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Electric Motors Maintenance Practice Training Needs Of Electrical Installation And Maintenance Works Students For Self Employment

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Abstract

This study was conducted to determine the electric motors maintenance practice training needs of electrical installation and maintenance works students for self employment in Nigeria. The electric motors studied include ceiline fan, standing fan, blenders and high speed AC motors (water pump). The population for the study was 58 which comprised of 11 Electrical/electronic teachers from the 2 Technical colleges and 47 craftsmen in Aba Abia State. Due to manageable size of the population, there was no sampling. Two research questions were raised and answered using mean and standard deviation while the null hypotheses formulated were tested using t-test at .05 level of significance. The study adopted a descriptive survey research design while data were collected using a structured 33-item questionnaire developed by the researchers and was validated by experts. The reliability of the instrument was established using Cronbach's Alpha which gave a high co-efficient index of .83. Some of the findings among others included that fault models in electric motors like low speed, burnt coil, faulty case/housing noise and the likes are required for training electrical installation and maintenance works students. It was therefore recommended that emphasis on more training should be made in electric motors maintenance, highlighting its benefist to life; Faults models and practical competencies identified should be integrated into the curriculum of technical colleges by curriculum planners and developers for effective teaching and learning for equipment of students for self employment in Nigeria.

Keywords: Electric Motors, Maintenance Practice.

Introduction.

Self-employment is the capacity of being a boss of oneself in a given trade or occupation. It refers to a situation where an individual creates, begins and takes control of the business decision rather than working for an employer. According to http://en.m.wikipedia.org.wiki/employment, self-employment is the act of generating one's income directly from customers, clients or other organizations as opposed to being an employee of a business or person. This implies that self-employment is a situation in which an individual works for him/herself instead of working for an

employer that pays salary or wages. These abilities of being free from working for an employer are undoutably a result of adequate skill acquisition which has been one of the goals of education.

In Nigeria, one of the educational programmes where skills in electrical/electronic appliances, equipment and machines for self employment can be obtained is technical education especially at technical colleges. Technical college according to Okoro (2008) are the principal vocational institutions in Nigeria designed to give full craft man training intended to prepare the individual to acquire practical skills, knowledge and aptitude required of technicians at sub-professional level. In the same vein, Nwachukwu, Bakare and Jika (2011) submits that technical college provides students through training with the relevant and adequate knowledge, skills and attribute for employment under the guidelines of a teacher in related occupations. Ekwue (2009) opined that technical college students require competent hands, adequate facilities and practical work experience towards effective skills acquisition in electrical trades to strive towards job creation self-reliance and self dependent for proper adaptation to the world of work that would subsequently enhance poverty reduction.

The electrical trade under the umbrella of electrical installation and maintenance works as offered in technical colleges prepares an individual with job-satisfying requirements towards employment and self-reliance. Ogwa and Nnachi (2016) submitted that electrical installation and maintenance works trade provides technical training to meet the demands of electrical industry and the needs of the individual allowing the students to identify their career objectives. Electrical installation and maintenance works curriculum is designed to prepare the students with entry level knowledge and manipulative skills for employment in the electrical industry. Skill is the ability to do something well, usually gained through training or experience. Skill acquisition in electrical installation and maintenance works employs measures and develops jobs in electrical installation geared towards making students confident and self employed on graduation (Ngwoke, 2006).

According to https://en.m.wikipedia.org/wiki/electrical_installation, electrical installation and maintenance works trade is a programme introduced by way of practical exercise, the maintenance of electrical system and circuits. In view of above, National Board for Technical Education (NBTE, 2004) maintained that electrical installation craftsmen are expected to test, diagnose, service, install and completely repair any fault on electrical machines and equipment using the manufacturer's manual. A well trained electrical installation and maintenance worker will be capable of designing, installing, repairing or maintaining electrical work systems in industries and residential buildings. Ogwa (2015) noted that the objectives of electrical installation and maintenance works trade is to give training and impact needed skills to technical college students in that area to

enable them secure employment in recognaized organisation, create job or become self-reliant economically. Electrical installation trade also equips an individual with functional and saleable skills, knowledge and attitude or value that would enable them operate in rendering services in electrical related institution or works. Consequently, the goals of electrical installation trade include:

- To empower individuals with desirable skills, knowledge and values to perform specific function in electrical installation area so as to become self-reliant after graduation.
- To empower individual in such a manner that will develop his intellectual capacities and help him to make informed decision in all aspects of life.

- To enable the graduate at this level desire to acquire higher locational training and up keep his occupation (Njoku 2008). Students, who undergo training in electrical installation trades are expected to posses' skills for excellence in installation of electrical machines and equipment, maintain nerve of machines and equipment, winding of electrical machines, testing and inspection of electrical installations, maintenance and repair of electrical machines and motors e.t.c.

Electric motor as one of electrical installations and maintenance trade's content is an electrical machine that converts electrical energy into mechanical energy. The reverse of this is the conversion of mechanical energy into electrical energy and this is done by an electric generator. In normal motoring mode, most electric motors operate through the interaction between an electric motor's magnetic field and winding currents to generate force within the motor. In certain applications, such as in the transportation industry with traction motors, electric motors can operate in both motoring and generating or braking modes to also produce electrical energy from mechanical energy (https://en.wikipedia.org/wiki/Electric_motor).

Electric motors are found in applications as diverse as industrial fans, blowers and pumps, machine tools, household appliances, power tools, and disk drives. Electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as from the power grid, inverters or generators. Small motors may be found in electric watches. General-purpose motors with highly standardized dimensions and characteristics provide convenient mechanical power for industrial use. These motors are widely used in everyday life and in turn demands maintenance as to prolong the life span. According to Ogbuanya (2009), maintenance involves all the actions/activities taken in order to prolong the service life of an item, machine or equipment. There are basically three types of maintenance. They are predictive, preventive and corrective maintenance. The author posited predictive maintenance as the care taken to avoid breakdown, preventive

maintenance as care taken to avoid untimed breakdown while corrective maintenance is sometimes referred to as equipment repair maintenance which involves all the actions that are needed or carried out to restore an item to its functional order. Corrective maintenance can be used interchangeably as broken maintenance or repairs. Maintenance in electric motors involves periodic check on the motor bearing for free movement of the rotary parts and application of lubricants, capacitor check for speed and easy start, solder joints, e.t.c.to ensure proper fuctioning. These motors could be faulty and repairs become the remedy.

Repairs according to Bridge Stone Michellin Pirelli (2013) are services that are required or necessary when something on a system is not working properly or may have worn to the point where replacement is required in order to maintain the performance of the system. For example; work done in fixing electrical/electronics appliances or machinery can be termed repairs. Repairs in electric motors involve faults finding competencies and on-the-job pratical skills like rewinding of coil, ability to assemble and disassemble electric motor. It is expected that electrical installation and maintenance works students possess these skills as technical education is an educational programmes where maintenance skills in electrical/electronic appliance, equipment or machine can be obtained (FRN, 2008). This was supported by Obi (2010) who posited that these skills are teacheable and are thereby improved upon when the individual is in practice after undergoing well supervised training.

Subsequently, it is disheartening that electrical installation and maintenance works graduates today lack necessary skills for self employment and entry into the world of work. Okoro (2008) remarked that technical college students do not have the knowledge and skills that will enable them to take up the available jobs in electrical installation and maintenance trades and this scenario had further contributed to the rising rate of unemployment and dependency amongst technical college graduates in the society and hence, there is need for proficient and well trained work force in electric motors maintenance practice for self employment on graduation.

Statement of the Problem

Technical college curriculum was developed for equipment of students with job entry level skills on graduation especially in maintenance of technological devices like the electric motor found in electric machines, equipments and the likes. Electric motor is one of the electrical installation and maintenance work trades content found in applications as diverse as industrial fans, blowers and pumps, machine tools, household appliances, power tools, and disk drives utilized in all works of life that ranges from domestic to industrial applications. This machine which adds value to living has been perplexed in its technological maintenance in that when these appliances are at down time, phasing out becomes the option as a result of lack of skilled manpower to maintain the appliances which is undoubtly evidence of ill training amongst technical college students. This scenario is

common today and has contributed to the increasing rate of unemployment, immorality and high dependency rate amongst technical college graduates in Nigeria. It is worthwhile to identify and integrate these maintenance pratices required in electric motors for effective teaching and learning towards equiping students of electrical installation and maintenance works for self employment on graduation.

Purpose of the study

The main purpose of this study was to determine the electric motors maintenance practice training needs of electrical installation and maintenance works students for self employment, but the study specifically sought to;

1. identify faults model in electric motors for training electrical installation and maintenance works students for self employment.

2. determine the practical skills in electric motors maintenance practice for training electrical installation and maintenance works students for self employment.

Research questions

The following research questions guided the study:-

1. What are the faults models in electric motors for training electrical installation and maintenance works students for self employment?

2. What are the practical skills in electric motors maintenance practice for training electrical installation and maintenance works students for self employment?

Hypotheses

The following hypotheses formulated were tested at .05 level of significance.

$H0_1$: A significant difference does not exist in the mean ratings of teachers and craftsmen on faults models in electric motors for training electrical installation and maintenance works students for self employment

$H0_2$: A significant difference does not exist in the mean ratings of teachers and craftsmen on the practical skills in electric motors maintenance practice for training electrical installation and maintenance works students for self employment

Research methods

The study adopted a descriptive survey research design. The study was carried out in Abia State particularly in Aba South, Aba North, Osisioma and Ugwunagbo Local Government Areas respectively. The population of the study comprised of 11 Electrical/electronic teachers from the 2 Technical colleges in Aba and 47 craftsmen obtained via pilot study in the afore-mentioned LGAs. Purposive sampling was adopted and due to the manageable size, the entire population was used. Data was collected using a

structured four point weighted 33-item questionnaire developed by the researchers. The response options were Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) respectively. The response categories were assigned numerical values of 4, 3, 2 & 1 respectively. The instrument was validated facially by three experts while the reliability of the instrument was established using Cronbach's Alpha which gave a high co-efficient result of .83. Cronbach's Alpha was used because the instrument was dichotomously scored (Uzoagulu, 2011).

Mean and standard deviation were used to answer the research questions. Upper and lower limits of the mean were used as basis for decision, thus items with mean responses within the range of the limit of values of: 2.50 and above were regarded as agree while mean ranges of 2.50 and below were regarded as disagree responses respectively.

The null hypotheses were tested using t-test at .05 level of significance. The null hypotheses was rejected when t-cal is greater than t-critical, otherwise it is not rejected when t-cal is less than t-critical.

Results

The results are presented in line with the research questions and hypotheses that guided the study

Research Question 1

What are the faults models in electric motors for training electrical installation and maintenance works students for self employment?

Table 1: Mean and Standard Deviation of faults models in electric motors for training electrical installation and maintenance works students for self employment.

		Teachers (11)			Craftsmen (47)			Overall (58)		
S/N	Fault models in electric motor include:	$\bar{x}_1$	SD	Decision	$\bar{x}_2$	SD	Decision	$\bar{x}_T$	SD	Decision
1	Low speed	2.77	.46	Agree	3.02	.45	Agreed	2.90	.46	Agreed
2	Burnt coil	2.89	.33	Agree	3.12	.31	Agree	3.01	.32	Agree
3	Starting fault	3.21	.49	Agree	3.24	.52	Agree	3.23	.51	Agree
4	Faulty bearing	1.81	.51	Disagree	1.88	.49	Disagree	1.85	.50	Disagree
5	Insulation fault	3.1	.93	Agree	2.3	1.04	Disagree	2.7	.98	Agree
6	Capacitor fault	3.44	.36	Agree	3.50	.36	Agree	3.47	.36	Agree
7	Stiff rotor	1.89	.43	Disagree	1.91	.54	Disagree	1.90	.49	Disagree

8	Improper coil fitting	3.11	.64	Agree	3.34	.48	Agree	3.23	.56	Agree
9	Wrong wire connection	2.54	.84	Agree	2.51	.77	Agree	2.53	.81	Agree
10	Case/housing noise	3.24	.58	Agree	3.33	.43	Agree	3.29	.51	Agree
11	Coil injury	3.48	.46	Agree	3.36	.48	Agree	3.42	.47	Agree
12	Shattered stator	2.68	.69	Agree	2.52	.61	Agree	2.60	.65	Agree
13	Weak solder	2.01	.64	Disagree	1.98	.71	Disagree	1.99	.67	Disagree
14	Air gap	3.66	.38	Agree	3.48	.47	Agree	3.49	.46	Agree
15	Power quality	3.49	.45	Agree	3.48	.47	Agree	3.49	.46	Agree
	Cluster Mean	**2.89**	**.55**	**Agree**	**2.68**	**.53**	**Agree**	**2.89**	**.54**	**Agree**

With reference to Table 1, the mean ratings of teachers and craftsmen revealed that items 1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 14 & 15 were agreed strongly while items numbered 4, 7 & 13 were disagreed with mean aggregate scores ranging from 2.53 to 3.49. The result of Table 1 shows that faults models identification in electric motors are necessary in training of electrical installation and maintenance works students for self employment. The grand mean value of 2.89 also attested to that. The standard deviation ranged from 0.32 to 0.98 indicating homogenity of opinions of respondents.

Research Question II

What are the practical skills in electric motors maintenance practice for training electrical installation and maintenance works students for self employment?

Table 2: Mean and Standard Deviation of practical skills in electric motors maintenance practice for training electrical installation and maintenance works students for self employment.

		Teachers (47)			**Craftsmen (11)**			**Overall (58)**		
S/N	Question Items	$\bar{x}_1$	SD	Decision	$\bar{x}_2$	SD	Decision	$\bar{x}_T$	SD	Decision
16	Ability to identify motor fault	2.88	.49	Agree	2.52	.61	Agreed	2.70	.56	Agreed
17	Ability to disassemble motor	3.20	.55	Agree	3.34	.43	Agree	3.27	.50	Agree
18	Ability to assemble motor	2.69	.69	Agree	2.51	.78	Agree	2.60	.74	Agree

19	Ability to use the right tool for the right job	1.94	.55	Disagree	2.50	.58	Agree	2.22	.57	Disagree
20	Competency in rewinding coil	2.73	.54	Agree	2.98	.59	Agree	2.83	.57	Agree
21	Competency in motor wire connection	3.24	.45	Agree	3.45	.38	Agree	3.35	.42	Agree
22	Ability to fit in insulation paper properly	3.08	.43	Agree	3.31	.50	Agree	3.20	.47	Agree
23	Ability to identify starting coil	2.92	.48	Agree	3.01	.44	Agree	2.97	.46	Agree
24	Ability to identify running coil	3.21	41	Agree	2.98	.67	Agree	3.10	.54	Agree
25	Competency in the use of meter	3.04	.49	Agree	2.78	.55	Agree	3.01	.52	Agree
26	Ability to fix bearing fault/change faulty bearing	3.22	.37	Agree	3.12	.41	Agree	3.17	.39	Agree
27	Competency in use of standard wire gauge	2.95	.63	Agree	3.01	.59	Agree	2.98	.61	Agree
28	Competency/knowledge of turn ratio	2.34	.49	Disagree	2.20	1.35	Disagree	2.27	.92	Disagree
29	Ability to identify motor components	2.14	.86	Disagree	2.00	.50	Disagree	2.07	.68	Disagree
30	Knowledge of slot arrangement	3.19	.68	Agree	3.44	.48	Agree	3.32	.58	Agree
31	Ability to identify top and bottom wires	2.36	.82	Disagree	3.67	1.05	Agree	3.39	.94	Agree
32	Ability to interpret circuit diagram	3.27	.83	Agree	2.43	.45	Disagree	2.85	.64	Agree
33	Competency in inspecting rotor and stator	2.51	1.43	Agree	2.41	.78	Disagree	2.46	1.11	Disagree
	Cluster Mean	**2.83**	**.62**	**Agree**	**2.87**	**.62**	**Agree**	**2.89**	**.62**	**Agree**

Table 2 shows that items 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 30, 31& 32 with mean scores of 2.70, 3.27, 2.60, 2.83, 3.35, 3.20, 2.97, 3.10, 3.01, 3.17, 2.98, 3.32, 3.39 & 2.85 were strongly agreed by teachers and craftsmen while items 19, 28, 29, & 33 with mean scores of 2.22, 2.27, 2.07, & 2.46 were disagreed responses. However, the cluster mean of 2.89 shows that practical skills in electric motors maintenance are undoubtably necessary for training electrical installation and maintenance works students for self employment. The standard deviation of .62 also showed that the disparity in the opinions of the respondents is slim.

Hypotheses

$H0_1$: A significant difference does not exist in the mean ratings of teachers and craftsmen on faults models in electric motors for training electrical

installation and maintenance works students for self employment.

Table 3: T-test analysis between teachers and craftsmen on faults models in electric motors for training electrical installation and maintenance works students for self employment.

Respondents	No	$\bar{X}$	SD	Df	Level of signi.	T.Crit	T.Cal	decision
Teachers	11	2.83	0.62	56	0.05	2.021	1.43	NS
Craftsmen	47	2.89	0.62					

NS: Not Significant.

The T-test result above shows that T-cal (1.43) is less than T-critical (2.021) at 56 degree of freedom. Therefore since the T-cal (1.43) is less than T-critical (2.021), the null hypothesis is not rejected. This implies that a significant difference does not exist in the mean ratings of teachers and craftsmen on faults models in electric motors for training electrical installation and maintenance works students for self employment.

$H0_2$: A significant difference does not exist between the mean ratings of teachers and craftsmen on the practical skills in electric motors maintenance for training electrical installation and maintenance works students for self employment.

Table 4: T-test analysis between teachers and craftsmen on practical skills in electric motors maintenance for training electrical installation and maintenance works students for self employment.

Respondents	No	$\bar{X}$	SD	Df	Level of signi.	T.Crit	T.Cal	decision
Teachers	11	2.89	0.55	56	0.05	2.021	0.69	NS
Craftsmen	47	2.68	0.54					

NS: Not Significant.

The T-test result above shows that T-cal (0.69) is less than T-critical (2.021) at 56 degree of freedom. Therefore since the T-cal (0.69) is less than T-critical (2.021), the null hypothesis is not rejected. This implies that a significant difference does not exist in the mean ratings of teachers and craftsmen on the practical skills in electric motors maintenance for training electrical installation and maintenance works students for self employment.

Discussion of findings

The findings of the study in research question 1 revealed that faults models in electric motors like low speed, burnt coil, faulty bearing, insulation fault, wrong wire connection, case/housing noise, improper coil fitting, capacitor fault, power quality and the likes are required for training electrical installation and maintenance works students. The T-test result also showed that T-cal (1.43) is less than T-critical (2.021) at 56 degree of freedom; therefore the null hypothesis is

not rejected. This implies that a significant difference does not exist between the mean ratings of teachers and craftsmen on faults models in electric motors for training electrical installation and maintenance works students for self employment. This is in agreement with the findings of Ohanu (2013) which identified various faults for diagnosis in DVD home theatre sound system that are necessary to be a requirement for integration into the curriculum for teaching and learning in electronic technology programmes in Nigeria.

The study further revealed in research question 2 that practical skills like ability to identify motor fault, ability to disassemble motor, ability to assemble motor, competency in rewinding coil, competency in motor wire connection, ability to fix bearing fault/change faulty bearing and the likes are required for training electrical installation and maintenance works students. The T-test result showed that T-cal (0.69) is less than T-critical (2.021) at 56 degree of freedom; the null hypothesis is not rejected. This implies that a significant difference does not exist between the mean ratings of teachers and craftsmen on the practical skills in electric motors maintenance for training electrical installation and maintenance works students for self employment. This is in agreement with the findings of Samson and Anthony (2015) which identified practical skills in the repairs of DVD home theatre sound system necessary for integration into electronic technology curriculum for workshop practice in technical colleges.

Conclusion

Based on the findings of this study, identification of faults models in electric motors are necessary for training electrical installation and maintenance works students for self employment. Teachers and craftsmen strongly agree that electric motors on-the-job maintenance practice training needs of electrical installation and maintenance works students for self employment could be achieved by identifying fault models in electric motors like weak solder joint, air gap, faulty bearing, insulation fault, wrong wire connection, case/housing noise, improper coil fitting, capacitor fault and power quality. These will stimulate students' interest and enhance their knowldge for effective maintenance of electric motors by electrical installation and maintenance works students for self employment. Also, both teachers and craftsmen strongly agreed that that practical skills like ability to identify motor fault, ability to disassemble motor, ability to assemble motor, competency in rewinding coil, competency in motor wire connection, ability to fix bearing fault/change faulty bearing and the likes are required for training electrical installation and maintenance works students. These will update their skills for effective maintenance of electric motors and as well remedy immorality and lessen the rate of dependency among technical college graduates by being self employed in Nigeria.

Recommendations.

The following recommendations were made in view of the findings of the study:

1) Emphasis on more training should be made in electric motors maintenance, highlighting its attendent benefit to life.
2) Faults models and practical competencies identified should be integrated into the curriculum of technical colleges by curriculum planners and developers for effective teaching and learning.
3) Government and stake holders (public and private sectors) should encourage practical training in technical colleges by provision of adequate tools and facilities that will enhance acquisition of practical skills.
4) Proper supervisory measures should be taken by technical college teachers to ensure that the skills taught are learnt and to be utilized for self employment on graduation.

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