

UTHM Perspective of e-Waste Disposal

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Abstract : E-Waste is unwanted, broken, or old electronic products and Malaysia is a densely populated country that is considered to be one of the world's fastest developing regions. The purpose of this study is to study about UTHM perspective of E-waste disposal and to bring awareness at the same time. Method for this study is an online questionnaire via 'Google Form' and website. The pre-post test was done by creating two different google forms which is the second google form is to measure the level of interest after publishing the website. The result for this study clearly shows that the attitude of the UTHM community towards e-waste disposal is at a good and satisfying level. Plus, the respondents are aware of e-waste and its creation, but they lack confidence; so, more e-waste awareness campaigns should be created.

Keywords: E-Waste, E-Waste Disposal, Website, Electronics, Campaigns

1. Introduction

e-Waste is unwanted, broken, or old electronic products and Malaysia is a densely populated country that is considered to be one of the world's fastest developing regions. Electrical and electronic equipment (EEE) has become indispensable and improves the standard of living, but they often contain toxic chemicals that harm human health and the environment and contribute to the climate crisis.

Many countries, especially in Malaysia, could not manage e-waste well, so more efforts are needed to establish wiser and more sustainable global e-waste generation, utilization, management and disposal. It is also pointed out that many countries around the world generate more e-waste

than safely recycled it, so more corporate efforts are required to overcome the e-Waste problem through appropriate study and training [1].

The problems posed by e-waste disposal in today's digitally connected world are primarily due to the way it produce, use, and dispose of electronic devices, which are currently unsustainable, so implementing appropriate strategies for electronic waste management will make a significant contribution to the achievement of sustainable development goals and reduce environmental issues by developing the necessary, needed, and required e-waste policies [2] [3].

The objectives of this study is to bring awareness to the UTHM community about e-Waste disposal in order to analyze the level of understanding among the UTHM community about e-Waste through questionnaires, to save the life of future generations, to expose and to bring knowledge to the UTHM community about e-Waste through a website and to get ideas from the UTHM community about innovation that can make from e-waste through Google Form.

2. Materials and Methods

The discussion is mainly focused on the study method and website design for this study as depicted in **Figure 1**. This study starts by listing all possible study questions followed by the selection of respondents and a study method. After that, the website design and concept will be explained at the end of this chapter. A flowchart will explain about the whole process for this chapter beforehand to make this study more organized and systematic.

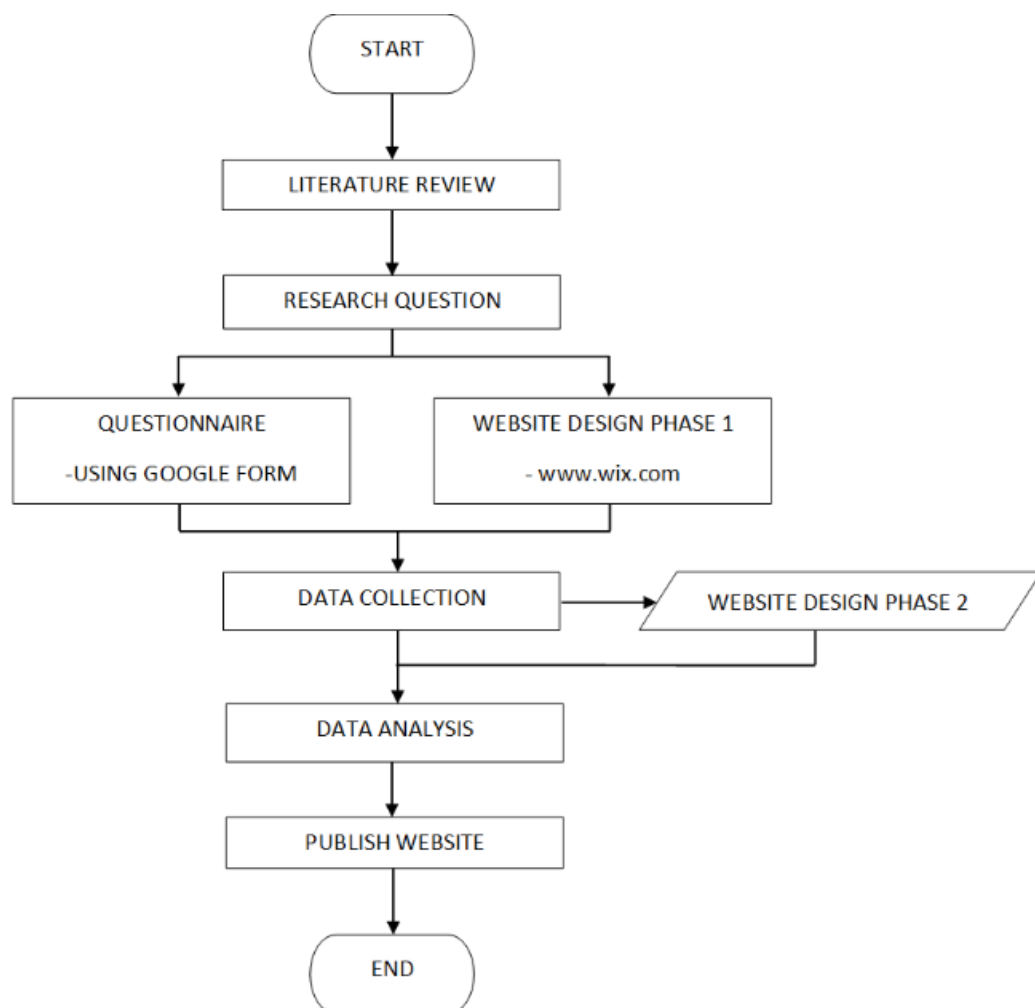


Figure 1: Flowchart of Study

2.1 Research Question

Google Forms is a free, web-based program that allows users to respond to questions. There are seven sections in this Google Form, including the first page of the introduction. This introduction explains what e-waste is and how much time will be spent filling out the Google Form. **Figure 2** shows the flow for designing question in Google Form.

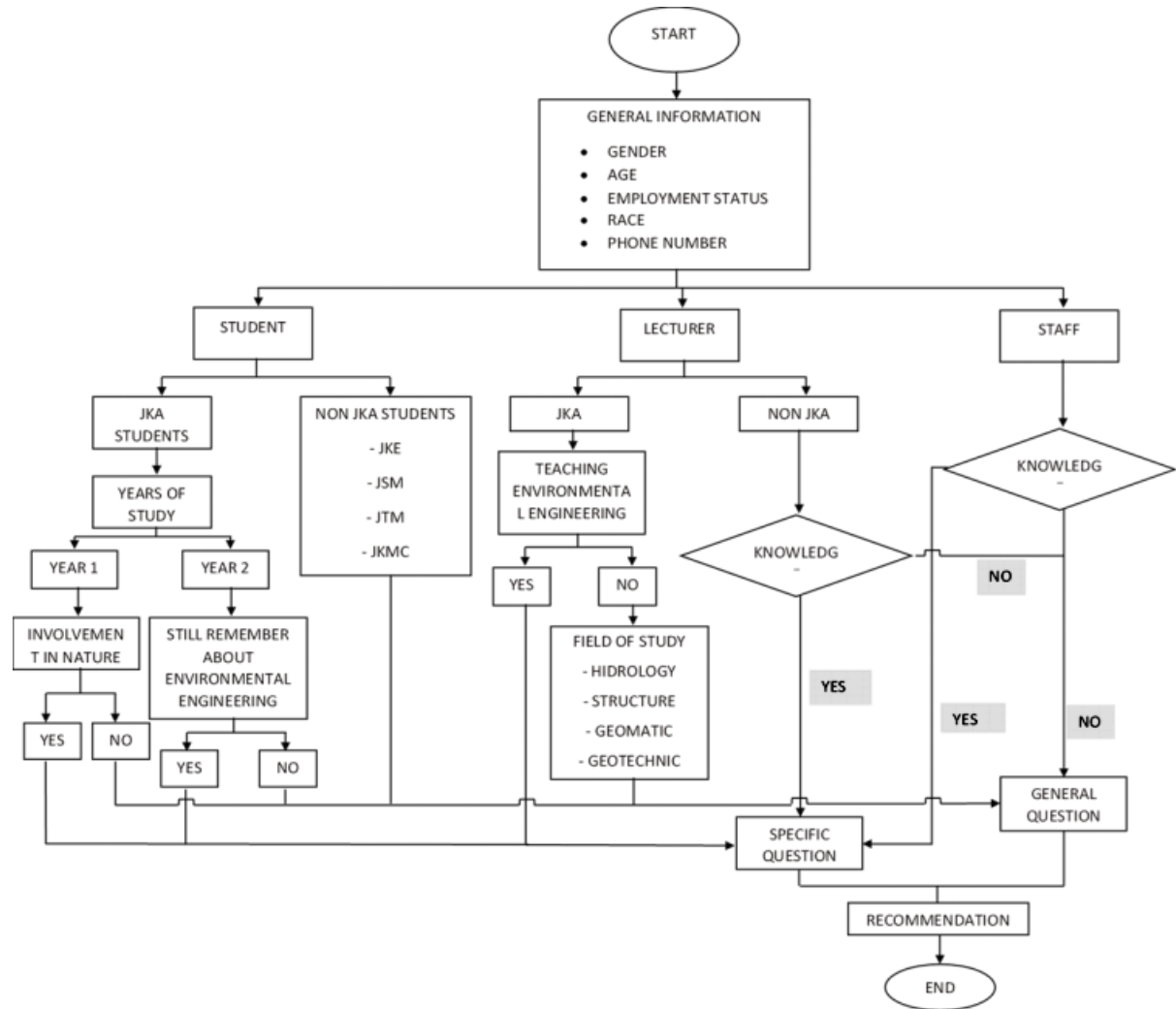


Figure 2: Flowchart of Questionnaire

Since understanding of how to properly dispose of e-waste is still regarded as new to our society, the study method for this study is an online questionnaire via 'Google Form' to survey knowledge about e-waste disposal among UTHM residents and staff.

A questionnaire is a research tool that consists of a series of questions or other forms of prompts that are used to collect data from a respondent. Responses can be compared to previous data to see whether there have been any changes in respondents' preferences or experiences. Respondents can also choose to remain anonymous when filling out the survey.

Open-ended questions, multiple choice questions, dichotomous questions, and scaling questions are some of the types of questions included in questionnaires. Open-ended questions differ from other

sorts of questionnaire questions. It can lead to unexpected outcomes, enhancing the research's originality and value. The results of the findings, on the other hand, are difficult to analyze.

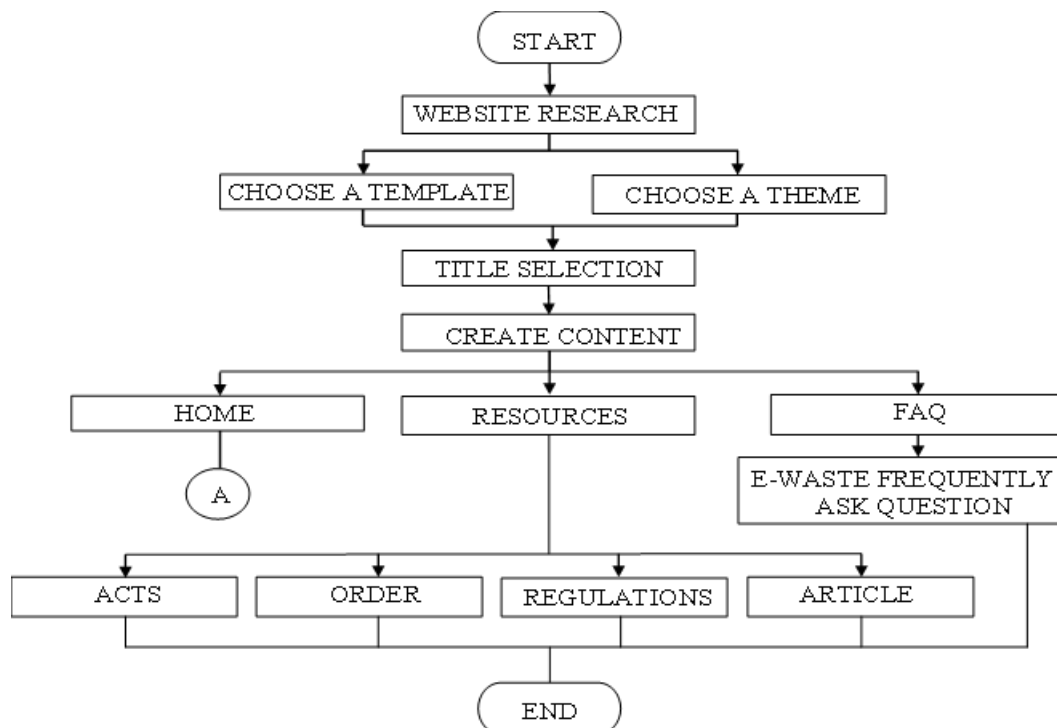
Multiple choice questions are a sort of closed-ended question where the respondent must choose one or more answers from a list of options. An incomplete question, one or more correct answers, incorrect answers, close alternatives, and distractors all make a multiple choices question, however not all multiple choice questions have all answer types.

The research questions for this study is:

- i) What method that can use to analyze the level of understanding among the UTHM community about e-waste?
- ii) What can people do about e-waste in order to save the lives of future generations?
- iii) How to expose the knowledge about e-waste to the UTHM community?
- iv) What is the way to get ideas about innovation of e-waste from the UTHM community?

2.2 Website Design

The website for this study was done by using a website builder, <https://www.wix.com/> . This website builder is user-friendly, interface-friendly, easy to update, intuitive, efficient, pleasant, easy to troubleshoot and effective error handling as it is not overly complex, but instead is straightforward, providing quick access to common features. Also, this website is well-organized, making it easy to locate different tools and options, also effective in terms of readability, functionality and accuracy.



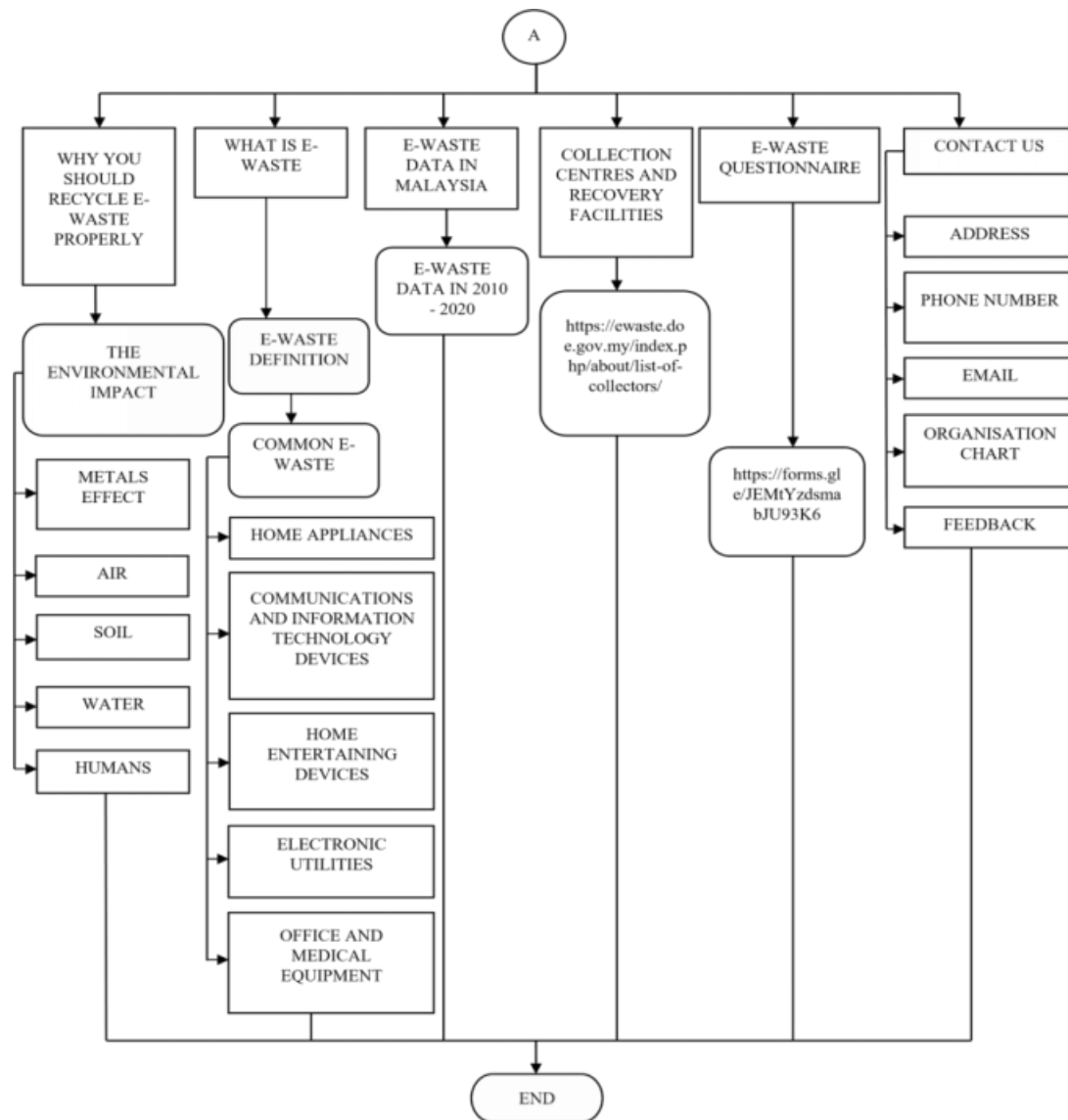


Figure 3: Flowchart of website

As stated in the methodology, a website was designed (<https://aa200666.wixsite.com/e-wastedisposal>). This website is used to create awareness among the UTHM community on the E-waste disposal. Important facts on the reasons why E-waste should be disposed of correctly, definition of E-waste, E-waste statistics in Malaysia, locators of collection centres and recovery facilities nearby and E-waste questionnaire for this study are published on the home page of the website. This information will improve the level of knowledge for the UTHM community on E-waste. As the questionnaire was embedded in the website, it can be seen that the level of knowledge and attitude of the respondents towards E-waste disposal has shown to be on a high level.

The website has four categories including the homepage, resources, frequently asked questions and contact us. As planned, this website was created to raise awareness towards e-Waste disposal so all the content in the website is related. This site included multiple subpages of the homepage which are ‘what is e waste?’, ‘why you should recycle e-waste properly’, e-Waste data in Malaysia from 2010 until 2020, collection centres and recovery facilities and e-Waste questionnaire.

Next, ‘what is e-waste’ page contains a supporting image towards the topic, some brief about e-waste and a list of common e-waste. The ‘why you should recycle e-waste properly’ page, includes the

impacts of e-waste on air, soil, water and humans. Other than that, e-waste data in Malaysia from 2010 until 2020 page only includes the supporting image and the table of data. For the collection centres and recovery facilities page was linked to another website that is complete with the address, details and place to recover or donate the e-waste. E-waste questionnaire is also a page that is linked to another web page which is google form. The questionnaire is a research purpose that consists of a set of questions that aims to collect information from the respondents.

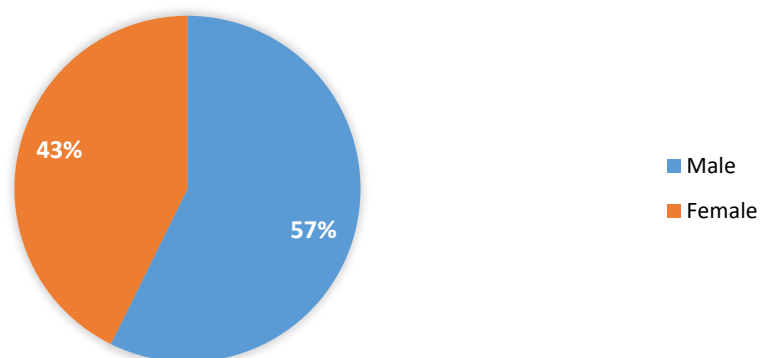
Additionally, the resources page includes acts, regulations, order and article journals about e-waste. Besides, the ‘frequently asked questions’ page includes a few questions and answers about e-waste. Finally, for the ‘contact us’ page, are the details about information, address, contact, feedback submission, and the team member’s information and image. This website will consume less energy to find the recycling centre or donation place and it can connect people around Malaysia to read or gain some knowledge about e-waste. This step can help Malaysians to recycle their e-waste properly and reduce the pollution.

3. Results and Discussion

3.1 Respondent information

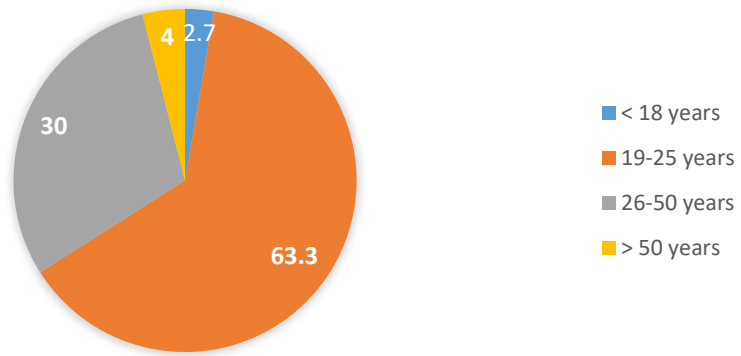
As stated in the methodology, the Google Forms was designed (<https://forms.gle/xA7r8uEdLRf6oVhU7>) and (<https://forms.gle/ts477Ehf71qwxDYc7>). The part covers the respondents' gender, age, race, and status in UTHM. **Figure 4** to shows the background of 450 respondents in this study. It can be seen that the majority of respondents are male, 57.3%. The age range that dominates this study is 19-25 years old (63.3%) and followed by 30% in the range of 26-50 years old. As Malays are the majority race in UTHM, most of the respondent race are Malay, Indian, Chinese and others in descending order. 65.3% of the respondents in this study are UTHM students where 82% are from JKA and the others are from different departments. The proportion of JKA Year 1 (49.2%) and Year 2 (50.8%) are almost equal. Besides that, 22.7% respondents of this study are academic staff with 78% of JKA staff and 53% of the respondents are teaching Environmental Engineering subjects. Remaining 12% of the respondents are management staff in UTHM. A big part of the respondents are electronics device users (98%). This aligns with the study title of E-waste disposal as most of the respondents will have experienced and practiced E-waste disposal.

RESPONDENTS GENDER (%)



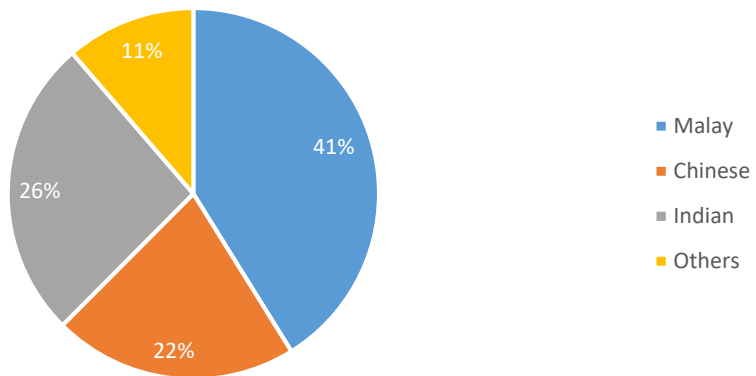
(a)

AGE OF RESPONDENTS (%)



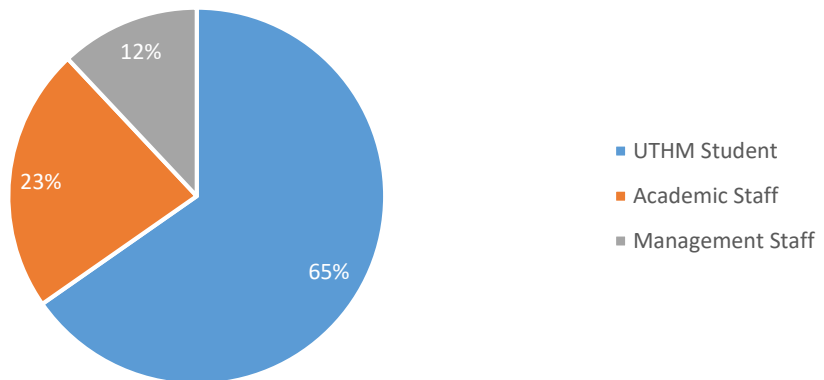
(b)

Race of Respondents



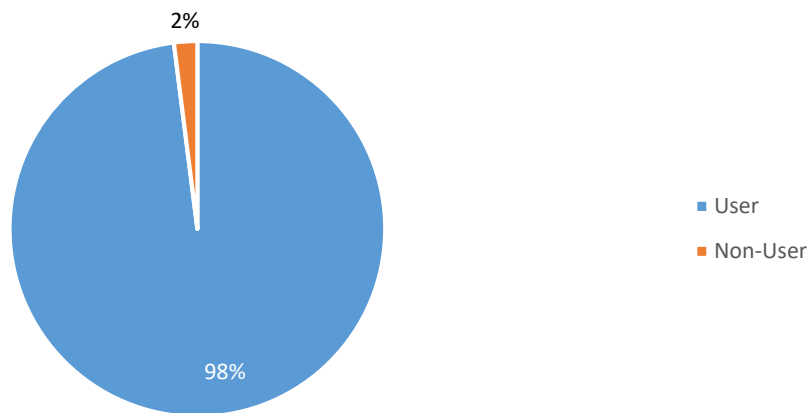
(c)

Status of Respondents



(d)

Electronic Equipment and Device User



(e)

Figure 4: Respondent general information;(a) gender, (b) age, (c) race, (d) status and (e) classification

3.2 Level of e-Waste knowledge among UTHM community

Figure 5 shows e-waste knowledge levels among the respondents. 56% of the respondents have answered yes for the knowledge of E-waste question which indicates majority respondents having the theoretical knowledge of E-waste. Most of the respondents also answered Cadmium and Lead in the open-end question of two chemicals in E-waste which is true according to [4]. When asked about the difference between E-waste and other wastes only 21% of the respondents were not aware of the differences. The ability to differentiate E-waste and other waste can be categorized as fair knowledge about E-waste regarding the level of knowledge and awareness. However, the majority of respondents (57%) were not aware of the threat posed by E-waste. This proves that information on e-waste in general has been received and acknowledged by the community of UTHM.

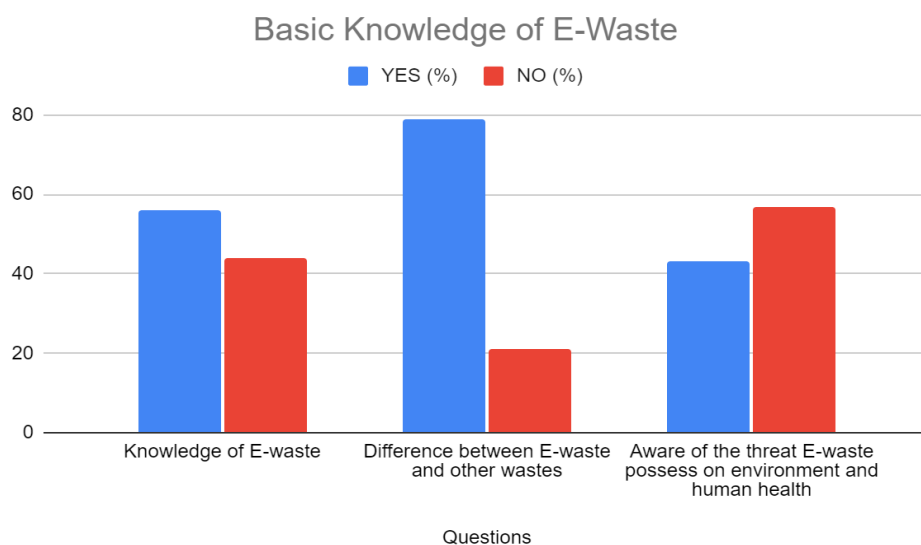


Figure 5: Basic knowledge of respondent

3.3 e-Waste disposal method

Table 1 shows e-waste disposal methods based on different electrical and electronic appliances. The majority of respondents practice the E-waste disposal method of selling them as used appliances (42%). By selling, the seller gets to generate money and with the influence of social media nowadays it is easy to find a used item buyer. The second most chosen practice is to send it to recycling facilities (23%) which aligns with the Department of Environment Malaysia who initiated household e-waste collection programs in collaboration with the Japan International Cooperation Agency (JICA) to established household e-waste collections from residences [5]. The third method is trading to new devices (17%), this can be due to renowned brands like Samsung and Huawei offering their customers to trade in their devices to get newer version devices. The fourth method is donating to others (9%), the fifth method is throwing in a rubbish bin (5%) and the last and least practiced method is storing indoors/outdoors (4%).

Table 1: Disposal method by respondent

| Methods | % |
|---------------------------------|----|
| Sell to used items | 42 |
| Donate to others | 9 |
| Sending to recycling facilities | 23 |
| Trade to new device | 17 |
| Throw in rubbish bin | 5 |
| Store at indoors/outdoors | 4 |

3.4 Level of e-Waste disposal awareness among UTHM community

Mean descriptive analysis was used to identify the level of awareness of e-waste disposal among the UTHM community in terms of their level of attitude and practice. Each of these variables has been assigned a mean and level. The level is classified using the scale of 1.00-2.33 is Poor, 2.34-3.66 is Medium and 3.67-5.00 is High. The levels categorized into three groups based on the level range calculation between mean higher score and lower mean score ($5-1=4$). Lower levels range from 1.00 to 2.33 ($1.00+1.33$), medium levels range from 2.34 to 3.66 ($2.34+1.33$), and higher levels range from 3.67 to 5.00 ($3.67+1.33$).

Table 2 shows e-waste disposal attitudes among UTHM community. The variables of attitude in this study were also divided into three parts of the sustainability domain which are environmental, social and economic. The findings show that the overall level of these variables are also high. This clearly shows that the attitude of the UTHM community towards e-waste disposal is at a good and satisfying level. Since most of the respondents in this study are students and academic staff who are involved with Environmental Engineering, the theory that they have learnt or taught has been reflected in their attitudes towards E-waste disposal. This aligns with [4] observation, for example, found that Port Dickson respondents had high understanding, behavior and practice with regard to recycling of e-waste, which was also largely affected by their education.

Table 2: Level of E-waste disposal attitudes

| Variables/Sub-variables | Levels | |
|-------------------------|--------|------|
| | Mean | Mean |
| Attitudes | 3.83 | High |
| Environment | 3.80 | High |
| Social/Health | 3.68 | High |
| Economy | 4.00 | High |

Table 3 shows the level of e-waste disposal practices among UTHM community, which is divided into three parts of the sustainability domain which are environmental, social and economic, similar to the variables for e-waste disposal attitudes. The findings show that the overall level of e-waste disposal practices are medium, in general. There is a difference between the findings of the level of knowledge and attitudes when compared to e-waste disposal practices. It shows that the community in UTHM is still at the middle level in terms of practicing sustainable e-waste disposal. The medium level of E-waste disposal practice might be due to some challenges as stated in the open-ended questions. The challenges highlighted are unavailability of E-waste recycling bins around UTHM campus and lack of a rewarding program for recycling E-waste.

Table 3: Level of e-waste disposal practices

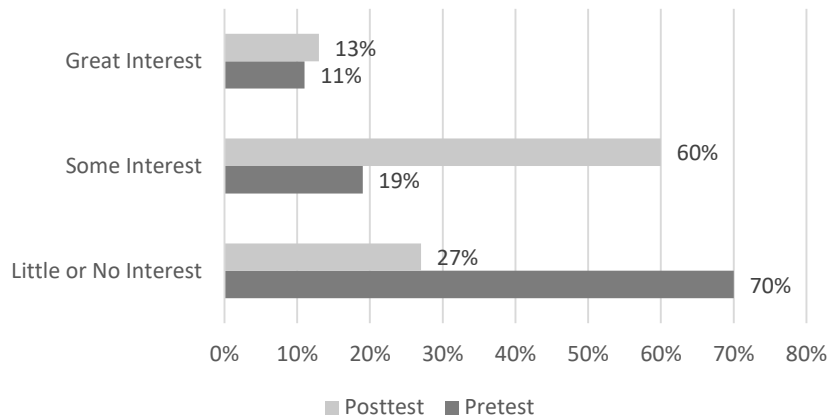
| Variables/Sub-variables | Levels | |
|-------------------------|--------|--------|
| | Mean | Mean |
| Practices | 3.29 | Medium |
| Environment | 3.00 | Medium |
| Social/Health | 3.93 | High |
| Economy | 2.93 | Medium |

3.5 Data Analysis Pre-Post

Table 4 and **Figure 6** shows the level of interest change pre-test to pre-post before and after publishing the website. The interest level for little or no interest for pre-test is 315 (70%) while post-test is 120 (27%). This shows huge different after the website published. For some interest, the pre-test is 85 (19%) while the post-test is 273 (60%). Lastly, for great interest, the pre-test is 50 (11%) and the post-test is 57 (13%).

Table 4: Interest level from Pre-Post

| Interest Level | Pre-test | Post-test |
|-----------------------|-----------|-----------|
| Little or No Interest | 315 (70%) | 120 (27%) |
| Some Interest | 85 (19%) | 273 (60%) |
| Great Interest | 50 (11%) | 57 (13%) |

Change in Interest Pre-test to Post-test**Figure 6: Change in interest pre-test to post-test**

Overall, it has been discovered that e-waste disposal and awareness among the UTHM community is getting better and is still in the process of improving. However, e-waste disposal awareness in the community is very closely related to the three main elements which are knowledge, attitudes and practices. In conclusion, it was found that knowledge and attitudes give effect to e-waste disposal practices even at a medium level. Therefore, in order to develop more practical e-waste disposal practices and thus sustain the environment, public exposure to e-waste issues should be improved through awareness campaigns as well as through the deployment of education agents at an early stage of life, namely in primary and secondary schools.

4. Conclusion

E-waste management has emerged as an emergent challenge for both developed and developing countries, since it is a rapidly rising level of trash that contains extremely harmful and poisonous compounds in its e-wasted components. It is produced in wealthy nations more than in underdeveloped countries. The industrialized nations either disposed of it in landfills or sent it to developing countries such as China and India. In wealthy nations, environmental rules for e-waste recovery and recycling are quite severe and costly. Future study may be conducted on e-waste creation and disposal management, as well as the development of sustainable e-waste collection and recycling technologies for a more sustainable society. Today's important problems for authorities include regulatory enforcement, upskilling the informal sector, awareness campaigns, a transparent recycling system, rewarding e-waste recycling, and so on.

As stated in the objectives, this study successfully analyze the level of understanding among the UTHM community through questionnaires. Furthermore, this study helped UTHM community to save the life of future generations by creating awareness among them through pre-test and post-test. Next, this study successfully achieved the objective to expose and to bring knowledge to the UTHM

community about e-waste by creating a website with all the information on e-waste. This website will use less energy to locate a recycling center or donation location, and it will link individuals all around UTHM community to read about or learn about e-waste. This step can assist UTHM community in properly recycling their e-waste and reducing pollution. Final objective is to get ideas from UTHM community about innovation that can make from e-waste. Respondents did not propose any solution to the problem. Assumed that this objective did not achieve.

Based on results and discussion, the respondents are aware of e-waste and its creation, but they lack confidence; so, e-waste awareness campaigns should be created. Besides, it was discovered that while respondents in UTHM are aware of the presence of dangerous elements in e-waste, they are unfamiliar with the range and impacts on human health and the environment. However, respondents are aware that valuable metals can be found in e-waste. E-waste management is a profitable industry. The incorporation of e-waste study into existing education courses is more appreciated.

Acknowledgement

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