

“E-WASTE MANAGEMENT EDUCATION - A STUDY AMONG STUDENTS OF OSMANIA UNIVERSITY”

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ABSTRACT

The Indian Government's ability to safeguard the country's environment depends on policies and education systems. Disposal of e-waste is one of the major challenges facing the world today. Hence, human beings are asked to reduce, reuse and recycle their waste. Even the most learned people are unaware about the segregation of objects to reduce, reuse and recycle. These three words if followed by each and every person would be helpful to protect our environment. Given the volume of e-waste a typical college campus can produce, adopting a waste management strategy that is designed to maximize participation is essential. A successful recycling program should operate with an infrastructure for on-site collection that is free and accessible. On-campus accessibility will maximize collections and foster widespread organizational support. Research on awareness regarding effective ways of e-waste handling among university students after WEEE policy implementation in India is limited. Therefore, the current study aims to educate students of Osmania University regarding 3 R's, that is recycle, reduce and reuse e-waste.

Keywords: e-waste, recycle, reduce, reuse, curriculum

INTRODUCTION

India is experiencing rapidly increasing rates of consumption of electrical and electronic products. This, accompanied with high obsolescence rates, has led to higher rates of E waste generation. E-waste handling is a problem of increasing proportion, especially when crude methods are adopted for recovery of useful components from it. The present study will throw a light on how aware are the students of Osmania University about e-waste and its disposal and management.

Most researchers tend to focus only on a particular aspect of the e-waste problem, looking at it through their own disciplinary lens. Despite the burgeoning literature on e-waste it is as yet a relatively new research area albeit a dynamic one. Therefore there are many open questions that are still to be answered, while new ones keep coming up with the growing volume of e-waste worldwide, new technical developments and the rapid replacement of old products with new and different ones. While there is still debate on how to best and most efficiently manage existing products, new product categories are emerging; such as electric cars or smart textiles which are currently not considered as e-waste, but which will soon need to be included in the e-waste debate. The disposal of e-waste, particularly computers, in universities has become a serious problem since the methods of disposal are very rudimentary and pose grave environmental and health hazards. The situation is worsened as there is no e-waste management system in place, as well as the lack of awareness, inadequate legislative mechanisms, a lack of funds and reluctance on the part of the government and corporate organizations to address this critical issue.

Given the volume of e-waste a typical college campus can produce, adopting a waste management strategy that is designed to maximize participation is essential. A successful recycling program should operate with an infrastructure for on-site collection that is free and accessible. On-campus accessibility will maximize collections and foster widespread organizational support.

Khatriwal, Luepschen and Kuehr in their book on E-waste management stressed the importance of looking at e-waste through an interdisciplinary perspective. Policies to promote the safe and environmentally sound disposal of e-waste are intertwined with the need for processing technology, infrastructure for the collection of e-waste, financing mechanisms and economic incentives, control and monitoring to ensure compliance as well as consumer awareness and behaviour change.

Sindhu Bala and Ms. Sukirti Goel conducted a study of E-Waste Management in relation to awareness of college students of Noida city through Simple Random sampling technique using a self-developed E-Waste Management Awareness Inventory (EWMAI) questionnaire to check the awareness of students regarding existence, danger and management of e-waste..

N.Tyagi, S.K. Baberwal and N. Passi conducted a study of the e - waste disposal method of Delhi University and came out with a Delhi University Waste Management Process Flow Chart.

Amit kumar, Dr Lalit Sharma et al. conducted a study to know the awareness, knowledge, perception, and attitude of college going student about existent, risk and management of E-waste which is the rapidly growing problems of the world. It also tried to identify current e-waste management practiced by the students.

Gerald L. Meneses, Warlito M. Galitathe suggested that the school should sponsor seminars regarding proper e-waste management and disposal for students, faculty and staff; teachers are encouraged to inculcate positive values to their students in terms of caring for the environment through proper e-waste disposal; and

the school administration may also consider the implementation of the proposed e-waste inventory management system so as to further improve the current practices in the University, making it more responsive to the challenges of today. Keeping in view the above studies it can be noted that educating students regarding 3 R's, that is recycle, reduce and reuse e-waste is very important and plays a major role for proper e-waste management for a student. Education regarding e-waste also helps a student while buying electronic products, opting for energy efficient ones, designed for easy upgrading or disassembly and made of fewer toxic constituents would go a long way in reducing e-waste generation.

OBJECTIVES

- To educate students of Osmania University about 3 R's, that is Recycle, Reduce and Reuse e-waste.
- To study the students willingness to participate in e-waste management activities in colleges/university.
- To understand the students willingness to learn e-waste management in their curriculum.
- To frame Vision 2025 on e-waste management for Osmania University.

METHODOLOGY

Data Collection and sampling

In consonance with the objectives, a survey was conducted to understand the awareness level of e-waste management among the students of Osmania University. The main aim of this project is to investigate the knowledge and awareness levels related to e-waste and related issues amongst students of Osmania University. This study was conducted through a survey questionnaire which was distributed to the students of Osmania University studying in various colleges. Colleges comprised of Graduate and Postgraduate colleges. Keeping in view the current pandemic situation, questionnaire was created and hosted using Google Forms and was distributed through a series of social media platforms. All the questions were marked as "mandatory" in order to submit the form, assuring in this way that we were not faced with an empty data case. The questionnaire was available for 10 weeks from November, 2020. No incentives were given for participation. A number of 1268 valid questionnaires were filled in. The data of the survey were analyzed using the IBM SPSS 22 statistical package. A descriptive statistics such as percentages and graphs were used to analyze the data from the survey. This is an exploratory research to understand the student's awareness towards e-waste management in Osmania University. For conducting this research, both primary and secondary data was collected.

Secondary Data:

Secondary data was collected from books, journals, magazines, already published research papers, reports of various organizations, NGO's, research groups and social activity groups, records and information maintained by various governments and other related agencies regarding e-waste and hazardous waste can be analyzed and used as per the requirements.

E-WASTE - DEFINITION

EEE includes a wide range of products with circuitry or electrical components with a power or battery supply. Almost any household or business use products like basic kitchen appliances, toys, tools to music, and ICT items, such as mobile phones, laptops, etc. Besides everyday household and business use, EEE are becoming increasingly used in transport, health, security systems, and generators of energy, such as photovoltaic. Traditional products, such as clothes and furniture, are often equipped with electrical components, and consequently are increasingly contributing to the global e-waste generated. More and more EEE is also employed in the expanding sector of the Internet of Things (IoT), such as sensors or devices pertaining to the concept of the "smart home" or "smart cities". EEE becomes e-waste once it has been discarded by its owner as waste without the intent of reuse. Each product has different material content, is disposed of and recycled in different ways, and is unequally harmful to the environment and human health if not managed in an environmentally sound manner. EEE comprises of a large variety of products.

The new UN document on e-waste viz., *e-Waste Monitor 2020*, defined the e-waste more elaborately. As per the convention given in the document, the electronic waste, or e-waste refers to all items of EEE and its parts that have been discarded by its owner as waste without the intent of re-use. E-Waste or WEEE or e-Scrap in different regions and under different circumstances in the world includes a wide range of products – almost any household or business item with circuitry or electrical components with power or battery supply. In this methodology as defined by the Partnership on Measuring ICT for Development (*Baldé et al., 2015*), the definition of e-waste is very broad and It covers six waste categories:

1. Temperature exchange equipment, more commonly referred to as cooling and freezing equipment. Typical equipment includes refrigerators, freezers, air conditioners, heat pumps.
2. Screens, monitors. Typical equipment includes televisions, monitors, laptops, notebooks, and tablets.
3. Lamps. Typical equipment includes fluorescent lamps, high intensity discharge lamps, and LED lamps.
4. Large equipment. Typical equipment includes washing machines, clothes dryers, dish-washing machines, electric stoves, large printing machines, copying equipment, and photovoltaic panels.
5. Small equipment. Typical equipment includes vacuum cleaners, microwaves, ventilation equipment, toasters, electric kettles, electric shavers, scales, calculators, radio sets, video cameras, electrical and electronic toys, small electrical and electronic tools, small medical devices, small monitoring and control instruments.

6. Small IT and telecommunication equipment. Typical equipment includes mobile phones, Global Positioning Systems (GPS), pocket calculators, routers, personal computers, printers, telephones.

DATA ANALYSIS AND INTERPRETATIONS

Table – 1: Demographic profile of the respondents

Variable	Category	Frequency	%
Native place	Rural	576	45.4%
	Urban	692	54.6%
Course	PG	384	30.3%
	UG	884	69.7%
Gender	Female	712	56.2%
	Male	556	43.8%
Age	17-20 years	940	74.1%
	21-25 years	304	23.9%
	25-28 years	024	02.0%
Parental Income PA	<Rs.1,00,00	304	23.9%
	Rs.1,00,000- 5,00,000	572	45.1%
	>Rs.5,00,000	392	31.0%
Faculty	Arts	116	9.1%
	Commerce	280	22.1%
	Education	120	9.5%
	Engineering	108	8.5%
	Informatics	116	9.1%
	Law	88	6.9%
	Management	128	10.1%
	Science	92	7.3%
	Social science	124	9.8%
	Technology	96	7.6%

Source: Primary data collected from the respondents

The above table gives an idea about backdrop of the respondents. Totally 1268 students of OU have been identified for the study. In order to have a comprehensive study, conglomeration of the student target group from constituent and affiliated colleges of OU has been picked up strategically to cover students from all walks of life on the basis of their native place, educational background, age, gender, economic status etc.

Demographic – More or less equal number of respondents from both rural and urban backgrounds have been selected to maintain a balance in the study. Students from urban area account for 55% and rest of 45% from rural area.

Academic – Higher number of respondents from UG level over PG level has been preferred as majority of the students of UG are prone to use electronic gadgets. 70% of the students of UG and 30% of PG have been selected.

Gender – Out of 1268 students, 712 were female students and 556 were male students .Slightly higher number of female students responded over male students (56:44) breaking the myth that boys are more tech-savvy than girls.

Age – Three age groups by giving preference to ideal range of 17-28 covering the students of both UG & PG have responded to the survey.

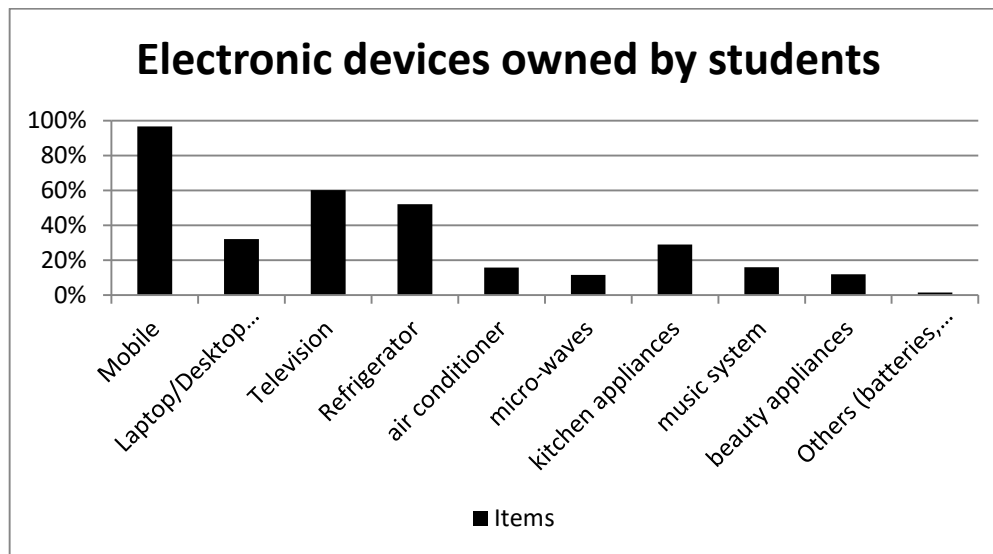
Economic status – No conspicuous efforts have been made by selecting students on the basis of their parental annual income. From the students chosen, majority of them had annual parental income between 1.00 to 5.00 lakh rupees.

Academic streams – It has been ensured that students of academic streams are covered in the study. However, students from Commerce stream are in more number as this course is much sought after among all others and had more student strength in OU.

Table -2: Electronic devices owned by students

Items	%
Mobile	96.8%
Laptop/Desktop computers	32.2%
Television	60.3%
Refrigerator	52.1%
air conditioner	15.8%
micro-waves	11.7%
kitchen appliances	29%
music system	16.1%
beauty appliances	12%
Others (batteries, inverters)	1.5%

Source: Primary data collected from the respondents

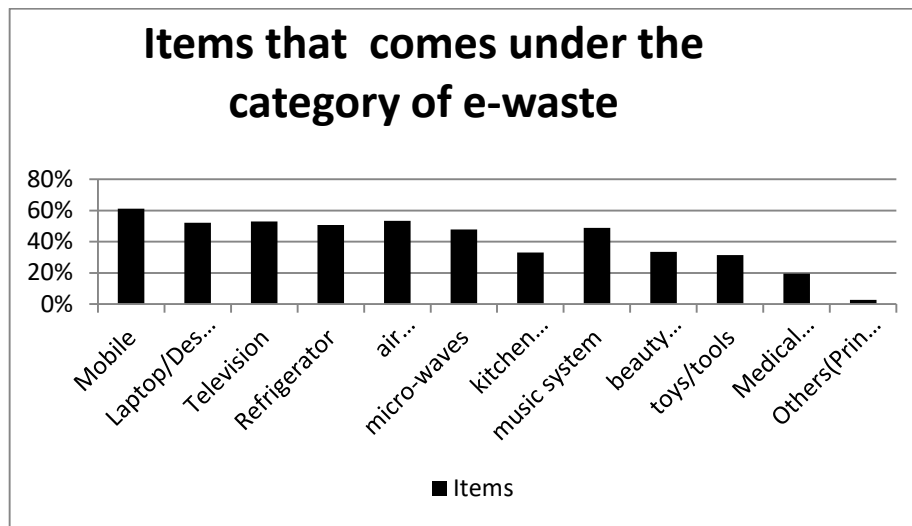


This table (No.2) gives a portrait of electronic gadgets owned by the respondents. Mobile phones dominate the list with 97% of the respondents possessing them. Affordable prices, low telecom tariffs, availability of internet facilities, rampant usage of social media, stuffed multiple features in the handset etc. have made mobile phone an inseparable and integral part of the system of current generation. Other gadgets owned by the respondents / their families in the ascending order of number are TVs, Refrigerators, and Laptops/Desktops etc. It is evident that majority of the respondents are in possession of electronic gadgets and that usage of such items has become a basis necessity of life.

TABLE-3: ITEMS THAT COMES UNDER THE CATEGORY OF E-WASTE

Items	%
Mobile	61.2%
Laptop/Desktop computers	52.1%
Television	53%
Refrigerator	50.8%
air conditioner	53.3%
micro-waves	47.9%
kitchen appliances	33.1%
music system	48.9%
beauty appliances	33.4%
toys/tools	31.5%
Medical equipment's	19.6%
Others(Printers, videogames, copiers, scanners)	2.7%

Source: Primary data collected from the respondents



Above table makes an attempt to understand the level of awareness of the respondents about the electronic gadgets that falls under the category of e-waste. Of the 12 electronic gadgets specified in the questionnaire, respondents (50-60%) felt that only 5 gadgets (Mobile Phones, Laptops / Desktops, TV's, Refrigerators and Air-conditioners) fell under e-waste category. Less than 50% of respondents voted for the remaining gadgets to be under e-waste. This indicates that the students have no clarity about e-waste and electronic gadgets that result in e-waste.

TABLE-4 : REDUCE, RECYCLE AND REUSE E-WASTE

			%
Do you know about segregation of waste?	Yes	656	51.7%
	No	416	32.8%
	Not Sure	196	15.5%
I Normally separate e-waste while discarding it?	Yes	720	56.8%
	No	296	23.3%
	Not Sure	252	19.9%
I look for ways to reuse e-waste?	Yes	840	66.2%
	No	228	18%
	Not Sure	200	15.8%
I try to repair things before I discard it	Yes	1036	81.7%
	No	148	11.7%
	Not Sure	84	6.6%
I buy used/refurbished products	Yes	528	41.6%
	No	468	36.9%
	Not Sure	272	21.5%
Would you be willing to pay extra money in order to have someone effectively dispose your e-waste?	Yes	472	37.2%
	No	524	41.3%
	Not Sure	272	21.5%
Are you committed to minimize e-waste?	Yes	904	71.3%

	No	192	15.1%
	Not Sure	172	13.6%
Do you think that you also have a role to minimize e-waste?	Yes	1024	80.8%
	No	108	8.5%
	Not Sure	136	10.7%

Source: Primary data collected from the respondents

Present table (No.4) deals with 3 R's (Reduce, Recycle & Re-use) of e-waste. 52% of the respondents have an idea about segregation of e-waste and 48% have no idea about it.

56% of the respondents separate e-waste while discarding and 23% do not segregate while discarding. 66% prefer to look for ways to re-use e-waste and 34% simply dispose of the same without trying to re-use.

82% of the respondents try to repair things before discarding while 18% prefer to discard things without trying to repair the same.

Only 42% of the respondents are willing to buy used / refurbished products whereas 58% prefer buying new products. 37% are amenable to pay extra money in order to have someone effectively dispose e-waste and remaining 73% are not interested to pay extra money.

71% of the respondents have confirmed that they are committed to minimize e-waste whereas 29% are not sure about it. 81% admitted that they have a major role to play to minimize e-waste whereas 19% are not sure about it.

TABLE-5: STUDENT WILLINGNESS TO PARTICIPATE IN E-WASTE MANAGEMENT ACTIVITIES IN COLLEGE/UNIVERSITY

			%
Did you ever attend any awareness programme conducted by college/university regarding e- waste management?	Yes	504	39.7%
	No	608	47.9%
	Not Sure	156	12.3%
Do you think awareness programmes on e-waste management in your college/university can help you manage your e-waste better?	Yes	968	75.7%
	No	200	15.8%
	Not Sure	108	8.5%
If you agree with the above question, are you willing to participate in such programmes in your college /university?	Yes	968	76.3%
	No	144	11.4%
	Not Sure	156	12.3%
Would you want more education and awareness about e-waste in your college /university?	Yes	1044	82.3%
	No	116	9.1%
	Not Sure	108	8.5%

Source: Primary data collected from the respondents

The above table aims at understanding the student willingness to participate in e-waste management activities in college / university.

40% of the respondents have confirmed that they have attended awareness programmes conducted by college / university on e-waste management whereas 60% have not attended the same.

76% think that awareness programmes on e-waste management in their college / university can help them manage e-waste better while others think such programmes have no impact on e-waste management.

76% of the respondents have informed that they are willing to take part in e-waste management programmes while others have not shown any interest.

82% of the respondents want more education and awareness programmes on e-waste in the college / university while others are disinterested in such activities.

TABLE-6: STUDENT WILLINGNESS TO LEARN E-WASTE MANAGEMENT IN THEIR CURRICULUM

			%
Do you have environmental topics in your curriculum?	Yes	932	73.5%
	No	240	18.9%
	Not Sure	96	7.6%
Did you study about e-waste management in your syllabus?	Yes	540	42.6%
	No	532	42%
	Not Sure	196	15.5%
Would you be willing to learn about e-waste management, if included in your syllabus?	Yes	972	76.7%
	No	160	12.6%
	Not Sure	136	10.7%
Would you like to study e-waste management as a separate subject in your course?	Yes	724	57.1%
	No	300	23.7%
	Not Sure	244	19.2%

Source: Primary data collected from the respondents

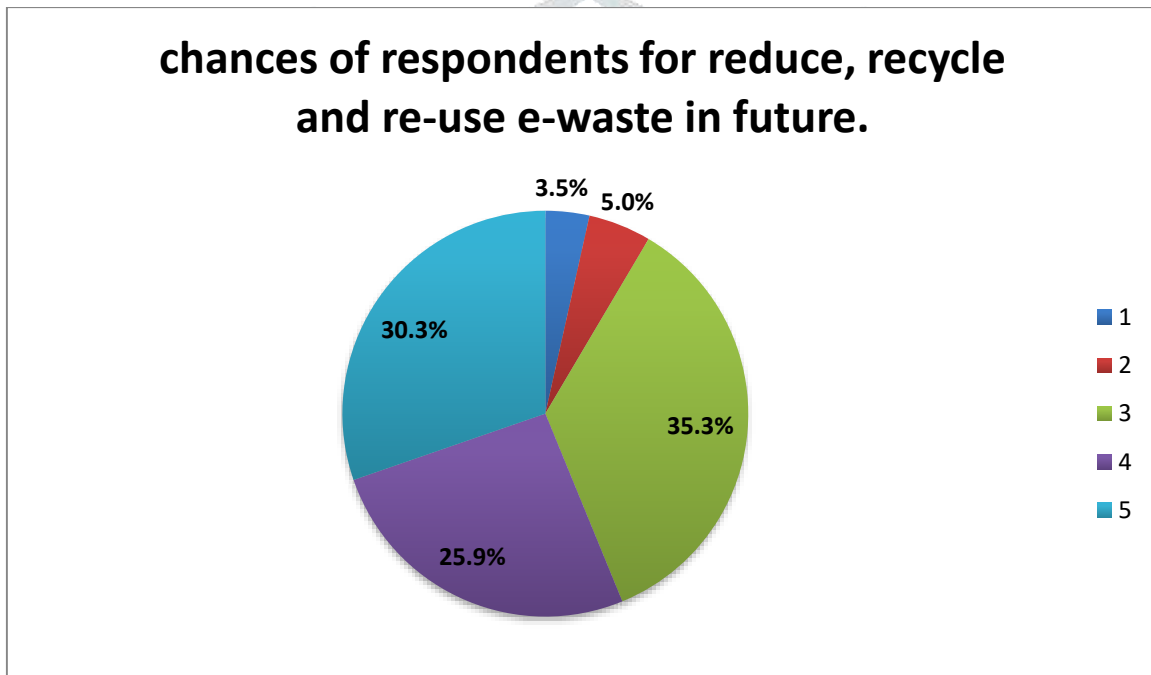
Above table envisages analyzing the willingness of students to learn e-waste management in their curriculum. 74% of the respondents have environmental topics in their curriculum and the rest do not have such topics. 43% studied about e-waste management in their syllabus and other 57% have not studied the same. 77% are willing to learn about e-waste management if included in syllabus and others are not

interested. 57% have shown interest in studying e-waste management as a separate subject in their course and others are not much keen to study the same.

TABLE-7: CHANCES OF RESPONDENTS FOR REDUCE, RECYCLE AND RE-USE E-WASTE IN FUTURE

Very low chance		to			Very high chance	
1	2	3	4	5		
44	64	448	328	384		
3.5	5	35.3	25.9	30.3		

Source: Primary data collected from the respondents



This table studies about the chances of respondents for reduce, recycle and re-use e-waste in future. 30% are confident that the chances are very high

Keeping a long-term goal in mind the following Vision-2025 for proper e-waste management has been formulated so that in the long run Osmania University becomes the intellectual capital for e-waste management. Comprehensive education and research can position Osmania University as a leader of e-waste management, primarily through the development of the intellectual capital necessary to create an e-waste management program.

VISION-2025 ON E-WASTE MANAGEMENT FOR OSMANIA UNIVERSITY**1. Short-Term plans – to be implemented within next six months**

- Start a nature/environment club at college/university level.
- Create an e-waste management monitoring committee
- Start E-Waste management research
- Collection point at OU
- start E-waste management Internship programmes
- sort, classify and catalogue e-waste management
- conduct seminars/workshops/webinars/awareness programs/runs etc

2. Medium Term plans – to be implemented within next 1-5 years

- Data base of e-waste research
- Diploma course on e-waste management with tie-up for placements
- Separate UG/PG course with on the job training facilities on e-waste processing, management and disposal
- Include e-waste management in UG-Environmental science curriculum
- Setting up an E-waste plant
- Use different media to create awareness

3. Long term plans - after 5 years

- Create a National level policy on e-waste management in universities
- OU as e-waste HUB
- Generate income through proper e-waste management/Research/collection point

CONCLUSION

The e-waste problem is young and poorly understood, and efforts to strategically deal with it are yet immature. This paper only attempts to point in the right direction – by having a strategic and holistic approach in dealing with the e-waste problem. Keeping in view the sustainability principles the following research was undertaken at the outset to educate students of Osmania University regarding 3 R's (Reduce, Recycle & Re-use) of e-waste. Being responsible global citizens, Osmania University students can play a major role in proper e-waste management, while buying electronic products, opting for energy efficient ones,

designed for easy upgrading or disassembly and made of fewer toxic constituents would go a long way in reducing e-waste generation.

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