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Development Of A Re-Training Programme For Electronics Technicians On Basic Electronics Troubleshooting And Repairs

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Abstract: This study was designed to develop a re-training programme for electronic technicians in basic electronic troubleshooting and repairs. Three research questions and two hypotheses were formulated to guide the conduct of the study. A descriptive research survey design was used for the study. A simple random sampling was used to select 150 respondents comprising of 50 electrical/electronic teachers and 100 master craftsmen as a population for the study. A structured questionnaire containing 67 items developed by the researchers and validated by experts from Industrial and Technology Education Department was used for data collection. The data collected was analyzed using mean, standard deviation; while t-test statistics was used to the hypotheses at 0.05 level of significant. The findings among others revealed that roadside technicians need training in the following areas: Identification of basic electronic component and their functions used of voltmeters to measured voltage or resistance of any components in an electronic device and analysis of electronic components and various principle of signal tracing. Based on the findings it was recommended that adequate training should be given to roadside technicians in the area of identification of basic electronic component and their functions and government should frequently organize vocational training for the roadside technicians virtually every year.

Keywords: Development, Retraining, Electronic Technician, Troubleshooting, Repairs

1 Introduction

Re-training programme have been realized as an strengthening skill acquisition among electronic technicians in troubleshooting and repairs like developed nations, they allowed economic stability through their consistent ability in reinforcing all human and material resources. With all the advances in modern electronics equipment's, trouble are still caused, most of the time by short circuit, open circuit or low direct current supply voltage (Grap, 2003). Troubleshooting as a form of problem solving most often applied to repairs of failed product or processes. It is a local systematic search for the source of a problem so that it can be solved, and so the product and process can be made operational again. According to long (1974), troubleshooting is the ability is not something someone is born with, but is the result of combining a proper procedure with skills and knowledge of the theory of the circuit. In order to trouble shoot a detective circuit, you must have a good understanding of how the circuit is, and how is supposed to work in the first instance. Effective troubleshooting results from selective acquisition of pertinent quickly about the cause of observed effects. (Gupta 2000) Good trouble shooting is a matter of observing the symptoms analyzing the possible cause and effect the possible measure. There is more there just a chance that the real cause of problem is not where the symptom (Schulder, 1999).Trouble shooting requires identification of the malfunction or symptoms within a system. Experience and skill is used to generate possible causes of the symptoms. Some of these symptoms among others include: reproducing symptom; intermittent symptoms: and multiple problems. Usually, troubleshooting is applied to something that has suddenly stopped working, it requires critical and logical thinking troubleshooting can also take the form of systematic checklist, procedures flowchart or table that is made before problems occurs developing troubleshooting procedures in advance allows sufficient thought about the steps to take to troubleshooting (Glen, 1998).Furthermore, it should be noted that after applying some of the general troubleshooting tips to narrow the scope of a problem location, there are techniques useful in further isolating it Long (2006), documents some of these techniques as: swap identical components techniques: remove parallel components techniques: divide system into section and test those sections, simplify and rebuild techniques and trap a signed techniques. Sahdev (2006) observed that electronic is often derived from electron which is present in all material. Electronics is a branch of science and engineering which deals with the flow of electrons through vacuum or gas or semi conductor, that electronic is a branch which essentially deals with electronic devices and utilization. Electronic circuit which contain a few basic components such as resistors, capacitors, inductors, tube devices and semiconductor devices. This refers to as basic electronics Resistors, capacitors and inductors are called passive components, whereas tube devices, semi conductor devices and transistors are called active components. Technicians are expected to diagnose the development and restored it to its original operating conditions. Technician, according to Henry (2010), a person skilled in the performance of technical or procedure aspects of a profession. Generally, the minimum preparation for this role is a training of 2years full time or the equivalent. Gupta (2000), defines technician as expert in trouble shooting circuit and system malfunction, along with a thorough knowledge of test equipment and how to use it to diagnose. Technician is also familiar with how to repair or replace faulty components, translate basically theory in to practical. Generally, a technician is someone in technological field who has a relatively practical understanding of the general theoretical principles in that filed. An electronic technician according to Williams (2008), is enlisted members or person who satisfactory complete initial electronic technician school training. Electronic technician need acquisition of skill in identifying the symptoms in electronic in order to diagnose or trouble shoot. Rumberger (1995), states that one important characteristics of every worker is the set of skill that workers required recognizes the distinction between the skills that is expected Sichino (1997), stressed that all worthwhile occupation require a minimal amount of training and many demand year of planned education and skilled devel-

opment activities. From the foregoing it can be seen that electronic technician is a skilful person that must have a good understanding of electronics circuit and concepts quickly isolate faulty component and repair the defective circuit in troubleshooting process. Miller (1997) noted that an effective trouble shooter must have skills in troubleshooting skills like signal tracing skill test and measurement skill, skill to isolate a fault, skill to read schematic diagrams, skill to read component and find replacement. However, evidences from the literature revealed that road side electronic technicians, some of which are dropout from secondary schools seem to have inadequate knowledge and skills in troubleshooting. It is often said that roadside electronic technician do encounter some difficulties when troubleshooting electronic equipment (schulder, 1999). This may be as a result of inadequate training received by their masters, alongside advancement in technology and increasing complexity of electronic equipments. It is against this background that it becomes necessary to develop a re-training programme for electronics technicians.

2 Purpose of the Study

The purpose of the study is to develop a re-training programme for roadside electronic technicians in basic electronic troubleshooting and repairs specifically, the study sought to:

1. Identify the training need of roadside electronic technicians on basic skills in isolating faults in electronic equipment.
2. Identify the training skill content in testing and measuring voltage and resistance in electronic equipments which could facilitate troubleshooting of electronics systems.
3. Identify the signal -tracing skills in electronic devices required for training these road side lectronic technicians in troubleshooting.

3 Research Questions

The following research questions were formulated to guide the study:

1. What are the training needs of road side electronic technicians on basic skills in isolating fault in electronic equipment?
2. What are the training needs of road side technicians on basic skills in testing and measuring of voltage and resistance in electronic equipment?
3. What are signal- tracing skills in electronics devices are required for training the road side electronic technicians in troubleshooting?

4 Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significant:

1. There will be no significant difference between the mean responses of electrical/electronic teachers and electronic master craftsmen towards the training needs of roadside electronic technicians on basic skills in isolating fault in electronic equipment.
2. There will be no significant difference between the mean responses of electrical/electronic teachers and electronic master craftsmen towards the needs of road side technicians on basic skills in testing and measuring of measuring of voltage and resistance in electronic equipment.

5 Methodology

A descriptive survey research was employed for this study. A total of 150 respondents consisting of 50 electrical/electronic teachers from all the seven technical colleges in Niger State and 100 master craftsmen selected through simple random sampling from electronic workshops in Minna metropolis were used as a population for the study. The study covered the entire electronic technician workshop in Minna metropolis of Niger State. A structure questionnaire developed by the researcher and validated by three experts from Industrial and Technology Education Department was used for data collection. The questionnaire items employed a four points rating scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). 270 copies of were distributed to electrical/electronic teachers and electronic master craftsmen and 266 copies were dully filled by the respondents and were returned. Mean, Standard Deviation and t-test statistical tool were used to analyze the data for answering the research questions. Mean score of 2.50 was chosen as a decision point for accepting or rejecting items. Therefore items with mean score of 2.50 and above were considered accepted, while items with mean score of 2.49 and below were considered rejected. The null hypotheses were tested at 0.05 level of significant.

6 Results

Research Question 1

What are the training needs of roadside electronic technicians on basic skills in isolating fault in electronic equipment?

Table 2: Mean responses of Electrical Installation/Electronic Teachers and Electronic Master Craftsmen on the training need of roadside electronic technicians on basic skills in isolating fault in electronic equipment.

N_1 =50, N_2 = 100

S/N0	Items	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_t$	Remark
1	Identification of basic electronic components and their function.	3.40	3.50	3.45	Agreed
2	General analysis of electronic components.	3.40	3.30	3.35	Agreed
3	Functions of components in electronic circuit.	3.40	3.20	3.30	Agreed
4	Checking of parts falling out of sockets or only partly seated.	3.30	3.15	3.23	Agreed
5	Visual inspection of leakage components.	3.10	3.35	3.23	Agreed
6	Checking of cracked or burned circuit boards.	3.10	3.20	3.15	Agreed
7	Visual inspection of bent transistors lead that may be touching.	3.10	3.40	3.25	Agreed
8	Observing the broken wires and components.	3.00	3.35	3.18	Agreed
9	Identification of burned components	3.30	3.35	3.33	Agreed
10	Checking of loose or partly seated connectors.	3.50	3.50	3.55	Agreed
11	Identify resistor values from color code.	3.20	3.25	3.23	Agreed
12	Using a sense of torch to detect over heating component.	3.00	3.20	3.10	Agreed
13	Determine the possible problem that could have result in to the fault.	3.40	3.25	3.33	Agreed
14	General safety precaution in the workshop.	3.60	3.45	3.53	Agreed
15	Testing and measurement of components.	3.10	3.25	3.18	Agreed
16	Identify inductor types	3.20	3.00	3.10	Agreed
17	Identify transistor and types	2.90	3.05	2.98	Agreed
18	List common type of semi-conductor	3.30	3.05	3.18	Agreed
19	Checking of the fuses in the equipments	3.20	3.30	3.25	Agreed
20	Reading of the service literature (manual)	3.50	3.25	3.38	Agreed
21	Checking of the bad connectors and loose connectors	3.30	3.65	3.48	Agreed
22	Identification of electronic component	3.40	3.30	3.35	Agreed
23	Identification of discoloured components	3.40	3.60	3.50	Agreed

Key
N_1= number of Electrical Installation/Electronic Teachers.
N_2= Number of Electronic Master Craftsmen.
$\bar{X}_1$ = Mean of Electrical Installation/Electronic Teachers.
$\bar{X}_2$ =Mean of Electronic Master Craftsmen.
$\bar{X}_a$ = Average Mean of Mean of Electrical Installation/Electronic Teachers and Electronic Master Craftsmen.

The data presented in table 1 revealed that the respondents with agreed with all the items as training needs of road side electronics on basic skills in isolating faults in electronics equipment.

Research Question 2
What are the basic training skill contents in testing and measuring voltage and resistance in electronic equipment?

Table 2: Mean responses of Electrical Installation/Electronic Teachers and Electronic Master Craftsmen on basic skill contents in testing and measuring of voltage and resistance in electronic equipments.

$N_1 = 50$, $N_2 = 100$

S/N0	Items	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_t$	Remark
24	Principle of operation of volt/ohms meter.	3.40	3.80	3.60	Agreed
24	Explain meter construction and components.	3.10	3.60	3.35	Agreed
26	Identification of various types of measuring, testing instruments.	3.30	3.35	3.32	Agreed
27	Metre protection, safety and usage.	3.10	3.25	3.18	Agreed
28	Explain care of equipment and test lead	3.20	3.25	3.23	Agreed
29	Identification of the features and terminals of a multimeter.	3.70	3.40	3.55	Agreed
30	Explain how logic pulsers are used.	3.50	3.05	3.28	Agreed
31	Test for detective capacitor and inductance	3.10	3.30	3.23	Agreed
32	Connections of the test lead to measuring.	3.20	3.30	3.25	Agreed
33	Connection of the test leads across the resistance under measurement.	3.20	3.40	3.30	Agreed
34	Reading of the display value of measurement from the measuring instrument.	3.30	3.35	3.33	Agreed
35	Connections of the test lead across the diode and read the display value.	3.00	3.65	3.33	Agreed
36	General principle of testing, measuring instrument.	3.10	3.35	3.23	Agreed
37	Analysis of electronic circuit	2.90	2.85	2.88	Agreed
38	Simple practical on test and measurement of components.	3.50	2.90	3.20	Agreed
39	Measure of resistors, capacitor and inductor.	3.20	3.25	3.23	Agreed
40	Identification of resistor, capacitor colour coding.	3.60	3.45	3.53	Agreed
41	Explain the function of active and passive components	3.20	3.45	3.33	Agreed
42	List the uses and precaution for logic test probes	3.20	3.45	3.33	Agreed
43	Problems encountered when using a multimeter	3.60	3.35	3.48	Agreed
44	Connectivity between ammeters, ohmmeter, voltmeter and the circuits to be measured.	3.40	3.25	3.33	Agreed
45	Analysis of electronic components	3.30	3.35	3.30	Agreed

Key
N_1= number of Electrical Installation/Electronic Teachers.
N_2= Number of Electronic Master Craftsmen.
$\bar{X}_1$ = Mean of Electrical Installation/Electronic Teachers.
$\bar{X}_2$ =Mean of Electronic Master Craftsmen.
$\bar{X}_a$ = Average Mean of Mean of Electrical Installation/Electronic Teachers and Electronic Master Craftsmen.
The data presented in table 2 revealed that the respondents agreed with all the items as basic contents in testing and measuring voltage and resistance in electronics equipment.

Research Question 3
What are the signal-tracing skills in electronics devices are required for training the roadside electronic technicians in trouble shooting?

Table 3: Mean responses of Electrical Installation/Electronic Teachers and Electronic Master Craftsmen on the signal-tracing skills in electronic devices required for training roadside electronic technicians in troubleshooting.

N_1=50, N_2=100

S/N	Items	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_t$	Remark
46	General analysis of electronic signal.	3.80	3.70	3.75	Agreed
47	Identification of digital signals in electronics	3.60	3.30	3.45	Agreed
48	Identification of analog signal in electronics.	3.20	3.15	3.18	Agreed
49	General principles of various signal tracing instruments.	2.90	3.25	3.08	Agreed
50	Explain the operation of an oscilloscope.	3.20	3.20	3.20	Agreed
51	Identifies input circuit signals level which may be expected for various common electronic components or test equipment.	3.30	3.50	3.40	Agreed
52	Selection of appropriate tools for signal tracing	3.40	3.20	3.30	Agreed
53	Identifies anticipated signals or voltage level for output circuits in audio and video equipments.	3.30	3.25	3.28	Agreed
54	Read the conceptual sections in the service manual of the instruments.	3.40	3.35	3.38	Agreed
55	Marking out of the relevant section in the schematic.	3.30	3.35	3.33	Agreed
56	Using the component layout in the service manual, find the components of interest on the board	3.30	3.30	3.30	Agreed
57	Identifying the test points identified by vendor in the service manual.	3.20	3.10	3.15	Agreed
58	Explain the interference of signals in electronics.	3.30	3.20	3.25	Agreed
59	Setting of the require frequency.	3.10	3.05	3.08	Agreed
60	Acquisition of skill in signal tracing.	3.70	3.25	3.48	Agreed
61	Simple practical of the uses of oscilloscope.	3.60	3.30	3.45	Agreed
62	Identification of the types of signal in the graphic coating of oscilloscopes.	3.00	3.50	3.25	Agreed
63	Purpose and function of each control on typical simple oscilloscope	3.40	3.45	3.43	Agreed
64	Explain vertical deflection of an oscilloscope	3.20	3.05	3.13	Agreed
65	Identify basic parameters used to describe the performance and inputs characteristics of an oscilloscope	3.30	3.20	3.25	Agreed
66	Functions of cathode ray tube	3.40	3.45	3.43	Agreed
67	Explain horizontal deflection of an oscilloscope	3.30	3.30	3.30	Agreed

Key

N_1= number of Electrical Installation/Electronic Teachers.

N_2= Number of Electronic Master Craftsmen.

$\bar{X}_1$ = Mean of Electrical Installation/Electronic Teachers.

$\bar{X}_2$ =Mean of Electronic Master Craftsmen.

$\bar{X}_a$ = Average Mean of Mean of Electrical Installation/Electronic Teachers and Electronic Master Craftsmen.

The data presented in table 3 revealed that respondents agreed with all the items as the signal-tracing skills in electronics devices are required for training the roadside electronic technicians in trouble shooting.

8 Hypotheses Testing

Table 4: t-test analysis of Electrical Installation/Electronic Teachers and Electronic Master Craftsmen training needs of roadside electronic technicians on basic skills in isolating fault in electronic (P< .05).

Respondents	Standard Deviation	t- Cal	t- Critical	Remark
Electrical/electronic teachers	0.308			
		0.048	1.96	No Significant
Electronic master craftsmen	0.123			

Table 4 revealed that calculated t does not exceed the t- critical value; this signified that there is no significant difference between the means responses of electrical/electronic teachers and electronic master craftsmen on the training needs of roadside electronic technicians on basic skills in isolating fault in electronic.

Table 5: t-test analysis of Electrical Installation and Electronic Teachers and Electronic Master Craftsmen on the basic training skill contents in testing and measuring voltage and resistance in electronic equipment. (P< .05).

Respondents	Standard Deviation	t- Cal	t- Critical	Remark
Electrical/electronic teachers	0.208			
		0.018	1.96	No Significant
Electronic master craftsmen	0.339			

Table 5 revealed that calculated t does not exceed the t- critical value; this signified that there is no significant difference between the means responses of electrical/electronic teachers and electronic master craftsmen on the basic training skill contents in testing and measuring voltage and resistance in electronic equipment.

9 Findings/ Discussions

The analysis in Table 1 revealed that trainees need training in the area of identification of basic electronic components and their functions, meaning that adequate knowledge should be given to them (roadside electronic technicians) on how to identify various components and their, this serve as a means to understand the operation of the component and to know if they are functioning well. This is in line with the views of Henry (2010), who pointed out that an electronic technician should have a relatively practical knowledge and understanding of general theoretical principle of how electronic components. The finding also revealed that visual inspection of bent transistors lead that may be touching should be given to the trainees. Meaning that all the transistors or any other components be inspected to determine whether it is touching to know what kind of symptom could have caused the problems. This is In agreement with Charles (1999), who declared that troubleshooting involves visual inspection of the interior of the electronic equipment.

The analysis in Table 2 revealed that roadside electronic technicians need to be equipped with principles of operations of volt/ohms meter. Meaning that they should be able to measure the voltage or resistance of any component in an electronic device, roadside electronic technicians need to understand the working principle of a volt/ohm meters. This finding is in line with the curriculum of the National Coalition for Electronic Education (2005), which says that any electronic troubleshooting training on test and measurement of voltage and resistance in electronic component should included principles of operation of multimetre. This is will enable them to measure accurately the voltage and resistance of any components.

The analysis in Table 3 revealed that analysis of electronic components and general principle of various signal tracing be given to road side electronic technicians. This conforms with the views of long (1974), ability to measure and test accurately is the result of adequate knowledge of theory of the various electronic devices or equipment and how they function. This is to enable the technicians understand the extent or condition to which a device could function or malfunctions during measurement and testing.

10 Conclusion

Vocational training programme has been an integral part of national development strategies in many societies because of its important on human resources development, productivity and economic growth. The Nation can only achieved her visions if special attention be given to vocational training and technological growth, promotion and rewarding creativity. The government must recognize the significance of vocational skill trainings especially among the electronic technicians in our country. It can be seen that in spite of the vocational training received by their trainers in troubleshooting, road side electronic technicians would have to meet the need to have the basic skills in troubleshooting and repairs of electronic equipment as this will contribute to the development of the country.

11 Recommendations

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

1. Adequate training in the area identification of basic electronic component and their functions should be given to roadside electronic technicians.
2. Adequate training should be given to roadside electronic technicians in the of analysis of electronic components and various principle of signal tracing.
3. Government should support any vocational training programme organized, with either fund or equipment.
4. The vocational education planners should consider this findings in developing vocational education curriculum.
5. In developing a vocational training programme the needs and the interest of the trainees should be consideration.

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