International Journal of Multidisciplinary Research and Development
www.allsubjectjournal.com
ISSN Online: 2349-4182 ISSN Print: 2349-5979
Received: 03-06-2023, Accepted: 18-06-2023, Published: 04-07-2023
Volume 10, Issue 7, 2023, Page No. 20-25

Skills competency among electrical/electronic technology undergraduate students in tertiary institutions in Kano state

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Abstract
Electrical and Electronic Technology Education is an aspect of Technical Education offered in tertiary institutions in order to produce Electrical teachers and technologist. For the program to be successful, the students need to be competent in Electrical installation and repairs. The paper assessed the skills competency among the Electrical/Electronic Technology Education undergraduate students in tertiary institutions in Kano state. Two research questions and two hypotheses were formulated to guide the study. The study has population of 103 Electrical/electronic Technology final year undergraduate students chosen from three tertiary institutions running Electrical Electronics Technology Education. The population is manageable, therefore no sampling technics was adopted. One hundred and three (103) copies of questionnaires were administered to the respondents and 96 copies were returned which represent a return rate of 93%. The reliability coefficient of 0.77 were obtained. The instrument were administered by the researcher and assisted by research assistants. The data collected were analyzed using mean and standard deviation to answer the research questions. The hypotheses were tested using t-test at 0.05 level of significance. The results revealed that undergraduate students of Electrical and Electronic Technology Education in university and affiliated program in college of education in Kano state are competent in terms of Electrical installation skills both in Domestic and Industrial Electrical Installations. It was concluded that the philosophy of introducing Electrical Electronics Technology education to reduce the rate of unemployment among the undergraduates of tertiary institutions in Kano state is achieved if the students continue to graduate with required practical skills competency in domestic and industrial Electrical installation. Finally the study recommends that electrical installation and maintenance work trade lectures should be encouraged by their institutions and other relevant stakeholders to acquire modern technical competencies in domestic and industrial installation and also should keep exposing their students to more practical skills in domestic and industrial installation for job employment after school.

Keywords: Competency, skills, electrical and electronic technology

Introduction

Vocational and Technical skills are essential for economic growth and development for any nation. Vocational and Technology Education program aimed at prepare youths for employment and self-reliance after school (Emmanuel, David & Aliyu, 2017) [10]. Electrical and Electronic Technology is an aspect of Technical Education program offered in tertiary institutions such as universities, polytechnics, and colleges of education (technical) with aim 0f producing Electrical and Electronic technologist, technicians and teachers (Oluwalola, 2019) [18]. According to the National Board for Technical Education (NBTE, 2011), the main goal of Electrical/Electronic Technology is to produce competent Electrical/electronic, technicians and Technologists who are skilled to conduct various types of Electrical and Electronics installations, diagnose, repairs and maintenance. The program is expected to give the students technical skills and competencies in working with Electrical and Electronics devices in order to grantee them to work with the industry or to become Electrical teacher. The program is also expected to help the students to start their own business, becoming self-employed and able to employ others or continuing their education in advanced Technical programs or post-graduate program in technical institutions such as Universities (FGN, 2004). This implies that the program was designed to enable students to gain the skills needed in technical field so that the graduates can be gainfully employed, either on a paid or self-employed basis to lower the country's unemployment rate.

Electrical and Electronic Technology deals with services and operations of machines, power tools, digital and analogue devices, Electrical installation and systems that use conductors and metals to conduct a current or flow of electrons. It entails the design and development of high-voltage systems and components for use in light and heavy machinery, such as motors, generators, Electrical power transmission and distribution systems, radio wave and optical systems, converters, and control systems (Hassan, 2021). Electrical/Electronic Technology, on the other hand, encompasses not only the design and manufacture of all of the aforementioned Electrical systems, but also their installation, testing, and maintenance with high skills (Alippi, 2014). Skill competency in Electrical/Electronic Technology poster undergraduates students employability ability and be gainfully employed, either on a paid or self-employed or becoming self-employed and able to employ others (Usman, 2020) [19].

A skill is the learned ability to carry out a specific action with predictable results and good execution. To measure the level of skill being demonstrated and applied, certain contextual triggers and situations are normally required. In other words skills simply means a person’s ability to device

elements of feeling, thinking and behavior within particular task domains and within specified contexts. Installation Skill competency of Electrical/Electronic Technology covers Electrical domestic installations skills competency, Electrical industrial installation skills competency, field work specific skills competency, transferable skills competency, intellectual skills competency, and safety skills competency. Work skills are practical activities, which can help an individual to acquire saleable skills. It entails a total array of responsibilities within an activity that an individual performs for work to have been done. Reliance is the state of having or engaged in a job for some form of payment. Self-reliance among the graduates may help the government to reduce societal problems such as burglaries, armed robbery, aggression, frustration, prostitutions, drug addiction and insecurity (Ya'u, Usman & Abdulhakim, 2020) [20]. The undergraduate Technical Education students in tertiary need to be competent in electrical installation skills, maintenance and repair of Electrical motors, gadgets related and equipment. Therefore, there is need to assess the competency level of the Electrical and Electronics undergraduates students for self-reliance in the field in Kano State.

Competence according to Babayo (2021), is a combination of practical and theoretical knowledge, cognitive skills, behavior and values that can be used to improve performance, quality of being adequately well qualified to perform a specific role. These attributes has been linked to better job performance and can be used as a benchmark for measuring job performance as well as developing, recruiting, and hiring employees. However, technical skills competency in Electrical installation and maintenance work can only be effective if teachers and students in the trade are competent and knowledgeable in both theory and practical. Students' quickly loose respect and confidence in the teacher who is ineptitude at the trade or occupation he professes to teach. Thus, Electrical installation and maintenance work trade teachers and students have to show mastery in both theory and practice of the trade.

Competency and skills of human resources are the vital resources that determine and controls other resource, and these human resources are acquired in tertiary institution to formally take charge of other resources in an organization so as to attain the desired goals or objective. Ogundele (2019) said most employers complain that good number of Electrical and electronic Technology graduate that are produced every year from university and the polytechnics lack necessary job site skills required and thereby make them unemployable. Emmanuel, *et al*. (2017) [10[states that competency is a cluster of related knowledge, skills, abilities that affects a major part of one's job that can be measured against well-accepted standards. Competency can be improved via training and development. Therefore, competency of technical persons with executive function shall be verified and attributed on the basis of evidence that the person has the necessary skills required for the scope of work (including practical skills where appropriate), can act competently across the specified range of activities, and has the relevant knowledge and understanding of the underpinning competency.

There is a notion that graduates of Electrical and Electronic Technology education and other related programs in this country are jobless owing to the fact that they lack requisite skill in their discipline for gainful employment. Ogbuanya (2013) [13], posited that majority of graduates in developing country are jobless due to incompetence in skill area they are supposed to possess. In Nigeria, skill proficiency in Electrical and Electronic Technology is currently required in order to provide undergraduates with the requisite abilities to enable them work for themselves to earn their daily needs (Bayeilo, 2018). The objective of Technical Education program in tertiary institution, is to provide training and impact the necessary skills leading to the production of manpower, craftsmen, technologist and other skilled personal who will be enterprising and self-reliant and also to provide basic knowledge and skills that would prepare students either to perform in an occupation or to make carrier in chosen trade (FGN 1998).

Ede (2019), stated that a lot of challenges have been identified by the society and the industries on the issues of competency skills among undergraduate students. To address the employability issues, promote productive self-employment, and reduce vulnerability to risky behaviors, skill competency of the graduates need to be developed. Skills competency are the engines of Economic growth & social development of any Nation. To achieve this, there is need for continued assessing of skill competency level of Electrical/electronic undergraduate students and assesses how well the young adult are prepared to meet the future challenges. This research seek to look into these problems in order to assess the skills competency level among the Electrical/electronic Technology undergraduate students in tertiary institutions in Kano state.

Objectives of the study

The main objective of this research is to assess the Electrical installation skill competency among Electrical/electronic Technology undergraduate students in Tertiary institutions in Kano State.

The specific objectives are to:

1. To assess the level of skill competency of the undergraduate students in domestic Electrical installations
2. Find out the extent of the competency of the students on industrial Electrical installations.

Research questions

1. What is the level of skill competency of the undergraduate students in domestic Electrical installation?
2. To what extents are the student's competency in industrial Electrical installation?

Hypotheses

HO_1: There is No significant difference between the mean responses of Electrical and electronic Technology undergraduate students of university and affiliated program in college of education Kano state on skills competency on domestic Electrical installation.

HO_2: There is No significant difference between the mean responses of Electrical and Electronic Technology undergraduate students of university and affiliated program in college of Education Kano state on industrial Electrical installation

Research methodology

The descriptive survey research design was adopted for this work. The design deals with systematic collection of

information from a target audience or population. The population of the study was final year Electrical and Electronic Technology undergraduate students in Tertiary institutions in Kano State. A total of 103 copies of questionnaires were administered to the respondents and ninety-six (96) copies of questionnaires were returned and found useful, which represent a return rate of 93.

A structure questionnaire was used as an instrument for data collection adopted from (Emmanuel, *et al*. 2017) [10]. The instrument was titled: **"**Skill competency among Electrical/electronic Technology undergraduate students in tertiary institutions in Kano State**"**. The research instrument was face and content validated by three experts in Electrical and Electronic department Technology Education from FCE (T) Bichi. To determine the reliability of the instrument, pilot test of the instrument was conducted using 20 final year Electrical and Electronics undergraduates students at Hassan Usman Polytechnic Katsina. The area used for the pilot study is not part of the population but the area have common characteristics with that of the study area. The data collected from the pilot study were analyzed using Test re-test method. A reliability coefficient of 0.77 were obtained.

The instrument were administered to the respondents by the researchers personally, and assisted by research assistants. The data collected were processed with Statistical Package of Social Science (SPSS), 25, the package were used to run descriptive statistics of mean and standard deviation to answer the research questions. In answering the research question, the decision rule were based on interval scale of mean score as follows: Highly Competent (HC4), Competent (C3) Incompetent (IC2 and Highly Incompetent (HIC1) respectively. The research null hypotheses were tested using Independent Sample t-test at 0.05 level of significance.

Result and discussions

The results of research questions were as presented in Table 1 and 2

Table 1: Mean and Standard Deviation of responses of Electrical and Electronic Technology final year undergraduate students of university and affiliated program in college of education in Kano state on practical skills competency on domestic Electrical installation.

S/N	Domestic Electrical installation skill competency in;	Mean	Std. Deviation	Remark
1	Identifying common sources of hazard in domestic Electrical installation	3.31	0.62	competent
2	Preventing hazard in domestic Electrical installation	3.14	0.59	competent
3	Carrying out simple surface wiring of domestic installation	3.27	0.67	competent
4	Identifying common types of protective devices	3.21	0.54	competent
5	Identifying Electrical accessories as indicated on the working drawing	3.18	0.66	competent
6	Installing the Electrical accessories as indicated on the working drawing	3.21	0.54	competent
7	Installing circuit breaker and fuses in Electrical installation	3.11	0.65	Competent
8	Determine the cable size to be used for Electrical circuit	3.18	0.63	competent
9	Selecting appropriate wiring type for a building	3.26	0.73	competent
10	Applying IEE regulation on Electrical domestic surface wiring	3.22	0.64	competent
11	Applying stuck and dice, hacksaw in conduit installation	3.22	0.73	competent
12	Applying appropriate procedure for preparing conduit installation work	3.19	0.64	competent
13	Selecting appropriate tools for conduit wiring	3.22	0.57	competent
14	Carrying out simple conduit wiring for a domestic building	3.17	0.63	competent
15	Drawing a cable using fish wire	3.10	0.58	competent
16	Carrying out continuity test of a conduit wiring	3.10	0.67	Competent
17	Carrying out polarity test of a conduit wiring	3.27	0.64	Competent
18	Carrying out earth leakage test of a conduit wiring	3.22	0.64	Competent
19	Identifying tools used for cable jointing termination	3.20	0.72	Competent
20	Applying IEE regulation concerning circuit breakers functionality	3.17	0.66	Competent
21	Installing lightening arrestor on buildings	3.10	0.61	Competent
22	Checking short circuit Grand score 70.18	3.16 3.19	0.64 0.64	Competent Competent

The result of assessing the level of practical skill competency of the undergraduate students of university and affiliated college of education in Kano state on domestic Electrical installation used to answer research question 1 as presented in Table 1. From the Table, the grand score of 83 students that participated in the study was 70.18 with mean score of 3.19 and standard deviation was 0.64. The mean score obtained fall under the decision rule of competence. The result therefore suggested the level of practical skill competency of the undergraduate students of university and affiliated program in college of Education in Kano state on skills competency on domestic Electrical installation is, they are competent

Table 2: Mean and Standard Deviation of responses of Electrical and Electronic Technology final year undergraduate students of university and in affiliated program college of education in Kano state on skill competent in industrial Electrical installation

S/N	Industrial Electrical installation skill competency in;	Mean	Std. Deviation	Remark
23	Use of safety equipment essential for industrial installation	3.25	0.65	Competent
24	Calculating cable rating for the motor	3.21	0.60	Competent
25	Constructing foundation for mounting motors	3.16	0.67	Competent
26	Connecting circuit from bus bar termination	3.19	0.69	Competent
27	Installing a motor starter	3.16	0.65	Competent
28	Drawing wires to surface conduit pipes	3.16	0.67	Competent
29	Connecting earth continuity conductor on trucking	3.16	0.73	Competent

30	Making maintenance on machine based specification	3.09	0.70	Competent
31	Identifying key elements of industrial installation	3.18	0.70	Competent
32	Fixing accessories on trucking systems	3.06	0.72	Competent
33	Demonstrate trunk wiring for industries	3.20	0.61	Competent
34	Testing motor polarities	3.22	0.78	Highly competent
35	Installing electric industrial motors	3.04	0.72	Competent
36	Effective earthing industrial motors	2.96	0.79	Competent
	Grand score 40.88	2.92	0.69	Competence

The result of assessing the level of practical skill competency of the undergraduate students of university and affiliated college of education in Kano state on practical skills competency on industrial Electrical installation used to answer research question 2 as presented in Table 2. From the Table, the grand score of 96 students that participated in the study was 40.88 with mean score of 2.92 and standard deviation was 0.69. The mean score obtained fall under the decision rule of competence. The result therefore suggested the level of practical skill competency of the undergraduate students of university and affiliated college of education in Kano state on practical skills competency on industrial Electrical installation is, they are competent

Results of research hypotheses

The results of test of hypotheses were presented in Table 3 and 4

Ho1; There is No significant difference between the mean responses of Electrical and electronic Technology undergraduate students of university and affiliated program in college of Education Kano state on practical skills competency on domestic Electrical installation.

The Independent-samples t-test employed to test null hypothesis 1 in Table 3 revealed the mean scores of 3.17 and 3.15 for undergraduate students of university and affiliated Program undergraduate students with standard deviations of 0.51 and 0.81 respectively. The t-value stood at 1.16 at degree of freedom of 42. The p=0.254 which was greater than the alpha value of 0.05. The result indicated that there was no significant difference the mean responses of Electrical and electronic Technology undergraduate students of university and affiliated college of education in Kano state on practical skills competency on domestic Electrical installation. The null hypothesis therefore ACCEPT

Table 3: Independent-Sample t-test on difference in the test of hypothesis one

Group	N	Mean	Std. Deviation	t	df	p-value
Undergraduate students of university	22	3.17	0.51	1.16	42	.254
Affiliated undergraduate students	22	3.15	0.81			

Research Hypothesis Two Ho2; There is No significant difference between the mean responses of Electrical and electronic Technology undergraduate students of university and affiliated program in college of education Kano state on industrial Electrical installation.

The Independent-samples t-test employed to test null hypothesis one in Table 6 revealed the mean scores of 3.19 and 3.14 for undergraduate students of university and affiliated undergraduate students with standard deviations of 0.51 and 0.81 respectively. The t-value stood at 2.12 at degree of freedom of 26. The p=.44 which was greater than the alpha value of 0.05. The result indicated that there was no significant difference between undergraduate students of university and affiliated undergraduate students. The null hypothesis is therefore ACCEPT

Table 4: Independent-Sample t-test on difference in the test of hypothesis one

Group	N	Mean	Std. Deviation	t	df	p-value
Undergraduate students of university	14	3.19	0.51	2.12	26	.44
Affiliated undergraduate students	14	3.14	0.81			

Discussion of findings

Based on the research question 1 in Table 1 revealed that the level of practical skill competency of the undergraduate students of university and affiliated college of education in Kano state on practical skills competency on domestic Electrical installation is competence. This is in agreement with Emmanuel, *et al*. 2017 [10], states that competency is a cluster of related knowledge, skills, abilities that affects a major part of one's job that can be measured against well-accepted standards. He stresses that, competency can be improved via training and development. Therefore, competency of technical persons with executive function shall be verified and attributed on the basis of evidence that the person has the necessary skills required for the scope of work (including practical skills where appropriate), can act competently across the specified range of activities, and has the relevant knowledge and understanding of the underpinning competency. The finding is also in line with Ogundele (2019) who stated that, Competency and skills of human resources are the vital resources that determine and controls other resource, and these human resources are acquired in tertiary institution to formally take charge of other resources in an organization so as to attain the desired goals or objective. He stresses that most employers recommend that good number of Electrical and electronic Technology graduate that are produced every year from university and the polytechnics have necessary job site skills required and thereby make them unemployable. The results of this study also agreed with (Caleb, And Udofia, 2013) [7] who stated that the use of skills, promotion by teachers of the importance of soft skills, updating of existing training packages, continued industry involvement in training, Improvements on how skills are explained and assessed and professional skills development of teachers were all strategies for promoting functional education skills acquisition by students. The findings further agreed with Yusof, Haruna, Roddin, Ibrahim, and Hamid, (2023) [21] who stated that the main objective of the Electrical/electronic Technology program in tertiary institutions is to prepare and produce qualified graduates with the precise skills to participate in industrious work as well as for self-reliance. They added that

Electrical/electronic Technology is a course of study where students acquire knowledge and practical skills about various electronic appliances to fulfil human life needs. They also justify that the goals of the Electrical/electronic Technology program to produce Electrical/electronic personnel for power generation, transmission, distribution and utilization.

The finding of research question two revealed that the level of practical skill competency of the undergraduate students of university and affiliated college of education in Kano state on practical skills competency on industrial Electrical installation is competence. The finding collaborate the earlier study conducted by (Adamu, *et al*. 2022) [1] who reported that vocational and technical supposed to gives the students needed entrepreneurship skills and competencies needed for self-reliance and employment and as such, it is a discipline which equips an individual with occupational skills and knowledge that will enable him to fit into and find job satisfaction in the labor market. Similarly he points out that vocational and technical equips its students with the marketing skills, competences, understanding, knowledge and attitude for performing as workers in industries and civil service as well as proprietors of businesses. However, effective teaching of the program is rooted in adequate skills and knowledge of the subject matter. The finding is also in line with Ede (2019), who stated that the employability issues, productive self-employment, and reduce vulnerability to risky behaviors, skill competency of the graduates need to be developed. Skills competency are the engines of Economic growth & social development of any Nation. To achieve this, there is need for continued assessing of skill competency level of Electrical/electronic undergraduate students and assesses how well the young adult are prepared to meet the future challenges.

Conclusions

The study disclosed that skills competency among Electrical/electronic Technology undergraduate students in tertiary institutions in Kano state. The results therefore suggested that undergraduate Electrical and electronic Technology students of university and affiliated college of education in Kano state on practical skills competency on domestic and industrial Electrical installation are competence. The program provide undergraduates Electrical and electronic Technology students of university and affiliated college of education in Kano state with adequate skills for their self-reliance upon graduation. The results therefore suggested that the undergraduate's students that offered Electrical/electronic Technology at degree level acquired the basic skills competency for self-reliance as stipulated in the objectives of Technical Education curriculum; hence the philosophy of reducing the rate of unemployment among degree graduates through Technical Education will now being achieved.

Recommendations

Based on the findings of the study, it was recommended that:

1. The electrical installation and maintenance work trade lectures should be encouraged by their institutions and other relevant stakeholders to acquire modern technical competencies in domestic and industrial installation.
2. The electrical installation and maintenance work trade lectures should keep exposing their students to modern practical skills in domestic and industrial installation for job employment after school.
3. Universities and colleges of education should create enabling environment by providing needed facilities and equipment that will encourage teaching the students skills competencies in domestic and industrial installation.

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