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Knowledge and Awareness Implication on E-Waste Management among Nigerian Collegiate

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ABSTRACT: Lack of awareness and cautionary information on effective and appropriate management operations associated with e-waste may pose potential threat to human health and the environment. This study assessed the knowledge and awareness implication of e-waste management among undergraduate students of Federal University Wukari, Taraba state. The research design adopted for this study was a cross-sectional study sample survey using questionnaire. The questionnaire was self-developed, pre-tested and validated so as to achieve the purpose of the study. The questionnaire assessed participants' demography, electrical/electronic equipment ownership and usage, awareness and knowledge of e-waste and e-waste handling and control management approaches. Administration of the questionnaire took place between the months February and March, 2017. The analysed data showed that students' ownership and usage of e-gadgets were high. Mean value of 2.8482 obtained for e-waste knowledge and awareness analysis implies average level of knowledge and awareness concerning e-waste management among the participants. The implication of e-waste knowledge and awareness on appropriate management practices among the students when subjected to Pearson correlation analysis gave an "r" value of 0.330 which was a positive correlation. The average level of e-waste management awareness among the participants was observed to have translated to average appropriate approaches in practice with mean value of 2.8763. This means that improvement on the level of e-waste management awareness can as well affect the level of e-waste management approaches in practice. ©JASEM

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The significant potential risks and adverse hazardous effects of wastes to humans, livestocks and ecosystem were established to be on the increase (CPCB, 2003). Atiemo *et al.,* (2012) observed that yearly 20 to 50 million tonnes of Electrical Electronic Equipment (EEE) wastes are generated worldwide, which pose potential threat to human health and the environment. According to Butu (2015) e-wastes are electrical/electronic materials that are disposed of by end users and include a wide range of products from simple devices to complex goods. Electrical and Electronic Equipment by making become technologically obsolete in a matter of months as a result of continuous development of new models. Most electrical appliances and electronic gadgets imported from the developed countries in their large proportion into our nation Nigeria has almost lived beyond their average life cycle before importation (Nnorom and Osibanjo, 2008). Observation made by Ahmad (2010) revealed that population, economic growth of a nation, market penetration, upgrade of technology and rates of obsolescence (average life cycle) also catalytically speeds up electrical/electronic equipment or products end of life and turn them to e-waste. The use of electrical appliances and electronic gadgets and the subsequent e-waste generation following average life cycle leaves toxic substances with great consequence to the environmental litters of solid e-waste (Butu and Okoro, 2014; Onwughara *et al.*, 2010; Nnorom and Osibanjo, 2008; Chi *et al.*, 2003). Large number of e-wastes in their proportion are generated which contain both toxic and valuable materials in them (Zhan and Xu, 2014). Disposal of these e-wastes without appropriate measures can cause health and environmental hazards to humans, livestocks and the ecosystem (Hossain *et al.*, 2010). Management of these wastes simply means waste collection, keeping, treatment and disposal in a safe manner so as to avoid harm to humans and the environment (Attah, 2013). This basically deals with concerted efforts of concerned persons through conscious and systematic attempt in maintaining and sustaining an aesthetic, economically viable, physically healthy, conducive and safe environment for living (Okwesili, *et al.*, 2016).

Literatures have shown that most developing nations of the world Nigeria inclusive use dump sites, lack collection point for electronic waste, time to transport the e-waste to the safe disposal site, appropriate infrastructure for sound hazardous waste management and lack of awareness among both individuals and the informal sector on the dangers of electronic waste (Paul and Tshetlhane, 2013; Lundgren 2012; Terada, 2012; Basel Action Network, 2011; SAICM, 2009). Poor level of awareness of people in general on the hazardous nature of e-waste as well as crude and unskilled approaches to e-waste management has adversely contributed to the e-waste problems in Africa (e-Stewards, 2013). Lack of awareness and cautionary information on effective and appropriate management operations associated with e-waste may pose health hazards on human especially with handling or re-using of expiry products (Hossain *et al.*, 2010). Licy *et al.*, (2013) supposed that environmental problems cannot be completely eradicated; as such it can only be reduced and controlled through proper awareness and practice concerning waste management. E-waste is hazardous, complex and expensive to treat in an environmentally sound manner (Inoka, 2016). Caution can only be effectively taken and acted upon if appropriate awareness of associated danger is in place. Knowledge like information about e-waste stems, spreads and influences actions of the populace as knowledge by one through communication or action circulates to others which is one of the major characteristics of an education setting. Based on the above background information, this study was carried out to assess the implication of knowledge and awareness on E-waste management among Nigerian Collegiate.

MATERIALS AND METHODS

This was a cross-sectional study conducted among the undergraduate students of Federal University Wukari, Taraba State, Nigeria. The tool used for data collection was a questionnaire developed after consultation of related studies. The same was pre-tested and validated for the study purpose efficacy and suitability. The designed questionnaire was divided into four sections and the categories of information assessed in each of the sections includes, participants demography, electrical/electronic equipment ownership and usage, awareness and knowledge of e-waste and e-waste treatment and management. “Yes”, “No” and “Not sure” were the response variables for the questions enumerated under e-waste knowledge and awareness each of which were assigned with 1 for No, 2 for Not sure and 3 for Yes. The questions enumerated on the questionnaire were coded using Statistical Package for the Social Sciences (SPSS) software version 16.0 (Chicago, IL, USA) and afterwards the data collected was entered for analysis. Informed consent was obtained from each of the participants. The P value was set at 0.01 for significance level.

RESULTS AND DISCUSSIONS

The response rate for the four hundred questionnaires distributed to the students in the three faculties in the school was (392/400) 98%. Participants’ distribution according to their faculties showed that 47.2, 31.6 and 21.2 percents were in pure and applied sciences, agriculture and life sciences and humanities management and social science faculties respectively (Table 1). The predominant age range among the participants was 21-25 years (54.8%). Two hundred and seventy three (273) participants representing 70.7% of the study population were male while the remaining 29.3% were female. Most of the participants (80.1%) reside outside the halls of residence provided by the school (Table 1).

Table 1: Demographic distribution of participants

Characteristics	Variables	Frequency	Percent
Age distribution of Participants	15-20	84	21.4
	21-25	215	54.8
	26-30	80	20.4
	31-35	12	3.1
	36-40	1	.3
Gender	Male	273	70.7
	Female	113	29.3
Faculty	Pure and applied sciences	185	47.2
	Agriculture and life sciences	124	31.6
	Humanities management and social science	83	21.2
Level	100	55	14.3
	200	107	27.8
	300	115	29.9
	400	93	24.2
	500	15	3.9
Place of residence	Off campus	309	80.1
	On campus	77	19.9

From the age range data obtained in this study, it was observed that most participants were young. Young people according to Collins (2013) have been identified as the most-placed to drive new (sustainable) modes of consumption through their participation in trend-setting youth cultures. Consumer's hunger for trendy and sophisticated lifestyle and a high rate of product obsolescence has resulted in rapid influx of new products (Chukwudebe and Diala, 2014). Data obtained for the e-gadget ownership showed high and large distribution of e-gadgets ownership and usage by the participants with cell phone (15.85%), fluorescent lamps/bulbs (12.66%) and computer/laptop (11.79%) being the most owned items (Figure 1).

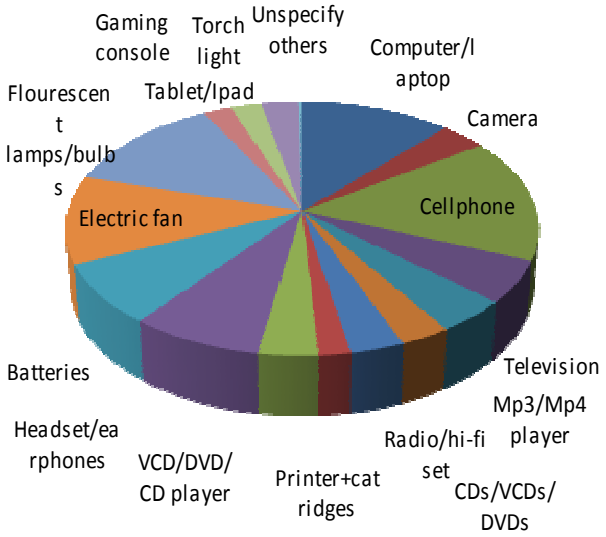

Fig 1: Participants' EEE ownership

Among the 17 specified and other unspecified e-gadgets owned by the participants in this study, computer/laptop (9.26%), cell phone (15.28%) and headset/earphones (4.50) were the most frequently used. This wide range and large quantity of e-gadget owned and used by the participants indicates large potential environmental contaminants and human health risk. Most electrical and electronic products have their lifespan between six and seventy-two months in which the products breakdown or need replacement due to emergence of new advanced models making the current one obsolete. As electrical/electronic equipment operates to their average life cycle (end of life) they become e-waste. This simply means that large volume of EEE ownership and usage implies commensurate e-waste generation potential. Other factors such as open circuits, electron migration, short circuits, dust, excessive heat or moisture also affects the useful life of the product (Chukwudebe and Diala, 2014). Tartiu (2011) stated that students must have awareness about environmental problems so that they can play their role very effectively in proper waste management. From literatures awareness depending on its level may or may not translate to appropriate practices (Azodo and Ismaila, 2016). In this study, students awareness on waste was assessed, this cut across the meaning of e-waste through to the e-waste management approaches. From table 2, it can be seen that most students were aware of what e-waste is but for the awareness of volume of e-waste that they generate, knowledge on local and international laws on e-waste and knowledge on local problems on e-waste. The sources of information cut across media 97(32.4%), teachers/mentor 79(26.3%), friends/peer group 39(13.0%), taught in school 36(12.0%), personal search 42(14.0%) and other unspecified sources 7(2.3%).

Table 2: Knowledge and awareness of e-waste management

Characteristics	Yes	No	Not sure
Meaning of e-waste	222(57.1%)	116(29.8%)	51(13.1%)
Awareness of volume of e-waste that you generate	70(25.5%)	117(42.5%)	88(32.0%)
Hazardous materials in e-waste	163(59.9%)	16(5.9%)	93(34.2%)
Health risks associated with e-waste	179(65.6%)	19(7.0%)	75(27.5%)
Special treatment of waste at disposal	163(60.4%)	15(5.6%)	92(34.1%)
E-waste a serious threat to the environ	183(67.3%)	36(13.2%)	53(19.5%)
Knowledge on local and international laws on e-waste	62(22.8%)	157(57.7%)	53(19.5%)
Knowledge on local problem on e-waste	85(31.2%)	143(52.6%)	44(16.2%)
E-waste contain toxic material	171(63.1%)	30(11.1%)	70(25.8%)
E-waste recycling	172(63.2%)	29(10.7%)	71(26.1%)
Re-usage of e-waste	166(61.0%)	39(14.3%)	67(24.6%)
E-waste recovery	151(55.7%)	45(16.6%)	75(27.7%)

Literature has shown that reuse is a positive waste management practice that extends the lifespan of a device before eventual recycling as such reduces the volume of waste generated as well as reduction of its potential human health hazards and environmental impact per time (Adediran and Abdulkarim, 2012). From the result obtained it was observed that participants deal with dysfunctional electronic devices in diverse manner such as "fix and re-use" 199(41.6%), "throw them away" 68(14.2%), "store or keep them" 62(13.0%), "buy new one" 95(19.9%), "sell them" 53(11.1%) and "unspecified others" 1(0.2%) (Figure 2).

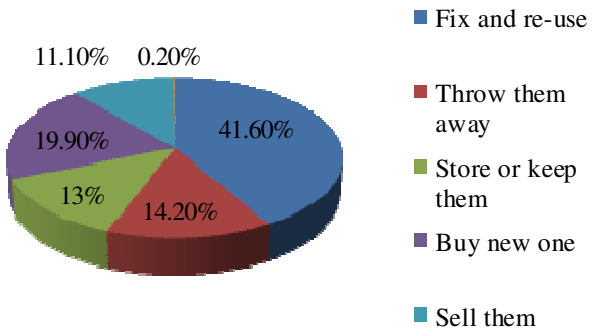

Fig 2: Participants' treatment of EEE at passive life stage

At the end of an average life cycle of an electrical/electronic equipment which includes the number of years an electrical/electronic equipment has efficiently been used (active life), refurbishment or reuse period (passive life) and time in which it is stored and at repair shops before dismantling (storage), it was found that participants keep the e-waste 132(20.3%) followed by those who sell them as scrap 131(20.2%) and participants that put them in a waste bin and latter dispose alongside other waste 120(18.5%) (Table 3)

Table 3: E-waste treatment after its average life cycle

Use of gadgets after damage	Frequency	Percent
Keep them	132	20.3
Throw them away	105	16.2
Put them in a waste bin and latter dispose alongside other waste	120	18.5
Sell them as scrap	131	20.2
Give them to scavengers	40	6.2
Burning/incineration	61	9.4
Dump in gutter, river or sea	31	4.8
Bury them	22	3.4
Unspecified Others	7	1.1

The mean and standard deviation of the responses to each of the 7 items of the questionnaire that assessed Nigerian collegiate level of appropriate approach to e-waste management practices from a total of 388 participants' responses to the items enumerated in this section of the questionnaire is shown in Table 4.

Table 4: Nigerian collegiate level of appropriate approach to e-waste management practices

Characteristics	N	Mean	Standard Deviation	Interpretations
Proper waste segregation practices	388	2.8144	1.25819	Average appropriate practice
Acquisition of new e-gadgets even if older ones are still working	388	3.1727	1.18717	Average appropriate practice
Buying of reputable brands due to durability	388	2.0309	.97994	Low appropriate practice
Buying of used e-gadgets so far they will work	388	3.0206	1.12734	Average appropriate practice
Gathering of domestic waste in a waste bin and disposed when filled	387	2.2868	1.27670	Low appropriate practice
Giving damaged e-gadgets to waste collectors for free	388	3.2320	1.21055	Average appropriate practice
Rate at which e-gadgets damage	388	3.2036	1.00505	Average appropriate practice

The responses indicated "e-waste segregation from other waste practices", "acquisition of new e-gadgets even if older ones were still working", "giving damaged e-gadgets to waste collectors for free", "buying of used e-gadgets so far they will work" and "rate at which e-gadgets damage" were all of average appropriate practice whereas "buying of reputable brands due to durability" and "gathering of domestic waste in a waste bin and disposed when filled" were of low appropriate practice (Table 4). However none was of very high, high and very low appropriate practices. Analysis carried out to ascertain the aggregate awareness of e-waste of each participant based on the items assessed on the questionnaire showed that there was average knowledge and awareness about e-waste among the participants. The implication of e-waste awareness on the involved management practice was also assessed the result showed average appropriate practices. The correlation analysis between e-waste awareness and management practices gave an "r" value of 0.33 which was a positive correlation (Table 5).

Table 5: Correlation between E-waste awareness and management practices among the participants

No of students	E-waste awareness mean	E-waste management practices mean	Pearson Correlation
388	2.8428	2.8763	.330**

Note. **Correlation is significant at the 0.01 level (2-tailed)

Conclusions: Continuous easier and more convenient benefits from Electrical and Electronics Equipment (EEE) have generally made life easy. Their efficiency and time saving features in application cut across the communication systems, entertainment industry, household equipment and domestic chores. The numerous benefits associated with e-gadgets not withstanding at the EoL if not properly handled may pose health and environmental hazards to humans, livestock and as well ecosystem. The knowledge and awareness implication on e-waste management among Nigerian collegiate assessed among the undergraduate students of Federal University, Wukari, Taraba state showed that the students were averagely aware of e-waste handling and control operations which translated to average level of appropriate management practices. This deserves improvement for higher level of appropriate e-waste management practices.

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