Effects of Self-help Guide for Repair and Maintenance of Domestic Electrical Appliances on Apprentices of National Directorate of Employment in Taraba State, Nigeria

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Abstract
This study aimed at determining the effects of self-help guide for repair and maintenance of domestic electrical appliances on apprentices of National Directorate for Employment in Taraba State. Three specific purposes, three research questions and one null hypothesis were postulated to guide the conduct of the study. non-randomized pre-test, post-test quasi-experimental design was adopted in this study. The population was 391 comprising 157 registered electrical/electronic certified technicians with at least Trade Test III certificate operating in Taraba State. Nineteen technical college teachers who major in electrical/electronic education and 215 newly recruited apprentices under the National Directorate of Employment in Taraba State formed population. Systematic sampling technique was used to draw 113 registered electrical/electronic certified technicians, all the nineteen technical colleges teachers and two intact clusters of 26 and 23 NDE newly recruited apprentices were purposively selected. A 197 item researcher-developed instrument titled "Effects of Self-Help Guide for Repair and Maintenance of Domestic Electrical Appliances Questionnaire" was used to elicit data for the study. The instrument was validated by three experts. One from Industrial Technology Education Department, University of Uyo, two from from Technology and Vocational Education Department, Nnamdi Azikiwe University Awka. A reliability index of 0.88 was obtained using the Cronbach's Alpha procedure. The instrument was administered and data were collected in-situ. The data obtained were analysed using mean values to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypothesis at 0.05 level of significance. The findings of the study revealed 12 safety precautions and 14 tools for carrying out repair and maintenance of domestic electrical appliances. The study also revealed that there was a significant difference in performance of newly recruited NDE apprentices who used and those who did not use the self-help guide for practical repair and maintenance during the experiment. It was recommended that the self-help guide should be adopted for use by users of electrical appliances in homes to mitigate high cost of engaging professional repairers and that workshops and seminars should be organized by the National Directorate of Employment and related government agencies to enlighten electrical repair and maintenance trainers and other vocational and technical teachers in order to improve their knowledge and skills on the use of self-help guide for repair and maintenance of domestic electrical appliances.

Keywords: Self-help, Repair, Maintenance, Electrical Appliances

Introduction

Domestic electrical appliances are important devices used in homes for various day to day functions like cooking, cleaning, exercising, purifying, food preservation among others. Majority of household domestic appliances are large machines usually used in the bedrooms,

bathrooms, halls and in the kitchens. Another type of small appliances relate to heating and cooling such as: fans, air conditioners, and heaters such as space heaters, ceramic heaters, gas heaters, kerosene heaters, and fan heaters. Yet another category is used in the kitchen, including: juicer-mixer, grinders, food processors, electric kettles, waffle irons, coffee makers, dough makers, and electric chimneys. All appliances however, must be maintained and repaired periodically.

Repairs in the view of Bridgestone (2013) are services that are required or necessary when something on a system is not working properly or may have worn-out to the point where a replacement is required to maintain the performance of the system. According to Australian Taxation Office (2012), repairs mean work to make good or remedy defects in, damage to or deterioration of property. Repairs in the context of this study refer to the activities undertaken for the restoration of a broken, damaged or failed component, device, equipment or appliance to an acceptable operating state. The term repair is synonymous but not same as maintenance.

Self-help on a general note is the action or process of bettering one's self or overcoming one's problem without the aid of others. Self-help consists of doing things by oneself, to try and solve one's own problems without depending on other people. A variant of self-help is "Do-it-Yourself" (DIY). "Do it yourself" is the method of building, modifying things by oneself without the direct aid of professionals or certified experts (Wolf & McQuitty, 2011). Do-It-Yourself is also described as behaviours where individuals use raw and semi-raw materials and parts to produce, transform, or reconstruct material possessions, including those drawn from the natural environment such as landscaping. Self-help or do-it-yourself approach which cuts across users of home electrical appliances in both urban and rural areas is frequently being applied in maintenance of home appliances.

Few electrical appliances used at home that need the users' attention for routine maintenance include refrigerators, food mixers, blenders, television sets, air conditioner, music players, home theatre, digital players, pedestal and ceiling fan, air purifier, personal computers, vacuum cleaners, iron boxes, water purifier, water heater, digital clocks, food processors, washing machine among others. However, the present study focused on developing a self-help guide for repair of microwave oven, electric fan, electric pressing iron, air conditioner, electric blender, electric kettle and electric water heater.

It is obvious that manufacturers of electrical appliances sell their products with an accompanying installation, operation and safety manuals exclusively. Such manuals do not make provision for clues on repairs in case of appliance malfunction or breakdown. In most cases, manufacturers instruct users to report any fault or noticeable malfunction of the electrical appliances to designated repair outlets, experts or agents who may or may not be readily available or accessible when their services are needed. Consequently, home appliances users incur colossal loss/waste on their costly purchased perishable foods that needed to have been processed or preserved due to failure of domestic appliances such as food processors, refrigerators or deep freezers to mention but few. Electrical pressing iron may fail or malfunction when a home appliances user needs to iron rumpled cloths for an important function, outing or occasion, leaving the electrical appliances user in a state of despair. It is not

uncommon that cooling appliances such as fans and air conditioners could breakdown in the night, during lockdown, sit-at-home or curfew days when movement is restricted thus, accessing the experts becomes impossible. Some faults only require replacement of a broken fuse, burnt/broken wire, failed joints or removal of dust in the domestic appliances. Users are left at the mercy of roadside technicians who extort by not only charging exorbitant repair fee for a fault that would have required a home appliances user little effort and time to replace. Some roadside technicians charge for gadget parts that were not faulty or never replaced at all.

Since maintenance and repairs services by experts or technicians are always expensive or not available, the idea is that the appliances user as the first to notice equipment failure should also be the first to administer first aid services or even total maintenance and repair of the gadget. Home owners who are products users should begin to maintain their household appliances by themselves. This process is called self-help or do-it-yourself. With the growing use of electrical home appliances, it is observed that most electrical appliances users attempt carrying out home appliance maintenance without recourse to the proper steps for carrying out repairs and services. The effect could be devastating with the user having to pay more to get the appliances fixed by experts. However, in the view of the researchers, if the self-help guide is detailed and descriptive enough in addition to having the right tools, simple electrical maintenance and repair of common faults in home appliances could be successfully accomplished by domestic appliances users. It is against this backdrop that the researchers were spurred to undertake a study to determine the effects of self-help guide for repair and maintenance of domestic electrical appliances on apprentices of National Directorate of Employment in Taraba State.

Purpose of the Study

The main purpose of the study was to determine the effects of self-help guide for carrying out repair and maintenance of selected home electrical appliances on apprentices of National Directorate of Employment Taraba state. Specifically, the study determined the:

1. safety precautions for repair/maintenance of domestic electrical appliances using the self-help guide
2. tools required for carrying out repair and maintenance using the self-help guide
3. difference in practical task performance between the control and experimental group on repair/maintenance of domestic electrical appliances.

Research Questions

The study provided answers to the following research questions:

1. What are the safety precautions required for carrying out repair/maintenance of domestic electrical appliances using the self-help guide?
2. What are the tools required for carrying out repair/maintenance using the self-help guide?

3. What is the difference in practical task performance between the control and experimental group when rated on repair/maintenance of domestic electrical appliances?

Research Hypothesis

The following null hypothesis was tested at 0.05 level of significance

H_{01}: There is no significant difference in practical task performance between the control and experimental groups when rated on repair/maintenance of domestic electrical appliances.

Methodology

This study, aimed at determining the effects of self-help guide for repair/maintenance of domestic electrical appliances on apprentices of National Directorate for Employment in Taraba State adopted the non-randomized pre-test, post-test quasi-experimental design. Quasi-experiments are carried out outside the laboratory. The quasi-experimental research design is used in educational research since it is simply not possible for an investigator to undertake true experiments especially in random assignment of participants to control or experimental groups. The population was 391 comprising 157 registered electrical/electronic certified technicians with at least Trade Test III certificate operating in Taraba State, 19 technical college teachers with majors in electrical/electronic education and 215 newly recruited apprentices under the National Directorate of Employment in Taraba State.

Taro Yamane's formula was used to determine a sample size of 113 from the 157 registered and certified electrical/electronic technicians with at least Trade Test III certificate and all the 19 technical college electrical teachers were used because of the manageable size.Systematic sampling technique was used in selecting the 113 electrical/electronic certified technicians with Trade Test III certificate and the entire 19 electrical/electronic teachers in technical colleges in Taraba State were used since their number was manageable. Purposive sampling technique was used to select two intact clusters of 26 and 23 NDE newly recruited apprentices. Therefore, the sample size of the study consisted of 183 participants.

A 197 item researcher-developed instrument titled "Effects of Self-Help Guide for Repairs and Maintenance of Domestic Electrical Appliances Questionnaire". The instrument was subjected to face and content validation by experts (Technical College teachers and three lecturers from Nnamdi Azikiwe University Awka; subsequently to obtain the reliability coefficient, a trial test was conducted on the technicians registered with National Directorate of Employment, Taraba State. A reliability index of 0.88 was obtained using the Cronbach's Alpha procedure. The instrument was administered and data were collected in-situ. The data obtained were analysed using mean statistics to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypothesis at 0.05 level of significance.

Results

Research Question 1: What are the safety precautions required for carrying out repair and maintenance of domestic electrical appliances?

The data for answering research question 1 are presented in Table 1

Table 1: Mean Responses of Respondents on Safety Precautions Required for Repair and Maintenance of Domestic Electrical Appliances (*n = 128*)

S/N	Personal and Equipment Safety	Mean	SD	Remark
1	Use hand gloves always	4.55	.544	Highly Appropriate
2	Use goggles	4.23	.630	Appropriate
3	Discharge the power capacitors in any appliance before working on it	4.55	.544	Highly Appropriate
4	Know the wire code of your country	4.22	.627	Appropriate
5	protect oneself and electrical equipment hazard	4.47	.560	Appropriate
6	keep tools at the designated place after use	4.09	.628	Appropriate
7	Identify hazards and risks	4.51	.502	Highly Appropriate
8	Evaluate hazards and risks	4.46	.587	Appropriate
9	Control hazards and risks	4.06	.624	Appropriate
10	Identify moving and static parts of electric appliances	4.44	.498	Appropriate
11	Choosing appropriate tools for the right job	4.55	.544	Highly Appropriate
12	Accept the responsibility of self-help repair and maintenance of appliances	4.23	.630	Appropriate

Data presented in Table 1 show that all the safety precautions required for repair and maintenance of domestic electrical appliances have their mean values ranging from 4.06 to 4.55. This implies that the mean value of each safety precautions is above the cut-off point of 3.50 indicating that all the 12 safety precautions required for repair and maintenance of domestic electrical appliances. Table 1 also reveals that the standard deviations (SD) of the items are within the range of 0.49 – 0.63.This indicates that the respondents are not far from one another in their responses.

Research Question 2: What are the tools required for carrying out repair and maintenance using the self-help guide?

Table 2: Mean Responses of Respondents on tools required for carrying out repairs and maintenance using the self-help guide *(n = 128)*

S/N	Tools for Repair and Maintenance	Mean	S.D	Remark
1	Star screw driver	4.53	.531	Highly Appropriate
2	Flat screw driver	4.44	.612	Appropriate
3	Voltage tester	4.46	.587	Appropriate
4	All types of pliers	4.55	.544	Highly Appropriate

5	Hammers	4.33	.641	Appropriate
6	Flashlight	4.32	.614	Appropriate
7	Utility knife	4.53	.531	Highly Appropriate
8	Insulating tape	4.44	.612	Appropriate
9	Cleaning brush	4.44	.612	Appropriate
10	Allen wrench (key) set	4.44	.612	Appropriate
11	Soldering iron/ lead	4.47	.588	Appropriate
12	Multi-meter	4.56	.543	Highly Appropriate
13	Blower for dust removal	4.32	.651	Appropriate
14	Extension cord	4.30	.622	Appropriate

Data presented in Table 2 show that all the tools required for carrying out repair and maintenance using the self-help guide have their mean values ranging from 4.30 to 4.56. This implies that the mean value of each tools required for carrying out repair and maintenance is above the cut-off point of 3.50 indicating that all the 14 tools are required for carrying out repair and maintenance of domestic electrical appliances using the self-help guide. Table 2 also reveals that the standard deviations (SD) of the items are within the range of 0.53-0.65. This indicates that the respondents are not far from one another in their responses.

Research Question 3: What is the difference in practical task performance between the control and experimental group when rated on repair and maintenance of domestic electrical appliances?

Table 3: Summary Apprentices' Mean Performance in Repair and Maintenance Practical (*n = 49*)

Apprentice Grouping	N	Pre-test Score $\overline{X}1$	Post-test core $\overline{X}2$	Mean Gain	Difference
Experimental Group	23	29.22	71.09	41.87	26.21
Control Group	26	27.42	43.08	15.66	

Data presented in Table 3 reveal that the post-test mean score of the experimental group who performed the repair practical using the self-help guide is 71.09 with mean gain of 41.87 while the mean post-test score of the control group who performed the practical without the self-help guide is 43.08 with a mean gain of 15.66. The result reveals that the mean gain difference between the scores of experimental and control groups is 26.21. This implies that apprentices who performed the repair practical using the self-help guide performed better than those who did not use the self-help guide.

Test of Statistical Significance of Hypothesis

The following null hypotheses will be tested at 0.05 level of significance.

Null Hypothesis 1: There is no significant difference in practical task performance between the control and experimental group when rated on repair and maintenance of domestic electrical appliances.

Table 4: Analysis of Covariance (ANCOVA) on difference in practical task performance between the control and experimental groups when rated on repair and maintenance of domestic electrical appliances

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9578.640[a]	2	4789.320	117.192	.000
Intercept	6627.537	1	6627.537	162.173	.000
PRETEST	3.782	1	3.782	.093	.762
Groups	9406.116	1	9406.116	230.163	**.000**
Error	1879.890	46	40.867		
Total	166357.000	49			
Corrected Total	11458.531	48			

The analysis of covariance (ANCOVA) in Table 4 shows that p-value of 0.000 is less than 0.05 level of significance. This indicates that there is significant difference in practical task performance between the control and experimental group as rated on repair and maintenance of domestic electrical appliances. The significance difference is in favour of the experimental group who used the self-help guide to carry out repair and maintenance. Hence the null hypothesis is rejected. This implies that the developed self-help guide is valid.

Discussion of Findings

The discussions of the findings of this study are presented in line with the purpose of the study under the following headings

Safety Precautions for Included in the Self-Help Guide for Repair and Maintenance of Domestic Electrical Appliances

The findings of the study revealed that all the 12 items on safety precautions for repair and maintenance of domestic electrical appliances were unanimously agreed upon by the respondents for inclusion in the self-help guide. Working in electrical workshop involves all the activities carried out in the workshop in order to achieve learning outcome or set objective of the programme. This finding supports the opinions of Chukwuedo and Nwachukwu (2014); Dung (2015) who noted that items that satisfy workshop safety practices are relevant and worthy for inclusion in the self-help guide to be developed for repair and maintenance of electrical appliances by users. The finding is in agreement with the opinion of Dung (2015)

who stated that all the safety skills identified in handling hand tools, operating machine tools, workshop safety and the personal protective equipment are required by electrical installation students for effective functioning in the workshop. One of the major problems affecting the management of workshop was lack of safety precaution in the workshop. The remote causes of accident in the workshops are as a result of not observing the workshop rules and regulation. The researcher opined that the importance of safety in repair and maintenance of domestic electrical appliances cannot be overemphasized as knowledge on safety affords users to carry out repair without fear of unknown.

Tools Required for Carrying Out Repair and Maintenance Using the Self-Help Guide

Data generated in this study to identify the tools and equipment required for repair and maintenance of domestic electrical appliances showed that all the 14 identified tools and equipment in this study are necessary. This corroborates the findings of Omofonmwan and Chukwuedo (2013) who found that the tools and equipment needed for skill acquisition in the repairs of digital electronics in the National Open Apprenticeship Scheme (NOAS) of the National Directorate of Employment (NDE) in Edo State were not sufficiently provided to the trainees. The determined tools and equipment were not entirely different from those used in carrying out corrective maintenance of other digital electronic appliances. Literature such as Tokhein, (2005) and Theraja, and Sedha, (2009) have identified these tools and equipment as those needed in the technology of electronic devices and appliance.

Practical Task Performance between the Control and Experimental Group on Repair and Maintenance of Domestic Electrical Appliances.

The finding of this study revealed that there was a significant difference in practical task performance between the control and experimental group as rated on repair and maintenance of domestic electrical appliances. The significant difference was in favour of the experimental group which used the self-help guide to carry out repair and maintenance. This finding is in line with that of Ariba (2016) who found a significant mean difference between artisans'skill performance before and after retraining using a developed programme. Similarly, Egbita and Kanu (2015), in a study conducted to measure the effect of a training module in improving knowledge competencies for technical and vocational teachers found that those trained using training module significantly improved more than those that were trained without it.

Recommendations

Based on the findings of the study, the researcher recommends the following:

(i) Self-help guide for repair and maintenance of domestic electrical appliances should be adopted in vocational training outfits such as the National Directorate of Employment (NDE).

(ii) The self-help guide should be adopted for use by users of electrical appliances in homes to mitigate high cost of engaging a professional repairer.

(iii) Workshops and seminars should be organized by the National Directorate of Employment and related government agencies to enlighten electrical repair and maintenance trainers and other vocational and technical teachers in order to improve their knowledge and skills on the use of self-help guide for repair and maintenance of domestic electrical appliances.

Suggestions for Further Studies

The following suggestions for further study are made:

1. The study should be replicated in other states of Nigeria.
2. The study should also be replicated in other areas such as domestic electrical installation craft, industrial installation, windings of electrical machines, and battery charging.

References

Ariba, O. (2016). *Development of a retraining programme for artisans in blocklaying and concreting in Lagos State.* (Unpublished PhD dissertation, Department of Industrial Technical Education, University of Nigeria, Nsukka).

Australian Taxation Office (2012). *Rental properties-claiming repairs and maintenance expenses*.http//www.ato.gov.au/individuals/content.aspx?doc=/content/00183233.htm

Dung, C. J. (2015). *Safety skills requirement by technical college electrical installation students in handling equipment in Plateau and Kaduna states*. (Unpublished M. Ed. thesis, Department of Industrial Technical Education, University of Nigeria, Nsukka).

Egbita, U. A. & Kanu, J. A. (2015). Competency-based teacher education (CBTE): A training module for improving knowledge competencies for technical and vocational education teachers in Nigeria. *Nigeria Journal of Education, Health and Technology Research, 7(87).*

Omofonmwa, O.G. & Chukwuedo, O.S. (2013). Availability and adequacy of resources for skill acquisition in digital electronic repairs in National Open Apprenticeship Scheme in Edo State, Nigeria. *International Journal of Vocational and Technical Education,* 5(6), 110-116.

Theraja, B. L., & Sedha, R. S. (2009). *Principals of electronic devices and circuits: Analog and digital in S.I. units. Ram Nagar.* New Delhi: S. Chand and Company Ltd.

Tokhein, A. (2005). *Digital electronics: Principles and applications* (6th ed). New Delhi: Tata McGraw Hill.

Wolf, M. & McQuitty, S. (2011). Understanding the Do-it-yourself consumer: DIY Motivation and Outcomes. Academy of Marketing Science Review, 1: 154-170