technology, cloud computing among others. In addition to digital simulation, immersive technologies; and teaching, assessment and evaluation technologies; in addition to AI, DevOps, industry 4.0/5.0 technologies coupled with other strategies of inculcation of digital skills in electrical / electronics technology education TVET lecturers in tertiary institution through lifelong learning. Consequently, it was recommended that, all the determined digital skills relevant to electrical / electronics technology education universities' lecturers should be enshrine into the curriculum of undergraduate students; and industrial collaboration and partnership with TVET institutions and government or private companies should be strengthened.*
Keywords*: University, TVET, Electrical/ Electronics Technology. Digital skills and Lifelong*

Introduction

Tertiary institutions are learning organisation that goes beyond secondary education. According to Federal Republic of Nigeria (FRN), one of the goals of tertiary institution shall be to reduce skill shortages in the production of skilled manpower needed in the labour market. In tertiary institution, electrical/ electronics technology education is a technical vocational education (TVET) programme. TVET programme are structured to equip individuals with requisite skills needed to meet the demand of the labour market and contribute to economic growth. It serves as a bridge between education and world of work. TVET is designed to prepare individual for the labour market, enhance productivity, foster entrepreneurship, and support lifelong learning for scio-economic development (UNESCO, 2015). TVET lecturers are academic staff that provides individual with knowledge, competencies and attitude necessary for employment in technical occupations and in teaching profession. They teach industrial and technology courses in different areas of technology education as well as the methodology of imparting knowledge and skills as a vocation; and also train the trainer in different technology areas such as: Automobile. Building, Metalwork, Wood work and Electricity and Electronics.

Electrical/ Electronics Technology is a field of technology primarily based on the application of electrical energy and electronic principles in the design, installation, operation, maintenance, and repair of

electrical and electronic devices and systems. Electrical technology focuses on the generation, distribution, and utilisation of electrical power. It involves equipment such as generators, transformers, motors, wiring systems and power distribution network; while electronics technology deals on circuits that controls the flow of electrons to process signals and information. It utilises devices and components; such as capacitors, resistors, transistors, integrated circuits, microcontrollers, communication system, computers among others. The practical areas of applications of electricity and electronics is to create, operate, install, repair and maintain devices and systems for problem solving and enjoyment of modern life. The practical skills in this area dwell in circuit testing and measurement, involving testing for electronics /electrical components for identification, polarity, rating and continuity; others are verifying the circuit performance, power consumption, signal, frequency and basic calibration (Tokatlidis, Tselegkarids, Rapti, Sapounidis, Papakostas,2024). The practical skills in the area of troubleshooting and repairs entails the determination of open and short circuits, fault diagnosis, tracing of faulty components and their replacements (Guartocruz, 2025). The digital and embedded skills are not left out, which entails use of simulation software, simulating circuits (prototype), printed circuit board among others (Jaya, Haryoko and Suhaeb,2025). In addition to soldering and the desoldering skills, safety skills in terms of electrical safety protection from electrostatic discharge and proper handling of electrical machines and power electronic components without excluding computer and digital skills incorporating artificial intelligence (AI)

Digital skills refer to knowledge and abilities needed to use digital devices, software, and online technologies including artificial intelligence effectively, safely; and equally access information, communicate, solve problem and perform task. Digital skills are set of skills required in using networks, digital devices and different applications by online that facilitate the management of information in line with the needed working and learning environments, including problem solving (Olaniyan, 2022). UNESCO- UNEVOC (2020) asserted that the four-key dimensions of digital skills in TVET are: 1) Digital literacy skills. 2) Simulation and immersive technologies 3) Digital tools for learning teaching and assessment 4) Industry 4.0/5.0 technologies integration with artificial intelligence UNESCO-UNEVOC (2020).. Digital skills' learning environment comprises of: Digital literacy platform such as Cisco Networking Academy, Future Learn, Coursera among others; Learning Management System (LMS), examples are Moodle, Canvas, Blackboard learn, all these are designed for employee training, and co-operate learning. Massive Open Online Courses (MOOCs) are also inclusive; and other mobile learning applications that allow flexible access to learning digital skills. Electrical/ electronics technology lecturers should avail themselves of these opportunities to develop themselves professionally in digital skills such as: basic computer literacy, Information and communication and cloud computing skills (Digital skills library, 2023) Simulation and Immersive Technologies are technologies like Virtual Reality (VR), Augmented Reality (AR), Mixed Reality(MR); and Digital Twin among others, are used in simulating real life environment, it provides avenue for helping lecturers and student practice hands on activities.

Thereby achieving training/learning without involving risks and cost inherent in traditional electrical /electronic workshop (Hassan etal,.2021). Digital tools used for teaching and assessment are e-portfolios, gamified test and online certifications (Law-Obi and Okoye,2025). Industry 4.0 technologies is in the area of smart manufacturing trends, that work with the aid of artificial intelligence. AI components are technologies that enable machines simulate human intelligence, machine learning, natural language processing, robotics and computer vision (Russell and Norving, 2021). In the same vein, digital technology can automate repetitive task/ skills to boost learning understanding and quicken computation of skills (Akpan and Horrnevor, 2022). The acquisition of digital skills is very beneficial to electrical /electronics TVET lecturers for it will enable them, to understand industrial automation systems; prepare for modern electrical / electrical jobs; develop skills for smart technologies and renewable energy systems. In addition to knowledge of the skills of simulation and CAD tools -software's, programming tools, predictive digital measuring instruments among others.

The multi-facet of electrical /electronics technology education programme in digitalisation is in the area of development / creation, delivery, learning, and assessment of skills digitally; including problem solving and task performance. Therefore, electrical/ electronics technology lecturers should be able to integrate and apply digital - tools, platforms, practices to enhance learning for rapid changing labour market driven by the fourth industrial revolution. Artificial intelligence (AI) in the context of electrical/ electronics technology is a digital tool for automation and control system, predictive maintenance, intelligent system and smart grid metering and consumption; fault dictation, diagnosis, and renewal energy system. In addition to simulation, signal processing and reduction; intelligent tutoring and other trending skills which are now demanded across industries (Salami and Tijani,2021). UNESCO (2021) report on AI and education guidance for policy matters asserts that imbedding AI competencies in curricula prepares learners for the evolving world of work and lifelong learning in technology driven environment. It has been observed that, putting the digital competencies in the curriculum is not the issue; but one may ask, Is the lecturers who will utilise these digital tools equipped with the skills.? This question is for us to ponder about. The lecturers in this field of study must imbibe the digital transformation such as AI, robotics, Big data, the internet of things (IoT) virtual / augmented reality for our TVET institutions to produce graduates who will be industrial relevant and technologically literate for employment (UNESCO, 2020).

There is evolution in the advancement of technology especially in the area of digital technologies used in teaching in TVET – electrical /electronics technology programme for, it has reshaped how skills are impacted and utilised in workplace. Presently, technical or practical skills are impacted to the learner barely on the traditional means of transferring knowledge and skills for vocational practices and for teaching. The process of transformation of the workforce to align with the digital era is being advocated. Many lecturers in electrical/ electronics technology education field are not finding it easy acquiring the digital skills because these media of learning, teaching. creating, and problem solving were not utilised during their preparation as such, they will not give what they don't have. The present lecturers need upskilling through lifelong learning in order to perform work with the digital technologies / tools and innovations in TVET education.

Lifelong learning is the persistence gaining of knowledge, skills and experience throughout a person's life beyond formal schooling. There is need for professional development in order to acquire knowledge in new: job skills, technologies, tools and certification due to technology evolution (DELTA). Lifelong learning is characterised by goal oriented; that is being focused on acquiring, improving, in knowledge and competence / skills. (Sue, etal.,2020). It is important for electrical / electronics technology lecturers to engage in lifelong learning based on digital tools that are used in solving real-world problem, learning practical skills for improving productivity and preparation for jobs. The changing technological innovations in digital skills are affecting the world of work, increasing unemployment, underemployment, and skill mismatch resulting in labour market inequalities.(Sue,etal.,2017) Therefore., it is good to assess the strategies of solving these problems through lifelong learning, in that many lecturers of electrical /electronics technology may be deficient in knowledge of digital skills and its utilisations : learn, create, teach and solve problem; and perform task virtually in real life.

The act of using industry collaboration and innovation ecosystem can promote the impartation of digital skills in electrical/electronic technology lecturers or instructors through lifelong learning. It will enable the transferring of digital skills to their undergraduate, achieving relevant future oriented and suitable workforce (Dandi, etal, 2021.) Digital skills such as artificial intelligence (AI), smart technologies for manufacturing, Programmable logic Circuit (PLC) tools industrial automation, Arduino IDE for embedded system programming, Robotics and big data are indispensable skills in the world of work (Hassan etal, 2021) The digital techniques can be learnt through partnering with industrial training officers in organisation of workshop by the training department of industries or the institution organising workshop and invite expert in any digital skills as a resource person(Okoye and Law-Obi,2025).. In the same vein, digital skills can be impacted to the lecturers and instructors through the Government

partnering with digital or internet providers to deliver online training on the digital technologies such as virtual and augmented realities. It is on record that Kenya's TVET Authority partnered with digital providers to deliver online training during COVID-19 (Ogbeide etal., 2025).

The learning and utilisation of competency-based training for skills and industry 4.0 (AI, IoT, robotics, automation, canvas' cybersecurity) are very relevant for TVET electrical /electronics technology lecturers (Ramat etal, 2024); these can be inculcated through lifelong learning via collaboration by professional as part- time lecturers (Law-Obi and Okoye, 2026). Equally, there is nothing wrong with the lecturers obtaining sabbatical leave in industries, this opportunity will enable them obtain first-hand knowledge, processes and utilisation of digital skills to turn out products (Okoye and Law-Obi, 2026). The lecturers can personally develop themselves via internet learning applications; which can be accomplished using online learning delivery tools like Digital Learning Platform, for example; Coursera, Cisco Networking Academy and Learning Management System, such as, Moodle, Canvas used for digital learning delivery, proteus for circuit simulations; auto card for electrical wiring and schematic designs. (Digital skills library, 2023).All these applications are very good learning tools that can be utilised by electrical/ electronics technology lecturers via lifelong informal learning (Ue-Lee and Azubike, 2021). Even, electrical/ electronics engineers from universities or polytechnics utilise these digital applications to perform the job of teaching, creating, solving problems, in the areas of impartation of knowledge, skills and attitude in electrical electronics technology/engineering, turning out technicians, technologists and engineers as their graduates; in different cadres of generation, transmission, distribution and installation of electricity and electronics works.

It has been revealed through research findings that in staff development in digital skills; much focus is needed in industrial revolution 4.0 / 5.0 technologies and its functional areas like IoT (Internet of Things) robotics, data science, artificial intelligence (AI), big data, cloud computing, machine learning, simulation, monitoring, assessment and evaluation; and digital's training platforms (Rana etal., 2021). Therefore, upskilling of electrical electronics technology TVET lecturers in tertiary institution is not an option but a necessity; for many lecturers have little or no knowledge in utilisation of multifaceted digitalization skills. There is need to strategize in numerous ways in training qualified staff through lifelong learning. In addition, World Economic Forum (2023) estimated that in the next decades skilled jobs will shift towards artificial intelligence, data science, robotics, DevOps, cloud computing and social media among others. Against this backdrop that the researcher deemed it necessary to determine the digital skills essential to be acquired by electrical/electronic technology lecturers and the means of achieving results though lifelong learning.

Purpose of the Study

The main purpose of this study was to determine the enhancement of digital skills through. lifelong learning in electrical/electronics technology education among TVET lecturers in tertiary institution in Abia State. Specifically, the study sought to:

1. Determine the digital skill needs of electrical/ electronics technology education TVET lecturers in tertiary institutions
2. Determine the strategies of lifelong learning inculcation of digital skills in electrical / electronics technology education TVET lecturers in tertiary institutions through lifelong learning.

Research Questions

The following research questions guided the study

1. What are the digital skill needs of electrical/ electronics technology education TVET lecturers in tertiary institutions?
2. What are the strategies of inculcating digital skills in electrical / electronics technology education TVET lecturers in tertiary institutions through lifelong learning?

Hypotheses

The following null hypotheses was tested at 0.05 significant levels as follows:

HO_1: There is no significant difference on the mean rating of electrical technology lecturers from polytechnics and electrical / electronics engineering lectures from universities on the digital skill needs of electrical/ electronics technology education TVET lecturers in tertiary institutions

HO_1: There is no significant difference on the mean rating of electrical/ electronics technology lecturers from polytechnics and electrical /electronics engineering lecturer from universities on the strategies of inculcating digital skills in electrical / electronics technology education TVET lecturers in tertiary institution through lifelong learning.

Methodology

The study determined the techniques needed in enhancing digital skills through lifelong learning in electrical/electronics technology education among TVET lecturers in universities in Abia state. Descriptive survey design was adopted for the study. The population of study was 43 respondents, comprising of 23 Electronical/Electronics Engineering Lecturers and 20 Electronical/Electronics Technology Lecturers from tertiary institutions in Abiah state. All the population was used as sample due to its manageable size; total population sampling technique was used. A 17 – item structured questionnaire titled, 'Enhancement of digital skills through lifelong learning in electrical/electronics technology education' was used for data collection; which was validated by three experts. The reliability of the instrument was 0.82 established using Cronbach Alpha. The questionnaire items were generated from the review of the related literature; which consisted of three sections, A to C. Section A, solicited for information on respondents' personal data. Section B assesses the digital skill needs of electrical/ electronics technology education universities' lecturers. Section C was based on the strategies of lifelong of inculcation of digital skills in electrical / electronics technology education tertiary institutions' lecturers. The instrument made use of 5 points Likert scale = Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD). The response categories values were assigned 5,4, 3,2, and 1 respectively.; mean and standard deviation were used to answer the research questions while t- test was used to answer the hypotheses and any item with a mean of 3.50 or above was considered agreed. The hypotheses were tested at 0.05 level of significance.

Table 1: Respondents' mean ratings on the digital skill needs of electrical/ electronics technology education TVET lecturers in universities

S/N	Ability to use and work with digital skills based on:	$\bar{X}$	SD	Remark
1.	Basic Computer literacy	4.62	0.65	Agree
2.	Cloud Computing	4.73	0.66	Agree
3	Information Communication Technology	4.57	0.70	Agree
4	Simulation technologies	4.85	0.74	Agree
5	Immersive technologies	4.33	0.75	Agree
6	Digital Twin	4.65	0.73	Agree
7.	Digital Tools for Teaching and Assessment	4.55	0.69	Agree
8.	Artificial Intelligence (AI)	4.76	0.68	Agree
9	DevOps (development and operations)	3.51	0.64	Agree
10	Industry 4.0/ 5.0 technologies	4.82	0.73	Agree
	Grand Mean	**45.39**		
	Average Mean	**4.54**		**Agree**

The data presented in table 1, revealed that 10 items had mean range from 3.51 to 4.85 above the minimum cut off point 3.50.; these are the agreed items; indicating that these items are the digital skill needs of electrical / electronics technology education TVET lecturers in universities; the close range of standard deviation from 0.65- 0-75 indicating strong agreement.

Table 2: Respondents' mean ratings on the strategies of inculcation of digital skills in electrical / electronics technology education universities' lecturers through lifelong learning.

S/N	Inculcation of digital skill through:	$\bar{X}$	SD	Remark
1.	Industry collaboration and innovation ecosystem	4.50	0.67	Agree
2.	Partnering with industrial training officers in organisation of workshop.	4.33	0.66	Agree
3	Government partnering with digital or internet providers	4.36	0.70	Agree
4	Collaboration by professional experts as part time lecturers	4.46	0.62	Agree
5	Obtaining sabbatical leave in industries	4.40	0.69	Agree
6	Digital literacy platform	4.44	0.74	Agree
7.	Learning Management System (LMS)	4.45	0.72	Agree
	Grand Mean	**30.94**		
	Average Mean	**4.42**		**Agree**

The data presented in table 2, revealed that 7 items had mean ranges from 4.33 to 4.50 above the minimum cut off point 3.50; which indicated that, the 7 items constituted the strategies of lifelong learning for inculcation of digital skills in electrical / electronics technology education TVET universities' lecturers and the standard deviation ranged from 0.62- 0.72 depicting relative homogeneity of responses among the respondents. The aggregate mean of 4.42 revealed strong agreement denoting that, the above items are the strategies of inculcating
digital skills in universities' lecturers through lifelong learning.

Table 3: Summary of T-test Analysis of Electrical / Electronics Engineering Lecturers from universities and Electrical / Electronics Technology from Polytechnics on the digital skill needs of electrical/ electronics technology education TVET lecturers in universities

Variables	N	$\bar{X}$	SD	t-cal	t-crit	Sig. Level	Df	Decision
Electrical / Electronic Engineering Lecturers.	23	4.65	0.69	1.20	1.98 0.05		896	Not Significant
Electrical /Electronics Technology Lecturers	20	4.43	0.67					
Total	43							

Table 3 presents t-test analysis of the difference Electrical / Electronics Engineering Lecturers from universities and Electrical / Electronics Technology from Polytechnics on the digital skill needs of electrical/ electronics technology education TVET lecturers in universities. The t-calculated value is 1.20 at 896 degree of freedom of decision (df) and 0.05 level of significance. Due to calculated value is less than the table value of 1.98, the null hypothesis of the study is accepted. Therefore, it can be concluded, that there is no significant difference between the two groups on the digital skill needs.

Table 4: Summary of t-test Analysis of Electrical / Electronics Engineering Lecturers from universities and Electrical / Electronics Technology from Polytechnics on the strategies of

inculcation of digital skills in electrical / electronics technology education TVET universities' lecturer through lifelong learning.

Variables	N	$\bar{X}$	SD	t-cal	t-crit	Sig.	Df	Decision
Electrical / Electronic Engineering Lecturers.	23	4.52	0.73	1.19	1.96	0.05	894	No Significant
Electrical /Electronics Technology Lecturers	20	4.32	0.75					
Total	43							

Table 4 presents t-test analysis of the difference Electrical / Electronics Engineering Lecturers from universities and Electrical / Electronics Technology from Polytechnics on the digital skill needs of electrical/ electronics technology education TVET lecturers in universities. The t-calculated value is 1.19 at 894 degree of freedom of decision (df) and 0.05 level of significance. Due to calculated value is less than the table value of 1.96, the null hypothesis of the study is accepted. Therefore, it can be concluded, that there is no significant difference between the two groups on the digital skill needs.

Discussion

It was found out from the first research question that 10 items were the digital skill needs of electrical/ electronics technology education TVET lecturers in universities for lifelong learning Based on the findings of study, electrical/ electronics technology education TVET lecturers' digital skills needs are in the area basic computer literacy skills affirmed (UNESCO- UNEVOC, 2020), that asserted that one of the four-key dimensions of digital skills in TVET is Information and Communication Technology, cloud computing among others (Australian Public Service Academy,2025), The findings also indicated Simulation, Immersion and Digital Twin technologies; which are used in simulating real life environment, it provides avenue for helping lecturers and student practice hands on activities without risk and high cost (Hassan etal,2021). Also, teaching, assessment and evaluation digital tools are indicated, the finding affirmed that digital tools used for teaching and assessment are e-portfolios, gamified test and online certifications (Law-Obi and Okoye, 2026). Equally AI, DevOps, industry 4.0/5.0 technologies were confirmed, stating that, AI components are technologies that enable machines simulate human intelligence, machine learning, natural language processing, robotics and computer vision (Russell and Norving, 2021). In the same vein, the learning and utilisation of competency-based training for skills and industry 4.0 (AI, IoT, robotics, automation, canvas' cybersecurity) are very relevant for TVET electrical /electronics technology lecturers (Ramat etal, 2024; World Economic Forum, 2023))

In the second research question, seven strategies of inculcation of digital skills in electrical / electronics technology education TVET universities' lecturers through lifelong learning were revealed. The digital skills acquisition can be achieved through the assistance of digital literacy platform Learning Management System and Massive Open Online Courses; which can be used personally for digital skills upskill throughout life time. Others are using industry collaboration and innovation ecosystem can promote the impartation of digital skills as confirmed. The digital techniques can be learnt through partnering with industrial training officers in organisation of workshop by the training department of industries or the institution organising workshop and inviting expert in any digital skills as a resource person. (Okoye and Law-Obi, 2025). In addition to making use of digital providers (Ogbeide etal.,2025), sabbatical leave in industries among others. Therefore, lecturers must integrate digital skills in their portfolio for it is not an option.

There is no significant difference established. indicated that, electrical/ electronics engineers from universities or polytechnics utilise these digital applications to perform the job of teaching, creating, solving problems, in the areas of impartation of knowledge, skills and attitude in electrical electronics technology/engineering.

Conclusion

Based on the findings of study, electrical/ electronics technology education TVET lecturers' digital skills needs are in the area of basic computer literacy skills, information and communication technology, cloud computing among others. In addition to digital simulation, immersive technologies; and teaching, assessment and evaluation technologies; in addition to AI, DevOps, industry 4.0/5.0 technologies coupled with other strategies of inculcation of digital skills in electrical / electronics technology education universities' lecturers through lifelong learning. Therefore, lecturers in electrical /electronics technology must upgrade themselves and integrate digitals skills in their portfolios, for it is not an option.

Recommendations

Based on the findings of the study the researcher among others recommends that:

1. All the determined digital skills relevant to electrical / electronics technology education universities' lecturers should be enshrine into the curriculum of undergraduate students.
2. Industrial collaboration, partnership with TVET institutions and government or private companies should be strengthened
3. All electrical / electronics technology education universities' lecturers should be encouraged to update their knowledge in the use of digital skills by attending conferences, workshops, in service training and other continuous education.
4. They should be encouraged by given them free computers, softwares, encourage to learn immersive and simulation technologies and provide internet connectivity and digital infrastructures
5. Lifelong personal upskilling through digital platforms should be encouraged.

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