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ENHANCING ATTITUDE TOWARDS E-WASTE MANAGEMENT THROUGH ENVIRONMENTAL HEALTH EDUCATION AMONG ELECTRONIC TECHNICIANS IN IBADAN OYO STATE, NIGERIA

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Abstract
Health hazard of e-waste is emerging as alarming public health problem in Nigeria. E-wastes are generated in an increased manner because electrical and electronic equipment purchased originally as second hand reached its end-of-life rapidly. Disposal of e-waste is done using unsanitary methods due to poor attitude of electronic technicians to e-waste management. This study sought to enhance attitude towards e-waste management through environmental health education among electronic technicians in Oyo State, Nigeria. A pretest-post test control group quasi-experimental research design was adopted for this study. Purposive and systematic sampling techniques were used to select one hundred participants. Three research hypotheses were tested at 0.05 alpha level. Data collected were analysed using Multivariate Analysis of Covariance (MANCOVA). Findings revealed that, there was a significant main effect of treatment on attitude towards e-waste management among electronic technicians in Ibadan Oyo State, Nigeria. [$F_{(1,84)}=4.900$, $p<0.05$, $\eta^2=0.055$]. *Based on the finding, it was recommended that environmental health education should be organised for electronic technicians.*
Keywords: *environmental health education, attitude, e-waste management, electronic technician, electrical and electronic equipment*

Introduction

Electrical and electronic equipment (EEE) that has outlived its usefulness is e-waste. Thus, discarded radio and television sets, computers, mobile phones, audio amplifier, refrigerators, fanning equipment, washing machines, microwaves, pressing iron and watches are all e-wastes. The accumulation of e-waste is on the high side in most African countries. This is because in the first

instance the equipment was purchased as second-hand as many people cannot afford the price of the new one. In this way, the equipment can only be used for a short time before it gets to its end-of-life. E-waste is emerging as a major public health problem in Africa in the recent time as a result of poor management and this has continued to attract the attention of researchers in diverse fields including health education.

In Nigeria, indiscriminate dismantling of used EEE has been observed to be a common practice among repairers of the equipment. United Nations Environmental Programme (2005) revealed that conventional solid waste disposal approach has failed to provide the needed sanity and sustainability desired in the market environment. Osibanjo, Nnorom, Bakare and Alabi (2012) reported that due to inappropriate recycling process, many tonnes of e-waste material and repair residues end up in workshops, yards, road sides, open fields, irrigation canals, river banks, ponds and rivers. Large quantities of e-wastes are being disposed of in market places in Nigeria using the most unsanitary methods such as open burning and open dump. There is a great concern about human health risk due to potential exposure to the hazardous substances in e-waste as a result of the crude management methods in use in developing countries (Osinbanjo, Nnorom, Bakare and Alabi, 2012).

In Nigeria, some of e-wastes are processed in backyards or in small workshops. The remaining parts are disposed of indiscriminately. The unsanitary disposal of e-wastes in the country has caused damage to the surrounding environment and human health. The health effect include damage to the central nervous system, skin disorder and cancer among other diseases which may be caused by constituents of electrical and electronic equipment like lead, mercury and beryllium (Tsydonova and Bengstsson, 2011). During burning of WEE, toxic materials such as dioxins and furans may be released to the environment, furthermore runoff water carries leachate (ash acidic + water = toxic water) into the sea, affect the aquatic life, also the ash leached into the soil which cause ground water contamination (Gaidajis, Angelakoglou and Aktsoglou, 2010). E-waste can also cause uncontrolled fire risk.

Poor management of e-wastes can be attributed to such factors as illiteracy, economic status, non-provision of e-waste disposal equipment and facilities, poor location of such equipment/facilities and inability of government agencies to maintain regular surveillance on how the wastes are being disposed Adekunle, Adekunle, Akintokun, Akintokun and Arowolo (2010) established that few traders in Ibadan are aware of neither the recycling plant nor the importance of having it. Personal exploration carried out revealed that electronic technicians in

Ibadan have negative attitude towards e-waste management hence its poor practice. This is because attitude is the tendency of an individual to react negatively or positively to an issue. In brief, attitude dictates behaviour.

In order to promote proper management of wastes, particularly e-waste among electronic technicians, health education is important. In corroborating this assertion Adio-Moses (2007) established that health education programme significantly enhanced traders' attitude and practices in relation to solid waste management. A typical aspect of health education that could effectively enhance the attitude of an individual towards e-waste is environmental health education. Environmental health education is aimed at improving environmental health literacy and skills through teacher education, instructional materials and public education (UN HABITAT, 2004).

Educational qualification is a moderating variable in this study. This was premised on the postulation of the Institute of Public Health (2008) that people who achieved a higher level of education are more likely to engage in healthy behaviours and less likely to adopt unhealthy habits. Educational attainment by an individual could aid acquisition of new experiences. A year of experience is another moderating variable in this study. Experience in the context of this study means exposure gathered through repeated action over times. Years of experience can aid an individual to benefit from an on-the-job training.

The study was predicated on Health Belief Theory. According to Tuner, Hunt, Dibrezzo and Jones, (2004) Health belief model is used to understand health behaviour and possible reasons for non-compliance with recommended action. The overall objective of the developers of the theory was to improve the health literacy of individuals by providing education about a particular disease. In achieving the objective, four major constructs addressed are: perceived susceptibility to a disease, perceived severity, perceived benefits, perceived barriers to recommended action (National Institute of Health, 2012). In the context of this study the first objective was to bring the attention of the electronic technicians to health hazards that they are susceptible to, the second objective was to let the individuals know through health education that the hazard in question is severe, the third objective was to let the people also know through health education that there are benefits (improved health status) if individuals take a certain recommended action (e-waste management) while the fourth objective was to let the individuals know that there are barriers (negative attitude) that can prevent them from taking the recommended actions. The Health Belief model is appropriate for this study. This is because the overall objective of the study which was to improve the health literacy of electronic technicians through

environmental health education in order to enhance their attitude towards e-waste management is in line with the stated objective of the model.

Statement of the Problem

In Ibadan metropolis, scraps and non-reusable parts of electronic wastes are discarded in unauthorised dumpsites, burnt in trash cans or allowed to lie in open places. Meanwhile, uncontrolled burning, disassembly and disposal of e-waste have been confirmed to cause a variety of environmental problems such as groundwater contamination, atmospheric pollution and occupational and safety effects among those directly or indirectly involved in the processing of e-waste (Adediran and Abdulkarim, 2004). Komolafe (2011) identified high rate of illiteracy, ignorance, uncivilized culture of indiscriminate waste littering and violation of town planning regulations as factors responsible for improper disposal of solid waste in the past five decades in Ibadan municipality.

The trend of poor management of e-waste may continue with its attendant hazards on human health unless appropriate intervention is organised. Previous studies, such as Adekunle, Adekunle, Akintokun, Akintokun and Arowolo (2010) and Adediran and Abdulkurim (2004) focused on contamination of environment and its effects on human health with little emphasis on attitude to e-waste management. Adio-Moses (2007) and, Bel and Mur, (2009) focussed their studies on management of solid waste. Hence little emphasis was laid on e-waste management. This study examined the enhancement of attitude towards e-waste management using environmental health education among electronic technicians in Ibadan Oyo State, Nigeria.

Objectives of the Study

The objective of the study was to determine the effect of environmental health education on attitude towards e-waste management among electronic technicians in Ibadan, Oyo State, Nigeria. Also, to examine the moderating effects of educational qualification as well as years of experience on attitude towards e-waste management among electronic technicians in Ibadan, Oyo State, Nigeria.

Hypotheses

The following hypotheses were tested in the course of this study.

1. There is no significant main effect of treatment on attitude towards e-waste management among electronic technicians in Ibadan Oyo State, Nigeria.

2. There is no significant effect of educational qualification on attitude towards e-waste management among electronic technicians in Ibadan, Oyo State, Nigeria.
3. There is no significant effect of years of experience on attitude towards e-waste management among electronic technicians in Ibadan Oyo State, Nigeria.

Methodology

Research Design

A pretest-posttest, control group quasi-experimental research design was adopted for this study. One experimental group and one control group were used. Experimental group was given treatments which are modes on environmental health education and the control group got instruction on nutrition education.

This study was carried out through the use of 2x3x3 factorial matrix. The use of the selected factorial matrix was based on the fact that the study involved the use of independent variables at two levels; experimental and the control. Moderating variables of educational qualification at three levels (primary, secondary and tertiary education) and years of experience at three levels (i) 1-5 years (ii) 6-10 years and (iii) 11 years and above.

Population of the study

The population for this study comprised all electronic technicians in Ibadan. Oyo state, Nigeria

Sample and Sampling Techniques

A sample size of 100 electronic technicians was drawn using purposive and systematic sampling techniques.

Research Instrument

Attitude Towards E-waste Management Scale (ATEWMS) was the main instrument used for this study. Twelve items were generated and reacted to by the respondents during pre-testing of the instrument. The data generated were then subjected to factor analysis, with 0.60 as criterion for retention of items. Each response was scored on a 4-point modified Likert format of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) with allotment of points in the following order: SA = 4, A = 3, D = 2, SD = 1. A cronbach alpha method was

used to test the internal consistency of the instrument and yielded a reliability of 0.72.

Method of Data Collection

Questionnaire items were administered pre and post intervention and on the spot collection was done using four research assistants.

Procedure for Treatments

A letter was written to chairmen of Electronic Technician Association in each of selected two Local Government Areas in the state to obtain permission to conduct the research. The venues used for the training were visited before the commencement of the intervention to familiarise with the environments. The technicians used as sample were given consent forms to fill in order to ascertain their willingness to participate in the study. The researcher with the research assistants held a one hour session for eight weeks with each of the groups.

The intervention sessions are briefed below:

Session I: Administration of questionnaire to collect pre-test scores and general orientation on environment and health.
Session II: Concepts, categories and sources of e-waste.
Session III: Hazardous components of e-waste and their effects on human health.
Session IV: Concept and methods of e-waste management.
Session V: Management of each categories of e-waste.
Session VI: Health and environmental impacts of e-waste management.
Session VII: Promotion of positive attitudes towards e-waste management.
Session VIII: Revision of activities in the previous sessions and administration of questionnaire to collect post-test scores.

Control Group: Nutrition education
Session I: Administration of questionnaire to collect pre-test scores and general orientation on nutrition and human health.
Session II: Carbohydrates: Sources and functions.
Session III: Protein: Sources and functions
Session IV: Fat and oil: sources and functions
Session V: Vitamin and minerals: sources and functions
Session VI: Water: sources and functions
Session VII: Concept of adequate/ balanced diet. Consequences of unhealthy diet.

Session VIII: Revision of activities in the previous sessions and administration of questionnaire to collect post-test scores.

Data Analysis

Multivariate Analysis of Covariance (MANOVA) was used to test the hypotheses at 0.05 alpha levels.

Results

Hypothesis one – There is no significant main effect of treatment on attitude towards e-waste management among electronic technicians in Ibadan Oyo State, Nigeria.

Table 1: Summary of results showing effects of treatment, educational qualification and years of experience on attitude towards e-waste management

Source	Dependent Variable	Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta squared
Corrected Model	Post-test attitude	2026.857	15	135.124	2.597	.003	.317
Intercept	Post-test attitude	185.256	1	185.256	3.560	.063	.041
Pre-test attitude	Post-test attitude	60.132	1	60.132	1.156	.285	.014
Treatment group	Post-test attitude	254.975	1	254.975	4.900	.030	.055
Educational qualification	Post-test attitude	79.578	2	39.789	.765	.469	.018
Years of Experience	Post-test attitude	121.635	2	60.818	1.169	.316	.027
Error	Error	4371.253	84	52.039			
Total	Total	74885.000	100				
Corrected total	Corrected Total	6398.110	99				

Table one shows that $F_{(1,84)}$, indicating the mean effect of treatment on attitude towards e-waste is 4.900; $p<0.05$. The p value (0.030) is lesser than 0.05 alpha level of significance Therefore there is significant main effect of treatment on attitude towards e-waste management among electronic technicians in Ibadan

Oyo State, Nigeria. The partial eta squared estimated is 0.055. This implies that treatment accounted for 5.5% of the variance observed in attitude toward e-waste after treatment.

Table 2: Estimated marginal means of participants' attitude towards e-waste management after treatment

Dependent Variable	Group	Mean	Std Error	95% confidence interval	
				Lower Bound	Upper Bound
Attitude	Experimental	28.711	1.989	24.756	32.665
	Control	22.055	1.344	19.382	24.728

Table 2 shows that participants given Environmental Health Education (experimental group) had higher mean score of 28.711 on attitude towards e-waste management compared with participants exposed to nutrition education (control group) who had a mean score of 22.055. This means that experimental group performed better than the control group. It implies that Environmental Health Education was effective in bringing about positive attitude towards e-waste management.

Hypothesis Two

There is no significant effect of educational qualification on attitude towards environmental health education among electronic technicians in Ibadan, Oyo State. Nigeria.

The result presented in table one shows that $F_{(2,84)}$, indicating that main effect of educational qualification on attitude towards e-waste management is .765; $p>0.05$. The P value (.469) is greater than 0.05 alpha level of significance hence the null hypothesis was accepted. This implies that educational qualification had no significant contribution to the participants' scores on attitude towards e-waste management. Partial eta squared of 0.018 implies that educational qualification had a contribution of about 1.8% to participants' attitude towards e-waste management.

Table 3: Estimated marginal mean scores of participants' attitude towards e-waste management by educational qualification

Dependent Variable	Educational Qualification	Mean	Std Error	95% confidence interval	
				Lower Bound	Upper Bound
Post-test Attitude	Primary School leaving Certificate	14.204	5.320	3.625	24.784
	SSCE/NECO	25.748	1.142	23.477	28.019
	OND	26.326	1.960	22.429	30.223

Table three reveals that participants that possessed Ordinary National Diploma (OND) had highest post-test mean score of 26.326 followed by those who obtained Senior School Certificate Examination (SSCE)/National Examination Council (NECO) with post-test mean score of 25.748, while the participants with Primary school Leaving Certificate had least post-test mean score of 14.204. This implies that participants with the highest educational qualification performed better than other groups.

Hypothesis Three

There is no significant effect of years of experience on attitude towards e-waste management among electronic technicians in Ibadan, Oyo State, Nigeria.

The result presented in table one shows that $F_{(2,84)}$ indicating effect years of experience on attitude towards e-waste management is 1.169; P>0.05. The P value (.316) is greater than 0.05 alpha level of significance hence the null hypothesis was accepted. There is no significant effect of years of experience on attitude towards e-waste management among the participants. Partial eta squared of 0.027 implies that years of experience accounted for 2.7% of the observed variance on attitude towards e-waste management among electronic technicians in Ibadan, Oyo State, Nigeria.

Table 4: Estimated marginal mean scores of participants' attitude towards e-waste management by years of experience

Dependent Variable	Educational Qualification	Mean	Std Error	95% confidence interval	
				Lower Bound	Upper Bound
Post-test Attitude	1 – 5 years	26.104	2.445	21.242	30.966
	6 – 10 years	22.203	1.990	18.244	26.161
	11 years and above	27.805	1.043	25.731	29.879

Table 4 shows that participants with over 11 years of experience had highest post-test mean score of 27.805 on attitude towards e-waste management, followed by 1-5 years with post-test mean score of 26.104, while participants with 6-10 years of experience had least post-test mean score (22.203). This implies that participants with the highest number of years of experience had better attitude towards e-waste management than other groups.

Discussion of Findings

The finding showed that there was significant main effect of treatment on attitudes towards e-waste management among the participants. In other words the experimental group given environmental health education had better attitude towards e-waste management than the control group exposed to nutrition education. The higher post- test mean score obtained by participants exposed to environmental education over those in control group is attributable to the treatment. The result is an agreement with the finding of Kurtz, Kurtz and Contreras (2004) whose pre-test and post-test result showed a significant improvement in women knowledge, attitude and preventive efforts with regards to exposure of themselves and their children to environmental tobacco smoke (ETS) after an educational intervention. In the same vein WHO (2006) postulated that through environmental health education, individual become more aware of various health hazards in their environment. The effectiveness of the environmental health education given may also be as a result of the participatory method used in teaching the selected topics coupled with the enthusiasm demonstrated by the participants during intervention/session. The expressions of the participants showed that the intervention came as a long awaited solution to the problem of health hazards of e-waste which prints and electronic media have been calling their attention to.

The finding from this study revealed that educational qualification had no significant effect on attitude towards e-waste management among electronic technicians in Ibadan, Oyo State, Nigeria. This implies that the contribution of participants' educational qualification was not strong enough to be significant. Nevertheless, participants with OND which happened to be the highest educational qualification had better attitude towards e-waste management than other groups with lesser qualification.

The result of the study revealed that the effect of years of experience on attitude towards e-waste management among electronic technician in Ibadan Oyo State was not significant. In other words there was no significant variation on attitude of the participants towards e-waste management based on the years of experience. Nevertheless, participants with highest number of years of experience had better attitude towards e-waste management than other groups.

Conclusion

Based on the finding of this study it was concluded that environmental health education was effective in enhancing attitudes toward e-waste management among electronic technicians. It was also concluded that educational qualification did not contribute significantly to the effectiveness of environmental education. Also, years of experience did not contribute significantly.

Recommendations

Environmental health education is apt to enhance attitude towards e-waste management. It is therefore imperative that functional environmental health education be made available to protect the health of electronic technicians from been ravaged by hazards of e-waste. It is along this line that the following recommendations are made:

1. Environmental health education directed specifically at e-waste management should be organised on regular basis for electronic technicians. The focus of the programme should be knowledge provision for positive attitude and eventual practice of sanitary e-waste management. Adequate human and material resources should be committed to the programme to ensure its effectiveness.
2. Relevant government agencies in the country such as Ministries of Health and Environment should include in their activities enlightenment programme for artisans to make them be aware of health hazards associated with their jobs and methods of preventing them.

3. Public awareness programme on known environmental health hazards in the society should be organised periodically. This should not be left in the hand of government alone, non-governmental organisations and health professional associations should be involved to achieve wider coverage of the country with the programme.
4. Adult literacy programme should be organised for all categories of artisans in the country most especially those with no formal education.
5. Law enforcement agencies should monitor the weekly (Thursdays) environmental sanitation exercise in Oyo State, Nigeria to ensure its effectiveness. During the exercise, particular attention should be paid to electronic technician workshops to enforce proper management of e-waste. E-waste disposal facilities must be adequately provided and strategically placed for easy accessibility.

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