DEVELOPMENT AND VALIDATION OF SELF-HELP GUIDE FOR REPAIR AND MAINTENANCE OF DOMESTIC ELECTRICAL APPLIANCES BY USERS IN TARABA STATE, NIGERIA

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ABSTRACT
This study aimed at developing and validating a self-help guide for repair and maintenance of domestic electrical appliances by users in Taraba State. Three specific purposes, three research questions and one null hypothesis guided the study. Research and Development design was adopted for the study. 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. Systematic sampling technique was used to draw 113 registered electrical/electronic certified technicians, all the 19 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 "Self-Help Guide for Repairs and Maintenance of Domestic Electrical Appliances Questionnaire" was used to elicit data for the study. The instrument was subjected to face and content validation by experts - Technical College teachers with specialization in electrical/electronics and three lecturers, one from Measurement and Evaluation unit of Educational Foundation and two from technology and vocational education (Electrical/electronics option 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 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 167 practical tasks for inclusion in the self-help guide. The study also revealed that there was a significant difference in the 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.

Keywords: *Development and Validation, Repair and 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 relates 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 Jenn (2021) 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 (2019), 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). Academic research has described DIY 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 researcher, 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 in this vein that the researcher deemed it fit to embark on this study to develop and validate a self-help guide for repair and maintenance of domestic electrical appliances by users in Taraba State.

Research Questions

The study provided answers to the following research questions:

1. What is the content agreed to by electrical/electronic teachers and technicians for inclusion into the self-help practical guide for carrying out maintenance/repairs of selected electrical domestic appliances by users?
2. What is the reliability of the self-help guide for carrying out repairs and maintenance of domestic electrical appliances by users?
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?

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 and maintenance of domestic electrical appliances.

Methods

Research and Development research design was adopted for the study. The study aimed at developing and validating a self-help guide for repair and maintenance of domestic electrical appliances by users was carried out in Taraba State. 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. Systematic sampling technique was used to draw 113 registered electrical/electronic certified technicians, all the 19 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 "Self-Help Guide for Repairs and Maintenance of Domestic Electrical Appliances Questionnaire" was used to elicit data for the study. The instrument was subjected to face and content validation by experts - Technical College teachers with specialization in electrical/electronics and three lecturers, one from Measurement and Evaluation unit of Educational Foundation and two from technology and vocational education (Electrical/electronics option 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 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 is the content agreed by electrical/electronic teachers and technicians for inclusion into the self-help practical guide for carrying out maintenance/repairs of selected electrical domestic appliances by users?

Table 1

Mean Responses of Respondents on the Self-Help Guide Content Agreed by Electrical/Electronic Teachers and Technicians for Maintenance/Repairs of Electrical Appliances

S/N	Practical task items identified for inclusion in the self-help practical guide	Mean	S.D	Remark
	Repair/Maintenance of microwave oven			
1	Inspect the door for obvious problems such as broken components	4.37	0.61	Appropriate
2	Clean the door seal along the inside front edge of the oven.	4.41	0.62	Appropriate
3	Use a mild detergent in warm water to rinse the oven before/after use	4.42	0.61	Appropriate
4	Inspect the door hinge to ensure that it is not damaged	4.40	0.61	Appropriate
5	Inspect the door latch on the outside and inside of the door to make sure it works smoothly	4.30	0.67	Appropriate
6	Inspect the door latch on the outside and inside to ensure that it is not blocked by baked-on food	4.41	0.62	Appropriate
7	Always unplug the microwave oven before carrying out any repair	4.43	0.62	Appropriate
8	Remove all trays or carousels inside the microwave oven (MO)	4.38	0.61	Appropriate
9	If the unit is built-in, remove fastener on the underside to remove the MO	4.41	0.60	Appropriate
10	Turn the unit on its back or side	4.39	0.61	Appropriate
11	Remove screw/bold that holds the housing to the frame	4.41	0.62	Appropriate
12	Carefully remove the housing and set it aside to access components within	4.65	0.47	Highly Appropriate
13	Identify the capacitor to find out if it is intact and make sure you do not touch it	4.25	0.58	Appropriate
14	Clean the switches and other simple components	4.54	0.50	Highly Appropriate
15	Test the electrical cord, fan fuse, interlock and other components	4.58	0.52	Highly Appropriate
16	Test the microwave thermostat using a multi-meter to ensure it is in good condition	4.52	0.58	Highly Appropriate
17	Assemble the microwave oven	4.53	0.54	Highly Appropriate
18	Test the microwave oven	4.55	0.61	Highly Appropriate
	Repair/Maintenance of Electric Fan			
19	Turn fan on to make sure that the motor works	4.38	0.60	Appropriate
20	Unplug the fan to either unhook the blade guard or unscrew the pin	4.16	0.68	Appropriate
21	Turn the blades or washer in the center of the fan counterclockwise to remove the blade	4.70	0.46	Appropriate
22	Slide the back half of the blade guard off the pin in the center	4.44	0.61	Appropriate
23	Flip fan around and find the screws in the back	4.11	0.69	Appropriate
24	Turn the pin in the front of the fan with hand to see if it rotates	4.38	0.61	Appropriate
25	Unscrew any washer or bolt blocking the base of the pin	4.17	0.67	Appropriate
26	Apply lubricating oil to the front and back of the pin	4.73	0.44	Appropriate

27	Spin the bolts around the lubricated section of the pin while spinning	4.71	0.45	Appropriate
28	Inspect the back of motor case for dust to wipe it off	4.31	0.63	Appropriate
29	Blow the plastic vent on the back with compressed air	4.27	0.65	Appropriate
30	Plug fan in and turn it on to see if the pin spins	4.50	0.58	Highly Appropriate
31	Assemble the fan by putting the blades, bolts and case back	4.52	0.60	Highly Appropriate
32	Check the supply cord to ensure that all the wires are in good condition	4.54	0.57	Highly Appropriate
33	Locate the fan coil fuse, replace, if broken	4.51	0.49	Highly Appropriate
34	Check the fan coil for continuity. Recoil or replace with a new one.	4.56	0.55	Highly Appropriate
	Repairs/Maintenance of Electric Pressing Iron			
35	Unplug the iron to ensure it is cool before cleaning	4.12	0.69	Appropriate
36	Use toothpick or pipe cleaner to remove build-ups in the steam vents, making sure the debris does not fall into the vents	4.37	0.61	Appropriate
37	Use a fine sewing needle to carefully clean the spray nozzle of mineral deposits	4.18	0.68	Appropriate
38	To flush sediment from a steam iron, pour 1.2 cup of water and ½ cup of vinegar into the water tank.	4.44	0.52	Appropriate
39	Place the iron on a rack over a broiling pan and set the iron to steam until the tank runs dry	4.44	0.57	Appropriate
40	Unplug the iron from power supply	4.11	0.63	Appropriate
41	Use a fine sewing needle to unclog the steam valve assembly.	4.45	0.50	Appropriate
42	Check the valve spring and replace if it is broken or has lost tension	4.45	0.58	Appropriate
43	If the spray pump is accessible, remove it and check for leaks by placing the spray tube in water and squirting the pump	4.05	0.63	Appropriate
44	Unplug the iron from power supply	4.45	0.50	Appropriate
45	Use a sponge and commercial soleplate cleaner or baking soda and water to remove dirt build-up on the soleplate	4.54	0.57	Highly Appropriate
46	Rinse well with water and dry, do not use harsh abrasive or immerse an electric iron in water	4.49	0.50	Appropriate
47	Use very fine steel wool or an emery cloth to remove scratches and burns on the soleplate, then clean the soleplate	4.78	0.46	Appropriate
	Repairs/Maintenance of Air Conditioner			
48	Unplug the unit from power supply	4.08	0.63	Appropriate
49	Remove the front cover	4.44	0.49	Appropriate
50	Remove any clip holding the filter in place and remove the filter	4.47	0.57	Appropriate
51	If the filter is not washable or is damaged, replace it with an identical filter	4.07	0.61	Appropriate
52	Use a shop vacuum with a brush attachment to loosen dirt from the cover and grilles	4.48	0.50	Appropriate
53	Spray the cover with a detergent water solution and rinse it with clean water	4.59	0.54	Highly Appropriate

54	Wipe the surface clean with a damp clothe	4.55	0.55	Highly Appropriate
55	Re-attach the cover	4.24	0.62	Appropriate
56	Unplug the air conditioner	4.55	0.54	Highly Appropriate
57	Remove it from the window if it is window mounted	4.24	0.62	Appropriate
58	Remove the housing as needed to access the cooling coils	4.47	0.57	Appropriate
59	Vacuum clean the coils	4.10	0.62	Appropriate
60	Vacuum clean the evaporator fins with the brush attachment of a shop vacuum	4.49	0.50	Appropriate
61	Make sure all components are clean and dry before reinstalling them	4.48	0.57	Appropriate
62	Unplug the unit from the electrical receptacle	4.07	0.63	Appropriate
63	Remove any debris with a small brush before continuing	4.45	0.50	Appropriate
64	Match up the fin comb to the fins to make sure that they fit property and will not damage the fins	4.55	0.55	Highly Appropriate
65	Unplug the unit and remove it from the window or wall	4.24	0.62	Appropriate
66	Remove the unit's cabinet or cover	4.12	0.69	Appropriate
67	Find the oil ports on the motor housing	4.37	0.61	Appropriate
68	Remove the caps from the oil ports. Insert a few drops of light (SAE-10) non-detergent oil into each port	4.18	0.68	Appropriate
69	Insert a drop or two of light (SAE-10) oil along the motor shaft where it meets the motor housing and the fan	4.44	0.52	Appropriate
70	Rotate the fan by hand to work the oil into the motor	4.44	0.57	Appropriate
71	Re-assemble and re-install the unit	4.11	0.63	Appropriate
72	Unplug the unit from power supply	4.45	0.50	Appropriate
73	Remove the front cover of the air conditioner	4.45	0.58	Appropriate
74	Take the unit out of the window or wall	4.12	0.69	Appropriate
75	If the unit has an evaporator drain pan and a condenser drain pan, locate the drain tube connecting them	4.37	0.61	Appropriate
76	Flush the tube with a cup of a solution of chlorine bleach and water to prevent algae formation	4.18	0.68	Appropriate
	Electric Blender Repairs/Maintenance			
77	Remove the blender base	4.44	0.52	Appropriate
78	Remove the multi-speed switch	4.44	0.57	Appropriate
79	Check the multi-speed switch with a continuity tester or multi-tester or multi-meter	4.11	0.63	Appropriate
80	Use a can of compressed air or an electrical contact cleaner to clean the switch	4.45	0.50	Appropriate
81	Replace the multi-speed switch	4.12	0.69	Appropriate
82	Remove the blender base of the blender	4.37	0.61	Appropriate
83	Locate the fuse in the wire from the multispeed switch to the motor	4.18	0.68	Appropriate
84	Use a continuity tester or multi-tester to check the fuse if the circuit is open (blown)	4.44	0.52	Appropriate
85	Replace the faulty in-line fuse with one of identical rating	4.44	0.57	Appropriate
86	Place a probe on each cord prong	4.11	0.63	Appropriate
87	Select a speed-control button or turn the speed controller slightly, then read the resistance on the meter.	4.45	0.50	Appropriate

88	Rotate the drive stud clockwise one turn. If the resistance reading (in ohms) changes, the motor needs service	4.45	0.58	Appropriate
89	Remove the base and turn the blender over. The other end of the drive shaft will protrude from the bottom side of the motor.	4.12	0.69	Appropriate
100	Grip the drive shaft with a pliers, then turn the blender on its side to attach a wrench to the drive stud.	4.37	0.61	Appropriate
101	Hold the drive shaft steady as you turn the drive stud clockwise	4.18	0.68	Appropriate
	Electrical Kettle Repairs/Maintenance			
102	If the kettle does not heat up or turn on, check Connection to the Mains	4.44	0.52	Appropriate
103	Turn off power supply to the heater at the electrical service panel	4.44	0.57	Appropriate
104	Post a sign warning others not to turn it on.	4.12	0.69	Appropriate
105	Check the main switch with a continuity tester or multi-tester or multi-meter	4.37	0.61	Appropriate
106	If it is faulty, replace with a good one	4.18	0.68	Appropriate
107	Fill the kettle with water	4.44	0.52	Appropriate
108	Plug the kettle into the mains.	4.44	0.57	Appropriate
109	Turn the kettle on. If the kettle does not begin to boil the water, there is a problem with the kettle.	4.11	0.63	Appropriate
110	Inspect the power cord to look out for signs of wear and tear	4.45	0.50	Appropriate
111	Check that the power cord is inserted correctly	4.12	0.69	Appropriate
112	Do Not Dry-Boil the Kettle (always fill the kettle with water before boiling	4.37	0.61	Appropriate
	Repair and maintenance of Electric Water Heater			
113	Turn off power supply to the heater at the electrical service panel and post a sign warning others not to turn it on.	4.44	0.52	Appropriate
114	Unscrew and remove the electric water heater access panel	4.12	0.69	Appropriate
115	Using a small screwdriver, turn the thermostat dial counterclockwise to lower the temperature, or clockwise to raise it	4.37	0.61	Appropriate
116	.If the water heater doesn't maintain the proper temperature, test the thermostat	4.18	0.68	Appropriate
117	Disconnect one wire to the upper thermostat to test it.	4.44	0.52	Appropriate
118	Set a multi-meter to RX1 (resistance times 1) and touch a probe to the thermostat terminals, the tester should show 1 or infinity (*open*)	4.44	0.57	Appropriate
119	Test the lower thermostat in the same manner	4.11	0.63	Appropriate
120	Unscrew it from its mounting and install one of the same model, size, and rating for replacement of the thermostat.	4.45	0.50	Appropriate
121	Turn off power at the electrical service panel and post a sign warning others not to turn it on	4.45	0.58	Appropriate
122	Remove the access panel on the electric water heater	4.12	0.69	Appropriate
123	Disconnect one of the element wires	4.37	0.61	Appropriate
124	Setting a multi-meter to RX1000 (resistance times 1,000), touch one probe to an element mounting bolt and the other to each element terminal screw in turn	4.18	0.68	Appropriate

125	If the tester displays anything but infinity (*open* circuit), replace the element	4.44	0.52	Appropriate
126	If necessary, set the multi-meter to RX1 and touch the probes to the terminal screws	4.44	0.57	Appropriate
127	If there is any resistance reading at all (closed circuit), then the element is good.	4.11	0.63	Appropriate
128	If not, replace both upper and lower elements are tested in the same manner	4.45	0.50	Appropriate
129	To remove the element, first drain the heater	4.45	0.58	Appropriate
130	Disconnect the remaining element wire.	4.12	0.69	Appropriate
131	Remove the mounting bolts holding the element in place. Remove the element	4.37	0.61	Appropriate
132	Replace the heating element with one of the same model, shape, and rating. Make sure you also replace any installation gaskets	4.18	0.68	Appropriate
133	Lift the spring lever on the valve to fill a small cup. Check the cup for sediment	4.44	0.52	Appropriate
134	If no water spurts out, or if water continues to drip after the valve is released, replace the valve	4.44	0.57	Appropriate
135	Cut power at the electrical service panel and post a sign warning others not to turn it on. Close the cold-water supply valve.	4.11	0.63	Appropriate
136	Drain a few gallons of water from the tank	4.45	0.50	Appropriate
137	Unscrew and remove the discharge pipe if used	4.12	0.69	Appropriate
138	Loosen the relief valve with a pipe wrench, then remove the valve by hand	4.37	0.61	Appropriate
139	Apply pipe tape to the threads of the replacement valve	4.18	0.68	Appropriate
140	Screw it into the tank by hand, tighten it with a pipe wrench.	4.44	0.52	Appropriate
141	Screw the discharge pipe (if any) into the valve outlet	4.44	0.57	Appropriate
142	Refill the water heater and restore electrical power	4.11	0.63	Appropriate
143	Shut off power at the electrical service panel and post a sign warning others not to turn it on	4.45	0.50	Appropriate
144	Close the cold-water supply valve and drain the water heater completely (see above	4.45	0.58	Appropriate
145	Unscrew the drain valve with a pipe wrench	4.12	0.69	Appropriate
146	Replace the drain valve with an identical unit wrapping the end with pipe tape	4.37	0.61	Appropriate
147	Refill the tank and restore electricity	4.18	0.68	Appropriate
	Repair and Maintenance of Food Processor			
148	Remove the control knob	4.44	0.52	Appropriate
149	Remove any screws that hold the body together	4.44	0.57	Appropriate
150	Remove the plugs as needed to disconnect the circuit board from the electrical source	4.11	0.63	Appropriate
151	Remove the plugs as needed to disconnect the circuit board from the electrical source	4.45	0.50	Appropriate
152	Remove other components that restrict access to the internal parts	4.45	0.58	Appropriate
153	Turn the processor upside down and remove the base.	4.12	0.69	Appropriate
154	Remove the drive belt and/or the drive gear	4.37	0.61	Appropriate
155	Remove the motor	4.18	0.68	Appropriate

156	Remove the processor's housing and components as needed to access the gear	4.44	0.52	Appropriate
157	Clean the gears with a toothbrush and inspect for wear or damage	4.12	0.69	Appropriate
158	Replace any damaged gears, if the gears are in good condition, lubricate them and reassemble	4.37	0.61	Appropriate
159	Remove the housing as needed to access the drive belt	4.18	0.68	Appropriate
160	Press the drive belt by hand to determine if the belt is too loose or too snug	4.44	0.52	Appropriate
161	Loosen the adjustment wheel setscrew or nut and adjust the belt tension as needed	4.44	0.57	Appropriate
162	Replace the belt with one of the exact same dimensions if necessary	4.11	0.63	Appropriate
163	Make sure the adjustment screw or nut is tightened so it does not work loose	4.45	0.50	Appropriate
164	Disassemble the unit to expose the drive shaft	4.44	0.57	Appropriate
165	Turn the drive shaft by hand, if it turns easily, it probably worn and requires replacement	4.11	0.63	Appropriate
166	Remove the drive shaft. In removing shafts some unit pry off while others are held in place with standard fasteners	4.45	0.50	Appropriate
167	Inspect the old drive shaft for the cause of the problem. Repair or replace as needed.	4.45	0.51	Appropriate

Number of Respondents (N = 132)

Data in Table 1 indicates that the mean of responses of respondents on content of the self-help practical guide for carrying out maintenance/repairs of selected electrical domestic appliances range from 4.05 to 4.59. These results indicate that the technical college teachers and electrical technicians agree and unanimously considered all the 167 task items suitable for inclusion into self-help practical guide for maintenance/repairs. Furthermore, with standard deviation ranging from 0.47 – 0.69, the results also indicate that the opinions of the technical college teachers and electrical technicians are clustered around the mean.

Research Question 2

What is the reliability of the self-help guide for carrying out repairs and maintenance of domestic electrical appliances by users?

Table 2

The summary of reliability coefficients from respondents' responses is presented on Table 2.

Distribution of reliability coefficient of the self-help guide for repair and maintenance of domestic electrical appliances

S/N	Self-Help Guide Practical Task Items	n	α	Remark
1.	Section 1: Repair/maintenance of microwave oven	18	0.78	Highly Consistent
2.	Section 2: Repair/maintenance of electric fan	16	0.86	Highly Consistent
3.	Section 3: Repair/maintenance of electric pressing iron	13	0.77	Highly Consistent
4.	Section 4: Repair/maintenance of air conditioner	29	0.73	Highly Consistent
5.	Section 5: Repair/maintenance of electric blender	15	0.81	Highly

6. Section 6: Repair/maintenance of electric kettle	11	0.86	Consistent Highly Consistent
7. Section 7: Repair/maintenance of electric water heater	35	0.80	Highly Consistent
8. Section 8: Repair/maintenance of food processor	20	0.75	Highly Consistent
Full Length Reliability Coefficient	**157**	**0.74**	**Highly Consistent**

Number of Respondents (N = 132)

Data in Table 2 indicate that the eight skill items in the self-help guide practical task items possess reliability coefficients ranging from 0.73 to 0.86. The overall total of 157 practical tasks in the self-help guide also possesses a full length reliability coefficient of 0.74 and is therefore adjudged highly consistent and acceptable.

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?

The data for answering research question 3 are presented in Table 3.

Table 3

Mean Scores of Apprentices' Performance in Repair and Maintenance Practical

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

N = 49

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.

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

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

Content as Agreed by Electrical/Electronic Teachers and Technicians for Inclusion into the Developed Self-Help Practical Guide.

Data in Table 1 indicated that the technical college teachers and electrical technicians agreed and unanimously considered all the 167 items suitable for inclusion into self-help practical guide for maintenance/repairs. The contents that emerged as a result of this study were carefully selected in line with the objectives. These contents are in line with the psychomotor competency-based training content in informal sector developed and validated by Agbo and Okoye (2022). Content refers to the subject matter or what is to be taught to the learners (Val, 2016; Alvior, 2015). This finding supports the earlier findings of Yalams (2001), Okwelle and Okoye (2012), Tsado (2013), Kamar (2015) and Agbo and Okoye (2022) as all the items of the instruments they developed were considered by the respondents as appropriate for use in assessing students' performance. This finding is distinct to that of Moses, Medugu, Mohammed and Wafudu (2017) as not all items identified by the researchers were considered appropriate by the respondents for inclusion in the instrument for assessing practical skills in domestic installation in technical colleges of Yobe State. It is the opinion of the researcher that careful scrutiny forensic selection of the items at early stage gave rise to the respondents agreeing to all the items to be included in the self-help guide.

Reliability of the Developed Self-Help Practical Guide

Data in Table 2 indicated that the eight skill items in the self-help guide practical task items possess reliability coefficients ranging from 0.73 to 0.86. specifically, skills items on repair and maintenance of microwave oven have a reliability of 0.78, skills items on repair and maintenance of fan have a reliability of 0.86, skills items on repair and maintenance of pressing iron have a

reliability of 0.7, skills item on repair and maintenance of air conditioner have a reliability of 0.73, skills items on repair and maintenance of electric blender have a reliability of 0.81, skills items on repair and maintenance of electric kettle have a reliability of 0.86, skills items on repair and maintenance of water heater have a reliability of 0.80 while skills items on repair and maintenance of food processor have a reliability of 0.75. This finding is analogous with Moses, Medugu, Mohammed and Wafudu (2017) where the instrument developed from their study possessed high reliability coefficients and were therefore adjudged consistent and reliable.

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

Data obtained from Table 3 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.

Conclusion

The development and validation of self-help guide for the repair and maintenance of domestic electrical appliances is a valuable initiative aimed at empowering individuals to handle basic household appliances issues. The developed self-help guide would not only enhance users' technical knowledge but also promotes safety, cost-effectiveness and sustainability by prolonging the lifespan of domestic electrical appliances and reducing unnecessary waste. The validation process ensures that the self-help guide is practical, user-friendly and comprehensive, making it an accessible tool for domestic electrical appliances users to perform routine maintenance and minor repairs confidently. The self-help guide for repair and maintenance of domestic electrical appliances was adjudged valid and effective because of its huge effect as evident on the high performance of the experimental group (NDE trainees who performed the practical using the self-help guide) compared to those who did not.

Recommendations

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

1. 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).
2. The self-help guide should be adopted by National Directorate of Employment (NDE) for use by users of electrical appliances in homes to mitigate high cost of engaging a professional repairer.

References

Agbo, N. M. & Okoye, K.R.E.,(2022). Development and validation of psychomotor competency-based content for retraining artisans in electrical installation works in South East, Nigeria. *Unizik Journal of Entrepreneurship (ENTREP), 3*(2). 21-38. https://unizikentrepjournal.com.ng/index/index.php/Journal/article/view/69

Alexander, I. U. (2022). *Development and Validation of Electrical Installation and Maintenance Training Module for National Directorate of Employment Skill Training in Akwa Ibom*

State, Nigeria. An unpublished PhD Thesis in the Department of Industrial Technology Education University of Uyo, Uyo.

Alvior, M. G. (2015). Seven criteria for the selection of subject-matter or content of the curriculum.*SimplyEducate.Me*. Retrieved on March 21, 2018 from http://simplyeducate.me/2015/02/07/7-criteria-for-the-selection-of-subject-matter-or-content-of-the-curriculum/

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 (2019). *Rental properties-claiming repairs and maintenance expenses*. http//www.ato.gov.au/individuals/content.aspx?doc=/content/00183233.htm

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).*

Huten, A. (2020). How to repair a microwave oven. Retrieved from https://www.mrright.in/ideas/appliances/how-to-repair-your-microwave-oven/, on 19th January, 2023.

Jenn, A. (2021). What is electrical maintenance? Retrieved from http://www.tpctraining.com/blogs/news/what-is-electrical-maintenance, on 25th January, 2023.

Moses, D., Medugu, J. D., Mohammed, A., & Wafudu, J. S. (2017). Development and validation of an instrument for assessing practical skills in domestic installation processes in technical colleges of Yobe State, Nigeria. *International Journal of Research in Engineering, IT and Social Sciences, 7*(7): 17–23.

Okwelle, P. C. & Okoye, K. R. E. (2012). Development and validation of instrument for assessing practical skills in building electronics systems in Nigerian technical colleges. *Journal of Emerging Trends in Engineering and Applied Sciences, 3*(5): 779–785.

Satheesh, (2019). Review of Electric Iron, *Journal of Emerging Technologies and Innovative ` Research (JETIR)*, *6*(1): 1777- 1780.

Sini, L. & Hamzat, A. (2018). Safety practice skills required by metalwork students of colleges of education for effective operation in the workshop: A case study of Federal College of Education (Technical) Gombe. *Gombe Technical Education Journal,* 11(1): 153-171.

Tsado, I. N. (2013). *Identification of tasks and procedures necessary for assessing practical work in block/brick laying and concreting in technical colleges in Niger State*. MSc Dissertation. University of Nigeria, Nsukka, Nigeria.

Val, R. (2016). *The meaning of curriculum content and learning experiences*. Retrieved from https://hyattractions.wordpress.com/2016/12/07/the-meaning-of-curriculum-content-and-learning-experiences.

Wolf, M. & McQuitty, S. (2011). Understanding the Do-It-Yourself Consumer: DIY Motivation and Outcomes. *Academy of Marketing Science Review, 1*: 154-170.