Assessing Skills Required in Maintenance and Repairs of Electric Motors for Self-Reliance in Post Covid-19 Era Among Electrical/Electronic Students in Rivers State Technical Colleges

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Abstract

The study is on assessment of Skills Required in Maintenance and Repairs of Electric Motors for Self-Reliance in Post Covid-19 Era Among Electrical/Electronic Students in Polytechnics in Rivers State. Two research questions were answered while two corresponding null hypotheses were formulated and tested at 0.05 level of significance to guide the study. The study employs descriptive research survey design. The population of the study was 830 Electrical/Electronic personnel comprising of 788 National Diploma students and 42 teaching staff of polytechnics in Rivers State. Teaching Staff were not sample while simple random sampling technique was used to select 265 National Diploma students as determine using Taro Yamen method. This gives a sample size of 307 respondents which was used for the study. The instrument for data collection was self-structure questionnaire tagged "Maintenance and Repairs Skills of Electric Motors for Self-Reliance Questionnaire" which was designed after modified 4-point rating scale and tested for reliability. A reliability coefficient of 0.80 was obtained through Pearson Product Moment Correlation coefficient. Data collected were analyse using mean with standard deviation while the null hypotheses were tested with z-test. Results from the study revealed that skills required for maintenance and repairs of electric motors include ability to identify motor fault, Ability to identify running coil, Ability to use the right tool for the right job, ability to use meter for reading, Ability to fix bearing fault/change faulty bearing, Ability to interpret circuit diagram and Ability to identify top and bottom wires among others. Based on the findings of the study, it was recommended among others that Faults models and practical abilities identified should be integrated into the polytechnic curriculum by curriculum planners and developers for effective teaching and learning.

Keywords: Assessment, Electrical/Electronic, Skills, Maintenance, Repairs, Self-Reliance, Electric Motors and Covid-19

Introduction

Electricity is dangerous in its application if not carefully handle with expertise knowledge and skills. It has no regard for its users therefore utilization of electricity by people needs high level of safety precaution for safe handling and utilization. It is also important to stressed using this commodity for domestic, industrial and commercial purpose can be conveniently be carried out through the process of electrical installation. This is the process of connecting a building to supply of electricity. This connection is determined by the purpose of customer. Similarly, after connecting or supplying electricity to a building for any purpose (commercial, domestic and industrial), they are further connected to different appliances which is regarded as a "Load". Electrical load is appliance that consumes electricity for its operation. These loads could be

municipal load, taction load, domestic load, commercial load among others. These loads can only function or operate only when they are link to electricity supply through electrical installation. Electrical installation is offered in technical colleges as electrical installation and maintenance works that houses other electrical fields such as electrical drafting, electrical wiring and working diagram, winding of alternating and direct current machines, cables and cable joining and wiring systems such as surface wiring, conduit wiring, trunking and ducting and electric motors and so on.

According to National Business and Technical Examination Board (NABTEB, 2007), Ohikhuare (2009) and Osaigbovo (2009), Electrical Installation and Maintenance Works (EIMWs) is an area that exposes the learners to acquire attitude, knowledge and practical skills regarding electrical drafting, electrical wiring and working diagram, winding of alternating and direct current machines, cables and cable joining and wiring systems such as surface wiring, conduit wiring, trunking and ducting. National Board for Technical Education (NBTE) as cited in Oluka and Onyebuenyi(2017) 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. Someone that is fully and competently trained in area of electrical installation and maintenance works must be able to design, install, repair and maintenance of electrical work systems as it relates to industries, commercial 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 recognized organization, 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 as enshrined in National Board for Technical Education (NBTE, 2014) include:

i. 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.
ii. 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.

iii. To enable the graduate at this level desire to acquire higher locational training and up keep his occupation.

Hence, students, who undergo training in electrical installation and maintenance works 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.

Electric motor as one of electrical installations and maintenance works 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 (Oluka &Onyebuenyi, 2017).

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. 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 and solder jointsto ensure proper functioning. These motors could be faulty and repairs become the remedy. To carried out repairs and maintenance services on electrical appliances including electric motors, it requires expertise skills in such area. Skill, according to Fantuzzo and Tighe as cited in Ya'u, Babaji and Hassan (2020) is referring to an individual's capability to control elements of behavior, thinking and feeling within specified contexts and within particular task domains. It was further explained that to possess a skill is to demonstrate the habit of acting, thinking and behaving in a specific activity in such a way that the process becomes natural to the individual through repetition or practice. On

the other hand, skill according to Deebom and Taylor (2020) is described as the ability of an individual to be able to carry out a specialized area in entrepreneurial trade expertly for self-reliance. To this end, it will not be an over statement to say skills acquisition is a programme made up of various kinds of skills to provide basic and special training/skills and capacity building/empowerment or the upliftment and well-being of an individual or a people (Adofu,2013). In the context of this study, skill is the ability of students of electrical installation works to demonstrate their knowledge, attitude in offering servicing, repairs and maintenance to electrical appliance that enhance self-reliance.

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, equipment and the likes. NBTE (2014) stated that the module is intended to provide the trainee with the knowledge and skill to enable him carry out all types of industrial/factory electric motor and maintenance of different types of AC and Dc motors applying all relevant regulations and safety precautions, principles of operation of AC and DC machines and their applications, controlling and maintaining electrical machines and equipment. The goal of winding electrical machine was aimed at providing trainee with the knowledge and skills to enable him wind AC and DC machines up to 10 KVA and select appropriate tools and equipment used for winding jobs. Winding of electrical machines involve both winding and rewinding of electrical generators and motors. Electric motors and generators are electrical machines used to convert mechanical energy into electrical energy by electromagnetic means.

It is true that electrical installation students could acquire skills in relevant areas such as electrical drafting, electrical wiring and working diagram, winding of alternating and direct current machines, cables and cable joining and wiring systems such as surface wiring, conduit wiring, trunking and ducting but not skills in electric motors. Hence, it becomes impossible for such an individual to carry out maintenance service on electric motors. Based on this reason, it is important to assess an individual skill's possession before allowing to carry out activities involving maintenance and repairs of equipment and motors.

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. 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 preventive, corrective and breakdown maintenance. Each of these types of maintenance has their own way of application. Different types maintenance is carried out at different times on the instrument depending on the nature of faults what the person intended to achieve. Due to the importance of maintenance and repairs as applies to equipment and tools, it is necessary to assess the skills of those that carried out these services especially on electric motors.

Statement of the Problem

The comfort generated from electricity and its corresponding importance make electrical energy more superior to any other form of energy. However, its careless handling as a result of quacks makes it accidence more devastating and deadly. The utilization of electrical energy through installation of appliances demands high level of expertise of an experience person who have been properly trained through a certified programme or institutions for skills acquisition in such specified area.

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. Skills acquisition has been seen as a mean of employment generation, reduction in poverty levels among others. Today, could acquisition of skills in maintenance and repairs of electrical motors create jobs for self-reliance for students of electrical/electronic trades in technical colleges in Rivers State? An attempt to provide answer to this question form the basis for this study to assess skills required in maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges.

Purpose of the Study

The purpose of the study is to assess skills required in maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges. Specifically, the study seeks to find out;

1. faults model skills required for maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges.

2. practical skills in electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges.

Research Question

The following questions were answered to guide the study.

1. What are the faults model skills required for maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges?
2. What are the practical skills required for maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance to guide the study.

1. There is no significance difference in the mean response of teachers and students of electrical installation and maintenance works on faults model skills required for maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges.
2. There is no significance difference in the mean response of teachers and students of electrical installation and maintenance works practical skills in electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges.

Methodology

The study adopted the descriptive research survey design. The study was carried out in all the four technical colleges in Rivers State which include Government Technical College, Port Harcourt, Government Technical College, Ahoada, Government Technical College, Tombia and Government Technical College, Eleo-ogu respectively. The population of the study was all the students and teachers of electrical installation and maintenance works in all the four technical colleges in Rivers State. As at the time of this study, technical colleges in Rivers State have about 14 teachers of electrical installation and maintenance works (EIMWs) and 488 students of EIMWs.

Due to small population size of teachers, there was no sampling while simple random sampling technique was employed to select 137 students. Hence, the sample size for the study was 151 respondents (Teachers = 14 and Students = 137) which was used in the study.The instrument used for data collection was a self-structure questionnaire tagged "Skills Required in Maintenance and Repairs of Electric Motors Questionnaire (SRMREMQ)". The instrument and design after modified 4-point rating scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) with numerical values of 4, 3. 2 and 1 respectively. The instrument was validated by two teachers from government technical college, Port Harcourt. The instrument was subjected to reliability. A reliability coefficient of 0.80 was established using Pearson Product Moment Correlation (PPMC) coefficient. Copies of the instrument were distributed directly to the respondents directly by the researchers. Data collected were analysed using mean with standard deviation while the null hypotheses were tested with z-test.

Results

The results of the study were presented as follows.

Research Question 1: What are the faults model skills required for maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges?

Table 1: Mean Response of Teachers and Students on Faults Model Skills Required for Maintenance and Repairs of Electric Motors

S/N	Item Statement	Teachers			Students		
		X	SD	RMK	X	SD	RMK
1	Improper coil fitting	3.21	0.66	Agree	3.41	0.66	Agree
2	Power quality	3.04	0.74	Agree	3.05	1.01	Agree
3	Case/housing noise	3.11	1.03	Agree	3.66	0.80	Agree
4	Faulty bearing	2.06	1.01	Disagree	1.54	0.71	Disagree
5	Capacitor fault	3.98	0.74	Agree	3.47+	0.60	Agree
6	Shattered stator	3.12	0.67	Agree	3.04	1.11	Agree
7	Proper wire connection	2.97	0.58	Agree	3.06	1.01	Agree
8	Stiff rotor	2.34	1.03	Disagree	3.14	0.67	Agree
9	Insulation fault	3.61	1.11	Agree	2.98	0.66	Agree
10	Low speed	3.08	0.74	Agree	3.05	0.71	Agree
11	Coil injury	3.96	0.96	Agree	3.22	0.58	Agree
12	Starting fault	3.17	0.68	Agree	3.47	1.01	Agree
13	Weak solder	1.25	1.01	Disagree	1.32	0.74	Disagree
14	Burnt coil	3.03	0.75	Agree	3.06	0.63	Agree
15	Air gap	3.33	0.84	Agree	3.71	0.84	Agree
	Average Mean	**3.02**	**0.84**	**Agree**	**3.01**	**0.78**	**Agree**

Source: *Researcher's Field Result; 2021*

Result from Table 1 revealed that the respondents (teachers and students) of electrical installation and maintenance works agree that all the listed items are faults model skills required for maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges with an average mean of 3.02 and 3.01 for teachers and students respectively which is greater than the cut-off point of 2.50 as benchmark. However, result from Table 1 further show that the respondents (teachers and students) also disagree that weak solder, stiff rotor and faulty bearing are fault models that cannot create job and enhance self-reliance. This was shown in the mean response which was less than 2.50.

Research Question 2: What are the practical skills required for maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges?

Table 2: Mean Response of Teachers and Students on Practical Skills Required for Maintenance and Repairs of Electric Motors

S/N	Item Statement	Teachers			Students		
		X	SD	RMK	X	SD	RMK
16	Using an ohm-meter to check the resistance value	3.52	0.68	Agree	3.56	0.60	Agree
17	Ability to identify starting coil	3.04	1.01	Agree	2.75	1.01	Agree
18	Competency in rewinding coil	3.11	0.67	Agree	3.21	0.78	Agree
18	Ability to fit in insulation paper properly	2.97	0.70	Agree	3.06	0.69	Agree
20	checking the windings if are open or blown	3.26	0.63	Agree	3.51	0.70	Agree
21	Ability to fix bearing fault/change faulty bearing	3.28	0.87	Agree	3.11	1.01	Agree
22	Ability to assemble motor	3.33	0.65	Agree	3.08	0.84	Agree
23	Ability to check the bearings	3.06	0.72	Agree	3.63	0.63	Agree
24	Competency in the use of meter	3.18	1.11	Agree	3.96	0.60	Agree
25	Competency in motor wire connection	3.46	1.03	Agree	2.84	0.73	Agree
26	Competency in use of standard wire gauge	3.11	0.88	Agree	3.14	0.54	Agree
27	checking the winding for short circuiting the frame	3.08	0.91	Agree	3.10	0.99	Agree
28	Ability to disassemble motor	2.91	0.69	Agree	3.23	0.86	Agree
29	checking the start or run capacitors used for starting or running some motors if equipped.	3.16	1.01	Agree	3.60	0.71	Agree
30	Ability to use the right tool for the right job	3.74	0.50	Agree	3.71	0.65	Agree
31	Ability to identify motor components	3.09	0.84	Agree	3.21	1.01	Agree
32	Ability to identify running coil	3.21	0.63	Agree	2.86	1.01	Agree
33	Ability to interpret circuit diagram	3.07	0.78	Agree	2.90	0.87	Agree
	Average Mean	**3.20**	**0.80**	**Agree**	**3.25**	**0.79**	**Agree**

Source: *Researcher's Field Result; 2021*

Result from Table 2 revealed that the respondents (teachers and students) of electrical installation and maintenance works agree that all the listed items are practical skills required for maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges with an average mean of 3.20 and 3.25 for teachers and students respectively which is greater than the cut-off point of 2.50 as benchmark.

Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance to guide the study.

1. There is no significance difference in the mean response of teachers and students of electrical installation and maintenance works on faults model skills required for maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges.

Table 3: z-Test Analysis on Faults Model Skills Required for Maintenance and Repairs of Electric Motors for Self-Reliance in Post Covid-19 Era

Groups	X	SD	N	Df	α	Zcal	Zcrit	Remark
Teachers	3.02	0.84	14					
				149	0.05	0.04	1.960	Accepted
Students	3.01	0.78	137					

Source: *Researchers' Field Result; 2021* Accept Ho if zcrit ≤ zcal; Otherwise Reject Ho

Since the calculated value of z (zcal = 0.04) is less than the critical value of z (zcrit = 1.960), the null hypothesis of significance difference was therefore accepted. This implies that there is no significance difference in the mean response of teachers and students of electrical installation and maintenance works on faults model skills required for maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges.

2. There is no significance difference in the mean response of teachers and students of electrical installation and maintenance on works practical skills in electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges.

Table 4: z-Test Analysis on Practical Skills in Electric Motors for Self-Reliance in Post Covid-19 Era

Groups	X	SD	N	Df	α	Zcal	Zcrit	Remark
Teachers	3.20	0.80	14					
				149	0.05	-0.22	1.960	Accepted
Students	3.25	0.79	137					

Source: *Researchers' Field Result; 2021* Accept Ho if zcrit ≤ zcal; Otherwise Reject Ho

Since the calculated value of z (zcal = -0.22) is less than the critical value of z (zcrit = 1.960), the null hypothesis of significance difference was therefore accepted. This implies that there is no significance difference in the mean response of teachers and students of electrical installation and maintenance works on works practical skills in electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges.

Discussion of Findings

Result from Table 1 revealed that faults model skills required for maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges include case/housing noise, faulty bearing, capacitor fault, shattered stator, proper wire connection, stiff rotor, low speed, insulation fault, and joining of coil. This finding is in line with Oluka and Onyebuenyi (2017) as found that faults models in electric motors for training electrical installation and maintenance works students for self-employment include low speed, burnt coil, starting fault, faulty bearing, proper wire connection, stiff rotor, low speed and insulation fault among others.

Result from Table 2 revealed that practical skills required for maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges include ability to identify starting coil, ability to assemble motor, ability to identify top and bottom wires, ability to identify motor components, ability to interpret circuit diagram, ability to identify running coil, ability to identify motor fault and competency in the use of meter. This finding is in line with 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. This finding is in line with Abdullahi (2010) as found that practical skills in electric motors maintenance practice for training

electrical installation and maintenance works students for self-employment include checking outside of the motor, checking the name plate of the motor, checking the bearings, push and pull the shaft in and out the frame, checking the winding for short circuiting the frame, using an ohm-meter to check the resistance value, checking the windings if are open or blown, checking the start or run capacitors used for starting or running some motors if equipped, and checking the fan among others.

Conclusion

The study concludes that assessing skills required in maintenance and repairs of electric motors for self-reliance in post covid-19 era among electrical/electronic students in Rivers State technical colleges. The study found that acquisition of fault models skills of electric motors such as faulty bearing, capacitor fault, shattered stator, proper wire connection, stiff rotor, low speed, insulation fault, and joining of coil and acquisition of practical works skills in maintenance of electric motors such as ability to identify starting coil, ability to assemble motor, ability to identify top and bottom wires, ability to identify motor components. Acquisition of these skills enhance self-reliance and job creation among electrical/electronic trades students of technical colleges in Rivers State.

Recommendations

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

1. There should be incorporation of identified fault model skills in to the curriculum of technical colleges to enhance acquisition among electrical/electronic trades students.
2. There should be training and retraining of teachers on acquisition of electrical installation and maintenance works in government technical college.

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