



In-Service Training Needs of Electrical/Electronics Technology Educators in the Use of Artificial Intelligence for Quality Service Delivery in Enugu State

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Abstract

The main purpose of the study was to determine the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence for quality service delivery in Enugu State. The study was guided by two research questions and two null hypotheses. A survey research design was adopted for the study. The population used for the study was 26 electrical/electronics technology educators in three tertiary institutions offering electrical/electronics technology programme in Enugu State. There was no sampling due to the manageable size of the population. The instrument used for data collection was a 19-item structured questionnaire grouped into two sections according to the research questions that guided the study. The items were structured in four-point rating scale. The instrument was validated and the reliability of the instrument was determined using Cronbach Alpha which yielded 0.81. Out of 26 copies distributed, 24 copies were returned giving 92.31% return rate. Mean, standard deviation and t-test statistics were the statistical tools used. Based on the data analysis, the study identified the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in lesson preparation and assessment of students for quality service delivery in Enugu State. Based on the findings of the study recommendations were made among which include; that electrical/electronics technology educators should be provided with in-service training on the use of AI in preparing and assessment of students learning as digital age demand and government should provide resources for in-services training of electrical/electronics technology educators in the use of AI in teaching.

Keywords *In-Service Training; Electrical/Electronics Technology; Artificial Intelligence*

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Introduction

The innovations in digital technology and digitalization era have dominated the various aspects of life, including educational system. Digital technology used in digital era are electronic tools, system, devices and resources that generate, store or process data. Well known example includes social media, virtual classroom, internet components, online games, multimedia and mobile phones, etc. According to Okeke (2015) digital technologies are referred to as the use of advance and communication technology to collect, store, analyze and share physical information and market information in each link of the product value chain, providing important technical support for innovation in various field. It is the combination of digital technology, e-content and instructional strategies to support teaching and learning activities and tasks online. Teaching and learning for quality service delivery in digital era as pointed out by Mbah and Odiye (2021) and Olaniyi (2022) is any type of instructional activity that is accompanied by digital technologies or by pedagogical approaches that use the technology effectively. Digital technologies are supposed to be utilized by teachers irrespective of educational level for effective and quality service delivery.

Further, achieving service delivery using digital technologies promote the educational experiences and achievement of diverse learners in an online learning environment. These digital technologies comprise of video lectures, voice thread, blogs, wikis, google, hangouts, social media, power points, prezi and Artificial Intelligence (AI). Artificial intelligence (AI) is an innovative technical framework that encompasses the creation of computer systems with the ability to execute activities that usually need human intellect (Felix & Webb, 2024). These activities involve problem-solving, acquiring knowledge, comprehending language, and seeing visual information. AI, or artificial intelligence, refers to the simulation of human intelligence in machines that are programmed to think and learn like humans. Obi (2022) pointed that AI in education refers to the application of artificial intelligence technologies to enhance teaching, learning, and educational administration processes. It involves the use of algorithms, machine learning, natural language processing, and other.

However, the origins of AI can be traced back to classical antiquity with the development of logic by Aristotle and other thinkers and scientists in the centuries that followed. These were important advances for exact mathematical reasoning that still prevail today. Later, the work of mathematician Blaise Pascal and the mechanical calculator, and in the 19th century, Charles Babbage, who designed the analytical engine, and later Ada Lovelace described it as a "thinking or reasoning machine" (Russell, 2019).

AI has become increasingly prominent in recent years, bringing about a revolutionary transformation in the methods by which jobs are completed in numerous businesses. Within the realm of education, artificial intelligence (AI) offers a multitude of possibilities to augment the learning process. Intelligent systems provide the ability to adjust to the specific requirements of each learner, deliver tailored learning experiences, and provide immediate feedback (Okeke, 2017). AI applications in education encompass adaptive learning platforms, intelligent tutoring systems, and virtual simulations which are used to impart knowledge and skills to the students. Through the use of artificial intelligence, electrical/electronics technology educators can construct dynamic and interactive learning environments that accommodate the various learning styles and capabilities of students. It is also useful in achieving sustainability in the skill development of the learners.

The convergence of AI and technology education presents significant opportunities for tackling the obstacles encountered by the educators and learners in addressing the training needs of the learners (Shobita, 2019). The use of AI tools and other Information and Communication Technology by electrical/electronics technology educators have the potential to fundamentally transform the methods of teaching and learning, hence enhancing accessibility, engagement and effectiveness of education. Adoption and utilization of AI in teaching electrical/electronics technology in tertiary institutions is seems to be low compared to its application in medicine and others.

AI has been increasingly used in education in recent years and applied in various areas, from personalized teaching to student performance evaluation. One of the earliest applications of AI in education was the development of intelligent tutoring systems, which provide personalized feedback to students based on their performance. These systems can identify areas where students struggle and provide specific guidance to help them overcome these obstacles (Lee, 2018; Russell, 2019). Another application of AI in education is data analysis. Schools and universities

can use AI to analyze large datasets, such as student grades and attendance, to identify trends and patterns that can help improve student performance. AI according to Hartono, Yonita and Mubarok (2023) and Kunade (2024) could potentially be used for the setting, marking and grading of exams and assessed coursework, as well as the delivery and invigilation of remote assessments. Human markers are prone to their own unique errors and biases, which can impact the grades that learners receive. Therefore, the need to adopt and apply AI in assessment of students for effective quality service delivery in Electrical/Electronics Technology Education.

At the tertiary education level, students are trained in Electrical/Electronics Technology to develop their skills in electrical installation, maintenance of electrical machine, electronics and design. Electrical/Electronics technology is one of the core areas of specialization in the technical education programme, which prepares learners for teaching and industrial engagements, through the provision of knowledge, skills, and attitudes desirable in the world of work (Chukwuedo & Omofonmwan, 2013). According Ogbunaya and Efuwape (2018) electrical/electronics technology is a subject area that involves the teaching of some abstract concepts such as atomic structure, flow of electrons, power generation, transmission and distribution, circuit design, electromagnetism, logic gates, circuit theory, amplifiers among others. Electrical/electronics technology education programme are implemented by the electrical/electronics technology educators. The teaching of electrical/electronics technology education is not gender sensitive as male and female lecturers are employed in the quality service delivery. The lecturers in their pedagogical responsibilities are required to adopt and utilize digital technologies such as AI to achieve the contemporary educational demand.

Furthermore, the use of AI by electrical/electronics technology educators in the lesson preparation, teaching and learning would produce a positive result in digital era, but the utilization can be attained if the electrical/electronics technology educators are exposed to these through in-service training. In-service training according to Osamwonye (2016) is relevant courses and activities which a serving employee may participate to upgrade this professional knowledge, skills and competence in their profession. Therefore, in-service training in education comprises of all forms of education and training given to educators who are already on the job of teaching and other instructional activities. Inservice training of teachers are continuous education of teachers which commence after initial professional education is over leading to improvement of professional competencies of the teachers (Oluka, Odeluga and Mbah, 2021). In-service training educators are already practicing teachers/educators who are undergoing a re-training programmes in the form of workshop and seminar in order to improve their service delivery in schools. Before any in-service training is provided to educators, it must address the needs of the educators for achieving quality services delivery to the learners. Oluka, Odeluga and Mbah (2021) opined that because of lack of in-service training on the need's areas of the educators especially on AI and other innovative pedagogy, the quality of service delivery by the educators declined. The identification of this AI in-service training needs would improve their performance in quality service delivery in electrical/electronics technology programme in tertiary institutions.

Quality service delivery in teaching is providing an excellent instruction programme to the students and society. According to Mbah (2016) quality service delivery involves consistently meeting or exceeding customers expectation by providing products and services that are reliable, efficient and satisfactory to the needs of the society. In-services training needs of electrical/electronics technology educators in the use of AI is aimed at identifying measures to achieve quality in the service delivery of the educator. The identification of the AI in-service needs for the electrical/electronics technology educators is imperatives as researchers like Maria, Antonia, Diana and Antonio (2022) conducted a study on digital skills, ICTs and students' needs and Olaniyi (2022) conducted a study on digital skills and future of business education. In a related development Oluka, Odeluga and Mbah (2021) identified the extent of provision of ICT in-services training needs of teachers in secondary schools. The reviewed related empirical studies were carried out in ICT and digital skills need but none of the study to best knowledge of the researchers determined the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence for quality service delivery. In order to bridge this gap, there is need to conduct a study on the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence for quality service delivery in Enugu State.

Statement of the Problem

In Nigeria, the use of AI and other ICT facilities have not attended the desired level. With the introduction of ICT facilities in schools and educational programme educators can adopt the use of AI in teaching to improve service delivery and academic performance (Adeyemi, 2020). The educator's extent of utilization of AI in teaching have not attend the desired level. It imperative to not that educators irrespective of discipline can adopt AI to facilitate the sourcing of materials, presentation and assessment of students' activities even in electrical/electronic technology education.

The use of AI as powerful tools in digital era has the capacity impart the desired knowledge, technological and scientific skills to the students. The world of technology has necessitated the utilization of AI for maintaining the students' interest, motivation and retention in their learning activities in digital era. The researcher is worried on the extent of utilization of AI in teaching and learning of electrical/electronics technology in tertiary institutions. The world is going digital and most human activities demands the knowledge and skills in AI to achieve effective service delivery. Therefore, the problem of the study posed as a question: what is the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence for quality service delivery in Enugu State.

Purpose of the Study

The main purpose of the study was to determine the In-service Training needs of Electrical/Electronics Technology Educators in the use of Artificial Intelligence for quality service delivery in Enugu State. The study specifically sought to determine the:

1. in-service training needs of Electrical/Electronics Technology Educators in the use of Artificial Intelligence in lesson preparation for quality service delivery in Enugu State.
2. in-service training needs of Electrical/Electronics Technology Educators in the use of Artificial Intelligence in assessment of students for quality service delivery in Enugu State.

Research Questions

The study was guided by the following research questions:

1. What are the in-service training needs of Electrical/Electronics Technology Educators in the use of Artificial Intelligence in lesson preparation for quality service delivery in Enugu State?
2. What are the in-service training needs of Electrical/Electronics Technology Educators in the use of Artificial Intelligence in assessment of students for quality service delivery in Enugu State?

Hypothesis

The following null hypotheses guided the study:

HO₁: There is no significant difference between the mean responses of Male and Female Electrical/Electronics Technology Educators on their in-service training needs in the use of Artificial Intelligence in lesson preparation for quality service delivery in Enugu State.

HO₂: A significant difference does not exist between the mean responses of Male and Female Electrical/Electronics Technology Educators on their in-service training needs in the use of Artificial Intelligence in evaluation of students for quality service delivery in Enugu State.

Method

This study adopted a survey research design. According to Nworgu (2015) survey research design is one in which a group of people or items are studied by collecting and analyzing data from only a few of them to represent the entire group. This design was adopted due to the responses from sample of Electrical/Electronics Technology Educators used for the study could be generalized to the rest of others teaching similar programmes in universities. The area of the study was Enugu State of Nigeria. Enugu State is one of the five states in South-East geopolitical Zone of Nigeria. The population comprised 26 electrical/electronics technology educators in three tertiary institutions (University of Nigeria Nsukka, Enugu State University of Science and Technology and Enugu State College of Education (Technical)) offering electrical/electronics technology programme in the State. The population was determined from field survey conducted by the researcher. The number was manageable and as such, there was no sampling.

The data collection was carried out using a 19 item structured questionnaire developed by the researcher based on the related literature. The instrument was structured in four-point response option of Very Highly Needed (VHN), Highly Needed (HN), Slightly Needed (SN) and Not Needed (NN) with numerical values of 4, 3, 2 and 1 respectively. The instrument was validated by three experts, two from Technology and Vocational Education Department and one from Measurement and Evaluation unit of Mathematics and Computer Education Department, all from Enugu State University of Science and Technology, Enugu. Their corrections and suggestions were used to produce the final instrument used for the study. The instrument was trial tested using 10 electrical/electronics technology educators in tertiary institutions in Anambra State who were not part of the population under study. The reliability coefficient yielded 0.81 using Crombach Alpha method. This 0.81 coefficient is in-line with Uzoagulu (2013) that reliability index of 0.60 to 1 shows that the instrument is highly reliable.

Two research assistants were used in the administration of the questionnaire and out of 26 copies distributed 24 copies were returned giving 92.31% return rate. Weighted means and standard deviations were used to answer the research questions. Decisions on the research questions were made using the lower and upper limits of the mean based on a four-point scale. The standard deviation was used to determine the homogeneity or otherwise of the opinions of the respondents. The t-test were used to test the null hypotheses. The significant value (at 2-tail) was compared with .05 level of significant at the appropriate degree of freedom. The null hypothesis was not rejected where the significant value was less than the .05 level of significance and at appropriate degree of freedom; otherwise the null hypothesis was rejected.

Results

The results of the study are presented according to the research questions and hypotheses that guided the study.

Research Question One

What are the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in lesson preparation for quality service delivery in Enugu State?

Table 1:

Mean and Standard Deviation ratings of the respondents on the in-service training needs of Electrical/Electronics Technology Educators in the use of Artificial Intelligence in lesson preparation for quality service delivery in Enugu State

S/N	<i>in-service training needs of electrical/electronics technology educators in the use of AI in lesson preparation includes:</i>	Male N= 14		Female N= 10		Overall		Decision
		X ₁	SD ₁	X ₂	SD ₂	X _G	SD _G	
1	Developing instructional content using AI	3.08	0.78	3.10	0.74	3.09	0.76	HN
2	Preparing lesson delivery with AI support system	3.11	0.67	3.16	0.66	3.13	0.66	HN
3	Uploading of lecture materials to students using AI	2.91	0.92	2.93	0.90	2.92	0.98	HN
4	Using AI in managing learners emotional intelligent	3.08	0.67	3.12	0.66	3.10	0.66	HN
5	Increasing learner's participation in lesson through the use of AI	2.90	0.71	3.02	0.72	2.96	0.72	HN
6	Prompting of information in AI searching	3.06	0.69	3.09	0.67	3.07	0.67	HN
7	Creation of learners engaging learning platform	3.22	0.67	3.21	0.64	3.21	0.65	HN
8	Methods of accessing vast amounts of educational materials	3.17	0.76	3.15	0.72	3.16	0.73	HN
9	Means of including simulations in lesson delivery	3.07	0.99	3.05	0.87	3.06	0.92	HN
10	Using links to illustrate complex concepts in AI	3.19	0.92	3.22	0.87	3.20	0.89	HN
	Cluster Mean/SD	3.08	0.78	3.10	0.74	3.09	0.76	HN

Note: X = Mean; SD =Standard Deviation; HN = Highly Needed

The analysis of data presented in Table 1 shows that the overall mean ratings range from 2.92 to and 3.21 showing highly needed. This means that electrical/electronics technology educators agree to the items as the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in lesson preparation for quality service delivery in Enugu State. The overall cluster mean of 3.09 further confirms highly needed. The low standard deviation of 0.76 indicates that the respondents have similar opinion to the items.

Hypothesis 1

There is no significant difference between the mean ratings of male and female electrical/electronics technology educators on the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in lesson preparation for quality service delivery in Enugu State.

Table 2:

Summary of t-test analysis of mean and SD ratings of Male and Female Electrical/Electronics Technology Educators on their in-service training needs in the use of artificial intelligence in lesson preparation for quality service delivery

Variables	N	t	df	Sig. (2tailed)	Mean Difference	Std. Error Difference	Decision
Male	14	0.257	22	.434	.21225	.57576	NS
Female	10						

NS= Not Significant

The result of t-test analysis in Table 2 shows that the t-value at 0.05 level of significance and 22 degree of freedom for the nine items is 0.257 with a significant value of 0.434. Since the significant value of 0.434 is more than the 0.05 level of significance the null hypothesis is not significant. This means that there is no significant difference between the mean ratings of male and female electrical/electronics technology educators on the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in lesson preparation for quality service delivery in Enugu State.

Research Question 2

What are the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in assessment of students for quality service delivery in Enugu State?

Table 3: Mean and standard deviation ratings of the respondents on the in-service training needs of Electrical/Electronics Technology Educators in the use of Artificial Intelligence in assessment of students for quality service delivery

S/N	in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in assessment of students includes:	Male N= 14		Female N= 10		Overall		Decision
		X ₁	SD ₁	X ₂	SD ₂	X _G	SD _G	
11	methods of grading using AI	3.0	0.6	3.0	0.6	3.0	0.6	HN
		4	8	6	9	5	8	
12	ways of providing personalized feedback	3.4	0.7	3.4	0.7	3.4	0.7	HN
		9	3	6	1	7	1	
13	analyzing student performance data using AI	2.7	0.6	2.6	0.6	2.7	0.6	HN
		2	7	8	6	0	6	
14	enhancing the assessment process with AI	2.8	0.6	2.8	0.6	2.8	0.6	HN
		6	8	4	3	5	6	
15	means of framing students' responses to quizzes	3.3	0.6	3.3	0.7	3.3	0.7	HN
		2	5	8	8	5	2	
16	ability to analyze textual content	2.7	0.7	2.9	0.6	2.8	0.6	HN
		0	1	4	9	2	9	
17	ability to send assessment report to the learners	2.9	0.6	2.8	0.6	2.9	0.6	HN
		7	8	5	7	1	7	
18	ability to use AI in monitoring students during examination	3.2	0.6	3.2	0.6	3.2	0.6	HN
		5	6	8	7	6	6	
19	uploading of students result to institution data base	3.36	0.69	3.39	0.69	3.3	0.6	HN
						7	9	
Cluster Mean/SD		3.08	0.68	3.10	0.69	3.0	0.6	HN
						9	8	

Note: X = Mean; SD =Standard Deviation; HN = Highly Needed

The data presented in Table 3 indicates that the overall item mean ratings range from 2.70 to 3.47 depicting highly needed. This shows that the items are the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in assessment of students for quality service delivery in Enugu State. The overall cluster mean rating of 3.09 indicates agree. The low standard deviation of 0.68 shows that the respondent's opinions do not differ remarkably to the itemized.

Hypothesis 2

A significant difference does not exist between the mean ratings of male and female electrical/electronics technology educators on the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in assessment of students for quality service delivery in Enugu State.

Table 4:

Summary of t-test analysis of Mean and SD ratings of Male and Female Electrical/Electronics Technology Educators on their in-service training needs in the use of Artificial Intelligence in assessment of students for quality service delivery

Variables	N	t	df	Sig. (2tailed)	Mean Difference	Std. Error Difference	Decision
Male	14	.729	22	.164	.34595	.63065	NS
Female	10						

NS= Not Significant

The result of t-test analysis in Table 4 shows that the t-value at 0.05 level of significance and 22 degree of freedom for the items is 0.729 with a significant value of 0.164. As the significant value of 0.164 is more than the 0.05 level of significance the null hypothesis is not significant. This means that there is no significant difference with respect to the items on the mean ratings of male and female electrical/electronics technology educators on the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in assessment of students for quality service delivery in Enugu State.

Discussion

The study found the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in lesson preparation for quality service delivery in Enugu State. The identified in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in lesson preparation including, developing instructional content using AI, preparing lesson delivery with AI support system, uploading of lecture materials to students using AI, using AI in managing learners emotional intelligent, increasing learner's participation in lesson through the use of AI, prompting of information in AI searching, creation of learners engaging learning platform, methods of accessing vast amounts of educational materials, means of including simulations in lesson delivery and using links to illustrate complex concepts in AI. This showed that the identified in-service training needs in the use of AI for achieving quality service delivery. The findings of the study were in agreement with Sheueller, Tomasino and Mohr (2017) and Obi (2022) that AI has the capability to promptly offer feedback to both students and teachers, facilitating quick intervention and adaptation of teaching tactics. For the educators to utilize AI in teaching, there is need to provide in-service training for them in the identified areas in the study. The further, the findings indicated that there was no significant difference between the mean ratings of male and female electrical/electronics technology educators on the in-service training needs in the use of artificial intelligence in lesson preparation for quality service delivery in Enugu State. This depicts that the gender of the respondents had on influence on the identified in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in lesson preparation for quality service delivery in Enugu State.

Furthermore, the findings of the study revealed the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in assessment of students for quality service delivery in Enugu State. The identified in-service training needs of electrical/electronic technology educators in the use of artificial intelligence in assessment of students includes; methods of grading using AI, ways of providing personalized feedback, analyzing student performance data using AI, enhancing the assessment process with AI, means of framing students' responses to quizzes, ability to analyze textual content, ability to send assessment report to the learners, ability to use AI in monitoring students during examination and uploading of students result to institution data base. This shows that the items are the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in assessment of students for quality service delivery in Enugu State. These in-service training needs on the use of AI in assessment are necessary for achieving effective human capacity in digital era. The findings were supported by Felix and Webb (2024) that the lecturers/teachers should be retrained on how to utilize AI in assessing the students' performance. The author pointed that human markers are prone to their own unique errors and biases, which can impact the grades that learners receive. The findings showed that the in-service training needs of electrical/electronics technology educators in the use of AI in students' assessment is highly needed. The findings

of the study showed that there was no significant difference with respect to the items on the mean ratings of male and female electrical/electronics technology educators on the in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in assessment of students for quality service delivery in Enugu State. The implication of the findings was that gender had no significant influence on the identified in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in assessment of students for quality service delivery in Enugu State.

Conclusion

The use of innovative ICT based tools in achieving quality instructional delivery have become the bedrock of digital era education. This therefore, necessitate the need to re-train the teachers on these ICT tools such as AI. The study identified in-service training needs of electrical/electronics technology educators in the use of artificial intelligence in lesson preparation and assessment of students for quality service delivery. If the identified AI needs of the electrical/electronics technology educators are utilized it will improve the lecturer's performance and quality service delivery. Technological innovations are increasing and there is need to integrate it into the teaching and learning environment. The identified needs for effective use of AI will facilitate the in-service training provided to the teachers and development of competency-based ICT training in AI utilization. The study therefore conclude that institution administrators and electrical/electronics technology educators should adopt the identified needs in order to provide in-services training needed in the AI utilization for human capacity development for digital era.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Electrical/electronics technology educators should be provided in-service training on the use of AI in preparing and assessment of students learning as digital age demand.
2. AI be provided and used to improve the teaching and learning of electrical/electronics technology in tertiary institutions in Enugu State.
3. Government should provide resources for in-services training of electrical/electronics technology educators in the use of AI in teaching.
4. Tertiary institution administrators should develop strategies that will enable the educators to build their capacity in the use of AI in teaching the students.

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