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Innovations into industrial-technology programmes of Nigerian universities for quality assurance

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ABSTRACT

The study innovated the industrial technology programmes of Nigerian universities for effective application of mobile communication technologies and quality assurance of graduates**.** Five research questions guided the study while three null hypotheses formulated were tested at .05 level of significance. The study made use of descriptive survey design and was carried out in Enugu State, Nigeria. The participants for the study were 120 comprising of 67 lecturers of electrical/electronic technology and 53 technologists of industrial technical education. A 97-item questionnaire was used as instrument for data collection. One hundred and eighteen copies of the questionnaire were retrieved. The data collected were analyzed using mean, factor analysis, standard deviation and improvement need index (INI) to answer the four research questions while analysis of variance was employed to test the hypotheses at .05 level of significance. Results revealed that 33 innovations for inclusion into programme of electrical/electronic technology. Furthermore, the results of the study revealed that teachers need improvement in implementing the innovated contents of electrical/electronic technology aspect of industrial technical education programme. Hence, there is need to package the findings of the study into training programme and use it for building the capacity of teachers of electrical/electronic technology in Nigerian universities.

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1. INTRODUCTION

Universities are known to be the origin or sources of innovations. They are setup to train individuals, develop and to conduct researches that could lead to innovations of society. Innovation and technology are recognised as drivers of economic growth and competitiveness in developed economies, but emerging economies often face challenges in introducing the regulations, policies and good practices that consolidate these areas [1-2]. Universities, as important sources of knowledge, technology and skilled human capital, can provide valuable ideas and support to new industries and are engaged in innovation and entrepreneurship dynamics through third mission activities [3]. University as an apex institution provides education for all and some of its major activities include: teaching of courses, conducting research and community development. In other words, the responsibilities of Nigerian universities include; admitting students, training students and graduating students in various programmes. Some of Nigerian universities for example, offer industrial technology/vocational education where individuals are meant to acquire knowledge, skills and attitudes for employment in relevant industries. By addressing industry skills, leadership, 21st century skills and integration of academic knowledge, vocational education courses have become an important element in most tertiary institutions such as high schools and universities. Vocational education is that aspect of education which through its programmes like electrical/electronic technology helps people to acquire practical skills or becomes more efficient in occupations of their choice. Industrial technical education is an aspect of vocational education. Industrial technology is a specially designed educational programme meant to develop, improve workforce for sustainable economy. In some countries, industrial technology is meant to be part of vocational education. Industrial technology programme generally plays important roles in the development of students and the future of any society [4-5]. The importance and benefits derivable from a well planned vocational education is multidimensional. These benefits to include: supply of food to meet the energy, nutritional and growth requirement of every individual; Provision of shelter through construction activities which are mostly the responsibility of an individual in industrial technical education; provision and maintenance of transportation and communication facilities; clothing and home management and as a tool for creating a productive economy and making it compete favourably with that of other developed nations in the world [6-7]. In [8] added that the Nigerian universities offer industrial technology courses such as electrical/electronic technology to train personnel for industries and technical teachers for secondary schools and non-university tertiary institutions.

Electrical/electronic technology equips individuals with knowledge, skills and attitudes required for effective management and maintenance of electrical and electronic equipment and gadgets such as radio, television, computers, among others. In electrical/ electronic technology, according to [9], students may study the behaviour of electrons and the practical uses to which such study can be applied. [10] also added that in electrical/electronic technology, one is expected to use acquired skills to operate, maintain, install and repair electrical and electronic equipment with electrical measuring and testing instruments. Electrical/electronic technology programme is therefore concerned with the acquisition of knowledge, skills and attitudes to perform such operations as repair, maintenance servicing, design, produce and construction of electrical/electronic related equipment for man use [11]. The benefits of electrical and electronic technology to immediate society are so enormous. According to [12], there is hardly any human activity where electronics have not made impact. It has become a major instrument in the implementation of almost all subjects and areas of life [13]. Both agent of transformation depends solely on electrical/electronic technology. Electronics/electronic technology is vast in nature and its content in schools is expected to experience changes and improvement from time to time in order to fetch graduates employments. Acquisition of skills and knowledge in using mobile communication technologies such as cell phones, computers, Ipads, Personal digital assistance, internet and other information technologies to execute given tasks easily is the answer to cope with the 21st century situation. As stated by [14], the demands for skills shift towards more sophisticated tasks suggest that individuals with poor 21st century skills are more likely to find themselves at risk of unemployment and social exclusion. Electrical/electronic aspect of industrial technology therefore requires some innovations as this will enable the students to acquire modern skills and allow graduates to fit and be employable in the 21st century environment.

Innovation is a tool to enhance sustainable development in education, and it has been receiving the attention of educators, educationists and researchers across the world. Introduction of recent concepts/technologies into a curriculum and removal of obsolete ones is sometimes called curriculum innovation. According to [15], curriculum innovation is the modification of what was existing before the development of ideals, practices, belief that are fundamentally new. Curriculum innovation can be defined as the deliberate actions to improve a learning environment by adapting a method of presenting material to students that involves human interaction, hands-on activities and student feedback. When curriculum innovation or change is made in the classroom of electrical/electronic technology for example, it can enhances the social skills of students and focuses on unique methods for teaching historical, technological, organizational or political lessons. An innovative lesson may encourage students to use online tools, mobiles technologies, multimedia software applications or hands-on lab experiments among others [16]. An innovative curriculum relies on students to make discoveries with an instructor present to serve as a mentor or guide instead of taking the role of the expert who controls the learning.

1.1. Statement of the Problem

Electrical/electronic technology, an aspect of industrial technology programme that requires innovations is on ground and people that studied it are not employable either in the industries or elsewhere. The present technology environment requires that people should be competent in electrical/electronic technology and in the use of mobile communication technologies such as cell phones, ipads, personal digital assistance, internet, and other information technologies; because they cannot work in those areas, therefore the causes of this incompetence is now hinged on the following that require innovations: training programme; teacher competence; and available facilities in the environment. If these three are accomplished through innovative strategies, people most especially graduates will find comfortable employment in the electrical/electronic technology related industries. The study was therefore anchored on conceptual framework making used of the following models: need assessment model and function of industry.

Generally, a model is known as the representation of reality. In research a model means an approach or a channel which research activities could be passed through to achieve end result. In [17] described need assessment model as the one used in carrying out a research work probably for individuals and companies that made up their minds to begin a project but they do not know how to be set about it. Their needs must form fulcrum of the study. The need assessment study is generally used to ascertain what is currently in place and what is needed in the future [18-19]. Function of industry model could be involved to conduct research in two directions: a) for improving the operations of an industry b) for establishing an industry through zero-base. This model could be used to identify skills for improving a training programme that supplies manpower for such industry or its allies. All these models provide anchorage for activity concept in research work; an activity concept involves various research activities that are to be carried out towards finding a solution to an identified research problem. Thus, this paper is aimed at innovating the electrical/electronic technology of industrial technology programmes of Nigerian Universities. In view of this, the researchers developed five research questions aimed at addressing the objectives of the study:

- What are the innovations to be integrated to the content of electrical/electronic technology aspect of industrial technical education programme?
- What is the factorial validity of the innovated contents of electrical/electronic technology, (iii) what are the competency improvement needs of teachers for implementing the innovated of industrial technical education programme?
- What are the facilities appropriate for implementing the innovated industrial technical education programme?
- What is the effectiveness of the contents of electrical/electronic technology and performance of Lecturers and Technologists of industrial technical education programme in making use of appropriate facilities?

1.2. Hypotheses

The following null hypotheses were tested at .05 level of significance:

- There is no significant difference in the mean responses of the respondents on the innovations of Electrical/electronic technology aspect of industrial technical education programme, competency improvement needs of teachers and facilities appropriate for implementing the innovated electrical/electronic technology aspect of industrial technical education programme

2. RESEARCH METHOD

The study adopted a descriptive survey design. Descriptive survey design according to [20] is a design that studies characteristics and focuses on people, the vital facts of people and their beliefs, opinions, attitude, motivation and behaviors. The descriptive survey design was appropriate for this study because it aimed at using questionnaire to elicit facts, beliefs and opinions or data from experts about innovation into electrical/electronic technology aspect of industrial technical education programme of Nigerian universities. The study was conducted in south eastern states of Nigeria. South eastern States are chosen because of the high presence Universities with the necessary human and material resources required for the conduct of the study. The population for the study was 120 participants which comprised of all the 67 lecturers of electrical/electronic technology and 53 technologists in the Industrial Technical Education Programme of the seven universities who met the criteria of this study. There was no sampling because of the manageable size of the population of the lecturers and the technologists.

The instrument used for data collection was structured questionnaire titled: Innovation of Industrial Technology of Nigerian Universities Structured Questionnaire (IITTNUSQ) developed by the researchers based on critical literature review [21-27]. The questionnaire items were developed and arranged in line with the three research questions and hypotheses formulated for the study. The instrument was assigned a five point Likert Scale response with corresponding numerical values 5, 4, 3, 2 and 1 and improvement need index [28-30]. The instrument was subjected to face, intrinsic and factorial validations. One hundred and forty items were retained out of 159 items presented to experts in form of structured questionnaire. This procedure conforms with what [31] suggested, that face validity should be determined by expert judgment. The intrinsic validity coefficients obtained for each section of the instrument according to [32] were as follows: Section A, 0.86; Section B, 0.83; section C 0.83. For proper selection of right innovations for inclusion into the final content of the electrical/electronic technology, the items (innovations) were subjected to factor analysis using 0.40 as factor loading at 10% over lapping variance [33]. In the result, all the 32 items with factor loading of 0.40 or above were selected for the study. It is an ideal thing to subject skills/items that make up training contents to factor analysis [34, 18].

Section A of part 2 of the questionnaire had (& = 0.82, n=20), Section B had (&= 0.78, n= 20), Section C had (&= 0.88, n=20) while the overall index yielded (& = 0.89, n= 20). The reliability co-efficient value of 0.80 or above allowed the researchers to launch the study on a large scale [35]. A coefficient of .60 is considered to be poor, 0.70 is acceptable, while over 0.80 is good. Out of 120 copies of the questionnaire administered, only 115 copies were duly completed and returned, representing 95.83 percent return rate upon which data analysis was based. This is an acceptable response rate according to a study by [36] who recommended a standard of 60+/-20% for surveys in managerial and behavioural sciences. Mean, standard deviation, weighted Mean and improvement need index (INI) and percentage were used to answer research questions while t-test was employed for testing the three null hypotheses at 0.05 and relevant degrees of freedom.

3. RESULTS AND ANALYSIS

First, the study sought to determine innovations for inclusion into the electrical/electronic technology aspect of industrial technical education programme of Nigerian University. The data presented in Table 1 reveal that all the items have their mean value ranged from 3.52 to 3.82. This shows that the mean value of each item was above cut-off point of 3.50, indicating that the items are can be integrated to the electrical/electronic technology of industrial technical education. Similarly, factor loading of the items (innovations) ranged from 0.52 to 0.78. This indicated that factor loading of each item was above 0.40, indicating that they can be included into the electrical/electronic technology. The standard deviation of these items ranged from .72 to .88 indicating that the respondents were close to one another in their opinion.

Table 1 also revealed that lecturers and technologists were very high in their performance in teaching their students in the following curriculum contents of electrical/electronic technology after receiving training: electrical and wiring system of modern vehicles (73.06%), but high in their performance in repair and servicing of industrial machines and equipment (61.10%), compositions of recent lamps (65.09%) and principles and operation of recent electrical/electronic technologies (67.13%); Table 4 reveals that lecturers and technologists were low in their performance in teaching mechatronics and their applications (45.10%), maintenance of phones and Ipads (46.00%), application of software for diagnostic faults and faulty equipment, (49.50%), maintenance of non-global warming potential refrigerators and air conditioners (47.08%), robots and robotic teaching (48.00%), smart and android phones (46.20%), website development (42.6%), mechatronic products in automobiles (43.50%), construction of meterless meter (41.67%) and reliability and maintainability of electronic equipment (47.80%). Also, the table reveals that these Lecturers and Technologists were average in their performance in teaching their students in the remaining 18 items. Generally, Table 1 shows that lecturers and technologists of electrical/electronic technology were of average performance (54.13%) after receiving training on teaching the innovated contents of electrical/electronic technology aspect of industrial technical education programme to their students. The Table 1 also indicated that all the items had their P-values greater than .05. This indicated that there was no significant difference in the mean responses of the respondents on the innovations to be integrated to electrical/electronic technology aspect of industrial technical education programme. Therefore, the null hypothesis of no significant difference was upheld for all the 33 innovations.

Researchers investigated the competency improvement needs of lecturers for implementing the innovated electrical/electronic technology aspect of industrial technical education programme. Data in Table 2 reveal that the performance gap values of 25 out of 26 items ranged from 0.22 to 1.50 and were positive. This indicates that the lecturers need capacity building or improvement on 25 items shown in the Table 1. One out of the 26 items had a performance gap value of -0.12, indicating that the lecturers do not need improvement or capacity building on the item because the level at which the item was needed was lower than the level at which the lecturers could perform the item. The Table 2 also indicated that all the items had their P-values greater than 0.05. This indicated that there was no significant difference in the mean responses of the respondents on the competency improvement needs of lecturers for implementing innovated electrical/electronic technology aspect of industrial technical education programme. Therefore, the null hypothesis of no significant difference was upheld for all the 26 items.

Table 1. Mean responses of the respondents on the innovations of electrical/electronic technology aspect of industrial technical education programme

S/N	Innovations	Mean	Factor Loadings	Lecturers and Technologist (%) Score	Sig.	Rem	Performance	Ho
1	Software development	3.56	0.56	54.06	0.56	R	AP	NS
	Latest testing and measuring instruments	3.70	0.64	56.90	0.34	R	AP	NS
3	Mechatronics and their applications	3.75	0.71	45.10	0.51	R	LP	NS
4	Smart workshop and practices	3.62	0.78	51.08	0.09	R	AP	NS
5	Maintenance of phones and Ipads	3.78	0.59	46.0	0.24	R	LP	NS
6	Interactive smart white board	3.68	0.65	58.04	0.10	R	AP	NS
7	Principles and operation of recent electrical/electronic technologies	3.58	0.67	67.13	0.09	R	HP	NS
8	Application of software for diagnostic faults and faulty equipment	3.57	0.58	49.50	0.46	R	LP	NS
9	Maintenance of recent technologies such as LED, LCD and home theatres	3.66	0.62	56.10	0.56	R	AP	NS
10	Compositions of recent lamps	3.59	0.55	65.09	0.34	R	HP	NS
11	Digital oscilloscopes and their application	3.78	0.56	55.02	0.26	R	AP	NS
12	Concept of non-global warming potential refrigerator	3.77	0.62	57.12	0.36	R	AP	NS
13	Non global warming potential air conditioners	3.69	0.52	51.30	0.34	R	AP	NS
14	Maintenance of non-global warming potential refrigerators and air conditioners	3.69	0.55	47.08	0.21	R	LP	NS
15	Robots and robotic teaching	3.73	0.63	48.00	0.25	R	LP	NS
16	Smart and android phones	3.67	0.60	46.20	0.21	R	LP	NS
17	Maintenance of mobile communication technologies	3.68	0.72	52.78	0.32	R	AP	NS
18	Modern teaching methods and strategies	3.59	0.57	58.12	0.13	R	AP	NS
19	Construction and improvisation of simple models for teaching electrical related subjects	3.70	0.59	56.80	0.23	R	AP	NS
20	Website development	3.79	0.67	42.6	0.13	R	LP	NS
21	Flashing of faulty cell phones	3.77	0.62	56.01	0.21	R	AP	NS
22	Solar panel construction and maintenance	3.75	0.60	55.9	0.34	R	AP	NS
23	Modern office technologies	3.62	0.64	51.02	0.41	R	AP	NS
24	Mechatronic products in automobiles	3.82	0.59	43.50	0.17	R	LP	NS
25	Electrical and wiring system of modern vehicles	3.52	0.61	73.06	0.43	R	VHP	NS
26	Use of modern hand tools such as percussion, cutting, soldering and grinding tools	3.68	0.58	67.12	0.54	R	HP	NS
27	Installation of electrification of industries	3.56	0.57	59.57	0.23	R	AP	NS
28	Solar panel systems and electricity generation	3.59	0.63	56.43	0.43	R	AP	NS
29	Repair and servicing of industrial machines and equipment	3.69	0.64	61.10	0.34	R	HP	NS
30	Biomedical electronic equipment	3.57	0.59	53.06	0.31	R	AP	NS
31	Construction of meterless meter	3.65	0.54	41.67	0.23	R	LP	NS
32	Reliability and maintainability of electronic equipment	3.77	0.75	47.8	0.35	R	LP	NS
33	Maintenance of teaching facilities like projectors, electronic boards among others	3.67	0.54	56.10	0.21	R	AP	NS
	Average Total			54.13				

Key: *Ho- Null hypotheses; NS- Not significant; R-Required; LP-Low Performance; AP-Average Performance; HP-High Performance; VHP-Very High Performance*

Table 2. Performance gap-analysis of mean ratings of the respondents on the competency improvement needs of lecturers for implementing the innovated electrical/electronic technology aspect of industrial technical education programme

S/N	Item Statements	Xn	Xp	Xn-Xp (PG)	Rem.	P-Value	Rem.
1	Application of modern technologies such as smart white board, etc for teaching electrical/electronic courses	3.68	2.98	0.70	CBNN	0.11	NS
2	Adoption of recent mobiles such as ipads, android phones, smart phones and personal digital assistance for teaching	3.82	3.60	0.22	CBN	0.21	NS
3	Teaching of students in blended learning environments	3.62	3.11	0.51	CBN	0.13	NS
4	Use of smart interactive white board for teaching electrical/electronic courses	3.60	3.02	0.58	CBN	0.09	NS
5	Use of online assessment format for assessment purposes	3.74	2.89	0.85	CBN	0.10	NS
6	Use of e-teaching platform for teaching	3.81	3.24	0.57	CBN	0.22	NS
7	Use of e-tutoring for students of electrical/electronic technology in different locations	3.12	2.10	1.02	CBN	0.12	NS
8	Teaching of students practical in a smart workshops/laboratories	3.88	3.31	0.57	CBN	0.11	NS
9	Teaching the concepts of mechatronic to students of electrical/electronic technology	3.76	2.45	1.31	CBN	0.32	NS
10	Teaching the principles and operations of recent electrical/electronic related technologies to students	3.78	3.08	0.70	CBN	0.12	NS
11	Demonstrate skills in maintenance of mobile phones, ipads etc	3.21	2.45	0.76	CBN	0.12	NS
12	Teaching testing and measuring instruments for maintenance work	3.86	3.05	0.81	CBN	0.23	NS
13	Use of various testing and measuring instruments for maintenance work	3.78	3.00	0.78	CBN	0.11	NS
14	Application of meter-less meter to diagnose and clear all kinds of faults	3.21	2.02	1.19	CBN	0.13	NS
15	Application of software analysis to diagnose electrical faults	3.21	2.33	0.88	CBN	0.21	NS
16	Teaching the concepts of mechatronics	3.33	2.50	0.83	CBN	0.11	NS
17	Clear faults in modern electronics such as LED, LCD and home theatre	3.67	2.56	1.11	CBN	0.31	NS
18	Teaching the Use and application of digital oscilloscopes	3.21	3.33	-0.12	CBN	0.21	NS
19	Solar panel concepts and demonstration of maintenance skills	3.78	2.28	1.50	CBN	0.12	NS
20	Recent lamps and their applications	3.67	3.21	0.46	CBN	0.10	NS
21	Software development and the skills involved in it	3.54	3.25	0.29	CBN	0.11	NS
22	Teaching of electrical/electronic through social media platforms	3.43	2.56	0.87	CBN	0.12	NS
23	Teaching the concept and maintenance of modern office technologies	3.12	2.45	0.67	CBN	0.16	NS
24	Teaching the concepts of website development	3.22	2.54	0.68	CBN	0.12	NS
25	Use of appropriate evaluation formats to assess students practical skills in various technical areas	3.58	3.27	0.31	CBN	0.12	NS
26	Teaching and maintenance of non global warming potential refrigerators and air conditioners	3.58	2.25	1.33	CBN	0.11	NS

Keys: *Xn = Mean of Needed; Xp =Mean of Performance; CBN = Capacity Building Needed, CBNN = Capacity Building Not Needed*

Furthermore, the researchers determine the appropriate facilities for implementing the innovated electrical/electronic technology aspect of industrial technical education programme. The data in Table 3 reveal that all the items have their mean values ranged from 3.50 to 3.83. This shows that the mean value of each item was above the cut-off point of 3.50, indicating that the items are the facilities appropriate for implementing the innovated electrical/electronic technology aspect of industrial technical education programme. Similarly, the standard deviation of these items ranged from .65 to .89 indicating that the respondents were close to one another in their opinion. The Table 3 also indicated that all the items had their P-values greater than 0.05 and this indicated that there was no significant difference in the mean responses of the respondents on the facilities for implementing the innovated electrical/electronic technology aspect of industrial technical education programme. Therefore, the null hypothesis of no significant difference was upheld for all the 37 facilities for implementing the innovated electrical/electronic technology.

Table 3. Mean responses of the respondents on the appropriate facilities for implementing the innovated electrical/electronic technology aspect of industrial technical education programme

S/N	Facilities	Mean	S.D	Sig.	Remarks,	Ho
1	Smart and well equipped workshops	3.56	0.77	0.05	Required	NS
2	Appropriate hand tools and equipment	3.50	0.82	0.05	Required	NS
3	Scraps of LED, LCD and home theatre	3.72	0.71	0.05	Required	NS
4	Digital multimeters and other modern equipment	3.56	0.65	0.05	Required	NS
5	Faults diagnostic software	3.66	0.81	0.05	Required	NS
6	Workbench	3.58	0.78	0.05	Required	NS
7	Conducive classrooms	3.68	0.69	0.05	Required	NS
8	Smart interactive whiteboard	3.55	0.78	0.05	Required	NS
9	Computer system or laptops of high capacity	3.62	0.76	0.05	Required	NS
10	Infrared rework stations and soldering irons	3.65	0.73	0.05	Required	NS
11	White boards and projectors	3.59	0.82	0.05	Required	NS
12	Relevant technical textbooks	3.78	0.73	0.05	Required	NS
13	Internet facilities and access	3.65	0.82	0.05	Required	NS
14	Soldering materials such as solder, lead suckers, etc	3.52	0.77	0.05	Required	NS
15	Relevant electrical/electronic components	3.60	0.82	0.05	Required	NS
16	Various circuit diagrams and manufacturer manuals for users	3.76	0.78	0.05	Required	NS
17	Instructional posters and magazines on maintenance of electronics	3.53	0.78	0.05	Required	NS
18	Mechatronic products	3.74	0.76	0.05	Required	NS
19	Constant electricity and standby generators	3.56	0.65	0.05	Required	NS
20	Demonstration boards and tables for practical class	3.53	0.74	0.05	Required	NS
21	Scraps of recent technologies contained in the curriculum content	3.83	0.67	0.05	Required	NS
22	Soldering paste and flux	3.70	0.79	0.05	Required	NS
23	Digital power supply	3.55	0.78	0.05	Required	NS
24	Eyelets and eye letting tools	3.55	0.83	0.05	Required	NS
25	Magnifying desk lamps	3.52	0.73	0.05	Required	NS
26	Ultrasonic and vacuum cleaners	3.69	0.69	0.05	Required	NS
27	Anti-static wrist strap	3.55	0.73	0.05	Required	NS
28	Anti-static mats and bags	3.50	0.81	0.05	Required	NS
29	Signal chart books	3.54	0.79	0.05	Required	NS
30	Intelligent printed circuit board cleaners	3.78	0.89	0.05	Required	NS
31	Anti-static tweezers	3.67	0.77	0.05	Required	NS
32	Electronic microscopes	3.65	0.79	0.05	Required	NS
33	Screw extractors	3.77	0.65	0.05	Required	NS
34	Universal serial bus	3.62	0.78	0.05	Required	NS
35	Broad holders	3.65	0.67	0.05	Required	NS
36	Assorted driving and cutting tools	3.54	0.71	0.05	Required	NS
37	Mobile and smart laboratories	3.67	0.78	0.05	Required	NS
38	Smart classrooms and workshops					

Key: S.D – *Standard deviation; Ho- Null hypotheses; NS- Not significant; Rem.- Remark*

4. DISCUSSION OF FINDINGS

The results of this study revealed 32 innovations for inclusion into electrical/electronic technology aspect of industrial technical education programme of Nigerian University. However, the lecturers and technologists were of average performance in teaching and using the facilities specified in the contents after receiving training. The implication of this finding is that contents of electrical/electronic technology in Nigerian universities lack some innovations and there is need to inject the content with relevant innovations. The implication also means that the contents are effective in improving lecturers and technologists' performance. These findings of the study could be attributed to the fact that electrical/electronic technology programme of Nigerian universities has not been reviewed for years. The findings of this study agreed with the findings of [37] who conducted a study on the integration of mechatronics in electrical/electronic technology programme of colleges of education in order to ensure occupational quality assurance of graduates in the 21st century Nigeria and found that 10 contents and 22 competencies of mechatronics were required for inclusion into the electrical /electronic technology programme of colleges of education to ensure occupational quality assurance of graduates in the 21st century. The results of hypothesis one shows that there wasno significant difference in the mean responses of the respondents on the innovations for inclusion into the electrical/electronic technology aspect of industrial technical education programme. This means that the respondents had similar opinions or perceptions on the innovations for inclusion into the electrical/electronic technology of Nigerian universities.

The result of the study in Table 2 revealed that improvement is needed by lecturers for effective implementation of electrical/electronic technology in Nigerian universities. These findings of the study could be attributed to the fact the capacities of lecturers of electrical/electronic technology have not been built regularly for effective teaching of electrical/electronic technology courses. This finding agreed with the findings of [38] who carried out a study to develop appropriate e-teaching contents for capacity building of technical education lecturers of colleges of education in Lagos State. These authors found that 22 competencies in e-teaching were appropriate for building the capacity of technical education lecturers. In [39] also stated that working women and men periodically need opportunities to update their skills and learn new ones. The results of hypothesis two shows that there wasno significant difference in the mean responses of the respondents on the competency improvement needs of lecturers for implementing innovated electrical/electronic technology aspect of industrial technical education programme. Similarly, the results presented in Table 3 indicate that majority of the respondents agreed with the 38 training facilities for implementing the innovated electrical/electronic technology aspect of industrial technical education programme. This finding corroborates the findings of [18] who found that fifty facilities were required for maintenance of cell phones and implementation of cell phone maintenance training modules. The finding was also in consonance with the findings of [40] that facilities help in teaching skills and competence to individuals. Adequate and relevant training facilities make the learning process more satisfying. The findings also in line with the finding of [41] that technologies such as cell phones, computers, Ipads among others are yet to be fully utilized for teaching in schools and colleges. The findings of this study also in agreement with the findings [42] that lecturers required performance competencies in using computer for teaching, operating computer and in applying computer to agriculture through the internet, e-mail and Microsoft power point. The findings of the above researchers in their various research activities helped to support the justification of the results of this study on the innovations into electrical/electronic technology of industrial technical education programme of Nigerian Universities. The results also showed that E- education is important in Nigeria [43]. Furthermore, the results of hypotheses one and two show that indicated that there was no significant difference in the mean responses of the respondents on the facilities for implementing the innovated electrical/electronic technology aspect of industrial technical education programme. This also means that the respondents had similar perceptions on each training facilities for implementing the electrical/electronic technology in Nigeria universities. The findings also identified the importance of information technology, since it is increasing in our education industry [44].

5. CONCLUSION

The aim of this paper was to innovate the electrical/electronic technology programme of industrial technical education programme of Nigerian Universities. A total of three research questions were answered: one was to determine the innovations to be integrated to electrical/electronic technology aspect of industrial technical education programme; the second was to identify the competency improvement needs of teachers for implementing innovated electrical/electronic technology aspect of industrial technical education programme and the third was to identify the appropriate facilities for implementing the innovated electrical/electronic technology aspect of industrial technical education programme. In order to answer these research questions, a 97-item questionnaire was developed and used as the research instrument and was administered to 120 participating individuals purposively selected from five tertiary institutions in south eastern, Nigeria.

In conclusion, the participating experts agreed that electrical/electronic technology aspect of industrial technical education programme needs to be integrated with 32 innovations prescribe in Table 1 above because it lacks recent contents and skills to be learned by students for future employments. The group of experts also agreed that electrical/electronic technology lecturers in Nigerian universities need improvement training or capacity building in 26 items for effective implementation of innovated programme. Various facilities were determined for the implementation of the innovated programme.

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