Pertanika J. Soc. Sci. & Hum. 28 (4): 2731 - 2748 (2020)

PERTANIKA JOURNALS

SOCIAL SCIENCES & HUMANITIES

Journal homepage: http://www.pertanika.upm.edu.my/

Knowledge, Attitude, and Practices on E-Waste Recycling among Public in Port Dickson

Tengku Adeline Adura Tengku Hamzah*, Amirah Sariyati Mohd Yahya and Aziz Shafie

Department of Geography, Faculty of Arts and Social Sciences, University of Malaya, 50603, Kuala Lumpur, Malaysia

ABSTRACT

Electrical and electronic waste (E-waste) is defined as electrical and electronic appliances that are broken or unwanted by the present owner and are due to be thrown away. The rise in volume at a global scale is driven by several factors, such as economic development, increasing populations, and the shorter lifespan of electrical appliances. This global environmental issue could affect both the environment and human health. As agreed by many researchers, E-waste recycling is one of the options that will help in dealing with this rising issue. However, are Malaysian citizens ready to participate in the recycling of E-waste? This is the question that motivated this research. This study was conducted among 271 respondents in Port Dickson to determine the knowledge, attitude, and practices (KAP) on E-waste recycling among the public. It is also intended to investigate the demographic factors influencing the issue. The findings show that educational background is the main factor that affects the KAP on E-waste recycling. Mass media, such as television, radio, and the internet, are the most likely sources of information on E-waste recycling for the respondents. The findings of this research are significant in providing insights for the government, NGOs, and other stakeholders in managing E-waste, and helping minimize this issue in the study area.

Keywords: E-waste recycling, KAP, Port Dickson

ARTICLE INFO

Article history:
Received: 05 November 2019
Accepted: 06 July 2020
Published: 25 December 2020

DOI: https://doi.org/10.47836/pjssh.28.4.13

E-mail addresses:
adelineadura@um.edu.my (Tengku Adeline Adura Tengku Hamzah)
amirahdropbox@gmail.com (Amirah Sariyati Mohd Yahya)
azizs@um.edu.my (Aziz Shafie)
* Corresponding author

INTRODUCTION

Electrical and electronic waste (E-waste) is defined as electric and electrical goods that have already been used and are due to be thrown away (Tiep et al., 2015). E-waste releases heavy metals, flame retardant

ISSN: 0128-7702
e-ISSN 2231-8534

materials, chemicals (Hendricks, 2012 in Shumon et al., 2014), and toxic pollutants into the environment and may have a direct impact on living things throughout the food chain. Among the toxic chemicals contained in E-waste are lead, mercury, cadmium, barium, beryllium, arsenic, chromium, and selenium, which have the potential to pose danger to human health and the environment. As such, in Malaysia, E-waste is categorised as scheduled waste and is monitored under the Department of Environment (DOE).

Proper methods to dispose of E-waste are highly challenging. Indiscriminate dumping of E-waste, or dumping of E-waste together with general household waste in landfill, may lead to groundwater contamination, while incineration of E-waste will emit toxic gases into the atmosphere (Kiddee et al., 2013). The volume of E-waste generated has risen globally due to a combination of several factors, such as rapid economic and population growth of one country and the decreasing lifespan of electronic goods (Kalana, 2010; Kiddee et al., 2013). As reported by the Department of Environment (DOE), the amount of E-waste generated in Malaysia in 2009 was 134,035.70 metric tons and was expected to increase up to 1.1 million metric tons in 2020 (DOE, 2009 in Shumon et al., 2014). It is projected that mobile phones and rechargeable batteries are the largest contributors to E-waste generation in the future (Tiep et al., 2015).

Management of household E-waste in Malaysia is not well established, and much of it ends up in an inappropriate landfill (Shumon et al., 2014). E-waste recycling is one of the options available to manage this issue properly. E-waste recycling can be defined as the reprocessing and reuse of electrical and electronic equipment which will help to protect the environment and human health from E-waste pollution (Conserve Energy Future, 2018). Recycling of E-waste enables the raw materials from E-waste to be recovered, hence this will lead to a decline in the amount of mining activity. Technologies for recycling E-waste will change the E-waste into a secondary resource and make it possible to extract the raw materials (Rhee, 2016). E-waste consists of different engineering materials that can be reused via evolving and available technology (Shumon et al., 2014) for example, iron, copper, and aluminium (Kiddee et al., 2013). Recycling also plays an important role in conserving energy. For example, recycling one million laptops can save energy equal to the electricity used by 3657 US houses in a year (Jaiswal et al., 2015).

In Malaysia, E-waste is controlled under Environmental Quality (Scheduled Wastes) Regulations 2005, First Schedule (Regulations 2) under code SW 110, as waste from electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode-ray tubes, and other activated glass or polychlorinated biphenyl-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyl. This regulation clearly states that E-waste

can be recycled and recovered only at the designated premises (Chow, 2017; Kalana, 2010; Suja et al., 2014). Besides legislation, DOE has also initiated a number of fixed recycling centres (FRC) and mobile recycling centres (MRC) in Pulau Pinang, Johor, Melaka, Negeri Sembilan, Kuala Lumpur, Selangor, and Putrajaya for the public to dispose of their E-waste (DOE, 2018). In Negeri Sembilan, there are two E-waste collection centres, which are located at Jusco Seremban 2 and Taman Arowana Impian, Seremban. E-waste collection is being supervised and handled by SWM Environment Sdn. Bhd. (DOE, 2018).

Even though legislation and facilities are widely known as important components in managing the E-waste, public participation also plays a prominent role in this issue. Knowledge, attitude, and practices (KAP) can be used in assessing public participation in E-waste recycling. Public participation has a vital role in the implementation of legislation and in improving environmental quality (Afroz et al., 2013). Knowledge may not affect public attitudes and practices, but, psychological factors can (Desa, et al., 2011). Population growth, economic growth, rapid development of technologies, and rapid urbanisation are the drivers for the increase in the amount of E-waste (Afroz et al., 2013; Akhtar et al., 2014; Borthakur & Govind, 2017; Kalana, 2010; Shumon et al., 2014; Tiep et al., 2015). This can be observed through the way the public handle and manage their E-waste. As an example, a study by Nokia revealed that E-waste was not disposed of immediately after it was not needed, but instead, it was kept in the house (Tiep et al., 2015). One of the initiatives to prevent this rising issue in Malaysia is the introduction of the 'Take Back Programme' (TBP), which was initiated by Panasonic, Motorola, Dell, HP, and Nokia. TBP is meant to reduce the amount of E-waste, but the public was not well informed and only restricted to certain areas (Tiep, et al., 2015). Initiatives by the manufacturing companies are considered sustainable alternatives that need to be practised regularly by all electrical and electronic (E&E) companies. Besides, the circular economy (CE) is also known as a sustainable alternative, where the used material resources are circulated into the new product development. CE includes recycling, remanufacturing, reusing, reconditioning, refurbishing, and repairing. All of these will help to achieve maximum efficiencies (Singh & Ordonez, 2016).

Knowledge, attitude, and practices KAP surveys were first used in the 1950s to evaluate the concept of family planning and, how it was being understood and practised by societies around the world (Launiala, 2009 in Ahmad et al., 2015). The three components can be defined as follows; Knowledge can be defined as facts, descriptions, information, and skills about a topic that can be received through education and experience; Attitude can be defined as how a person feels and thinks about something, as it works as a psychological emotion either positive or negative on the practices of an individual (Jekria & Daud,

2016); Practice is action based on knowledge and attitude (Babaei et al., 2015). Based on these three components, knowledge will form attitude; while knowledge and attitude will form practices (Ahmad et al., 2015). It is apparent that knowledge and attitude are the two most important factors in determining practices (Babaei et al., 2015), as a lack of knowledge could affect practices (Mathur et al., 2011; Madhukumar & Ramesh, 2012 in El-Gilany et al., 2017). KAP research is widely used in managing different types of waste. Since waste management is a global issue, it is also widely discussed in different parts of the world. The utilisation of KAP as a research instrument in waste management studies will help in determining which demographic backgrounds influence the process. Furthermore, it will be able to obtain insights into which study instruments influence the other study instruments and how they are related to one another. The effectiveness of KAP research will help to develop a good output; hence, it is able to suggest ways to overcome the issue based on the KAP instruments. Based on KAP research, it can also be concluded that on-going training and education could help in increasing the level of knowledge, attitude, and practices towards the study topic. Thus, this study seeks to determine the current status of KAP together with the satisfactory level and sources of information regarding E-waste recycling among 271 respondents in Port Dickson.

METHODS

Study Area

To achieve the study objective in determining the KAP of the public regarding E-waste recycling, this study was conducted in Port Dickson, Negeri Sembilan. Waste generation in Malaysia, including E-waste, is a huge environmental problem. Port Dickson is a well-known tourist attraction spot and is always bustling with various activities. It is highly crucial to understand the issues related to E-waste management in this area so that proper and appropriate management and monitoring actions can be taken to ensure proper controls are in place. Misappropriate management of E-waste in tourist attraction spots such as this study area could put the country in jeopardy in terms of the income generated from tourism activities. Furthermore, the output of this study can be used as an example for other tourist spots in Malaysia that share the same characteristics as Port Dickson. Historically, Port Dickson has been known as a tourism area since the colonial era (Abdullah et al., 2017). It is located in Negeri Sembilan, which is about 90 kilometers from Kuala Lumpur. Currently, now Port Dickson is still one of the beach tourism destinations in Malaysia (Praveena et al., 2018). The population of this tourism destination (2.5225° N, 101.7963° E) was recorded at 119,300 in 2017 (State Government of Negeri Sembilan, 2017). The Port Dickson coastline consists of 18 kilometers facing the Straits of Malacca (Abdullah et al., 2017; Praveena et al., 2018), which joins the Indian Ocean to the Pacific Ocean and

the South China Sea (Praveena et al., 2018). The coast road, which is about 22 kilometers long, is parallel to the Port Dickson coastline and connects this tourism destination with Malacca and also Seremban district (Abdullah et al., 2017). Port Dickson enjoys a pleasant tropical climate with an average annual temperature between 21 Cº and 32 Cº, a humidity range of between 80% and 90%, and an annual rainfall of 2381 mm (Praveena et al., 2016 in Praveena et al., 2018). Figure 1 shows the location of Port Dickson, Negeri Sembilan.

Port Dickson is administratively under the supervision and jurisdiction of Majlis Perbandaran Port Dickson. Rancangan Tempatan Port Dickson, which focuses on developing Port Dickson as a sustainable tourism area (McKercher, 2003 in Abdullah et al., 2017), has divided Port Dickson into three main corridors. The tourism corridor (Zone 1), consists of Port Dickson town to Tg. Agas, the industrial corridor (Zone 2) is located along the highway of Seremban-Port Dickson, and agricultural activity (Zone 3) is located in the rural area of Port Dickson (Abdullah et al., 2017).

Participants

As reported by the State Government of Negeri Sembilan, the population of Port Dickson in 2017 was 119,300 and covered a range of demographics backgrounds. In any research, there are several strategies and options for determining the sample size, for example, using published tables, using a census for small populations, referring to the sample size of similar studies, and applying

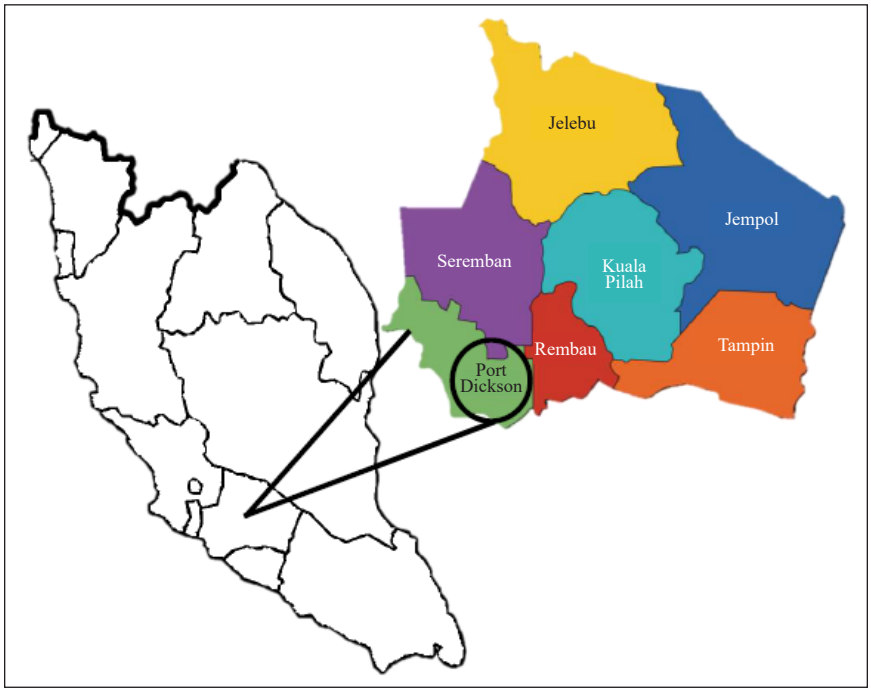

Figure 1. Location of Port Dickson, Negeri Sembilan (Pejabat Daerah dan Tanah Rembau, 2019)

formulae to calculate sample size (Israel, 1992). Based on the population size of Port Dickson, the minimum sample size of N=100 was required considering the confidence level of 95% and margin sampling error of 10% based on the table published in Israel (1992). Finally, a stratified random sample (N=271) was drawn from the public around Port Dickson who participated in this study. Respondents had to fit three criteria; held Malaysian citizenship, be aged 18 years and above and be a resident of Port Dickson. The age criterion is similar to that of several previous studies related to E-waste. Besides that, individuals aged 18 years and above usually already have their own income and hence are able to buy any electrical and electronic appliances on their own (Akhtar et al., 2014; Kalana, 2010; Sivathanu, 2016).

Of those respondents (N=271), 53.5% were female and 46.5% were male. The biggest proportion (28.4%) of the sample were the respondents aged 24 years old and below, while the married group (62.7%) were the predominant marital status. Regarding the education level of the sample, 53.9% of the respondents had a background of high school education and most of the respondents were at the time working in the private sector (30.3%). For the number in households, the highest proportion of the respondents (66.8%) were those who had between one and five persons in their house. About 78.2% of respondents, had a terrace house as their type of residence, which was the highest percentage among all the listed types of residence. In addition, the 38% of the respondents survived with no monthly income. Table 1 shows the general demographic data of the respondents in Port Dickson.

Instrument

The instrument used in this research was the questionnaire survey. The questionnaire was developed after reviewing the scientific literature on this subject. The structure of the questionnaire was designed by the researchers based on previous research and the items were adopted from previous questionnaire items related to waste and E-waste management. Table 2 shows the items adopted from previous research.

The questionnaires were divided into five parts as follows; part A (8 items) collects demographic data, part B (14 items) collects data about knowledge, part C (7 items) collects data about attitude, part D (4 major items and 7 sub-items) collects data about practices and part E collects data about the sources of information regarding E-waste recycling and includes a comment section regarding the E-waste management in the respondent's housing area. The KAP of E-waste recycling was measured using a nominal scale (Yes or No).

Research Design and Data Analysis

In this study, a quantitative research methodology was used based on the method of surveys and the application of statistical tests. The collected data were reported in the descriptive analysis and analysed using the chi-square in Statistical Package for Social Science (SPSS) to determine which elements of the demographic background

Table 1
General demographic of respondents in Port Dickson

Demographic background		Frequency	Percentage (%)
Gender	Male	126	46.5
	Female	145	53.5
Age Mean ± SD 4.91 ± 2.822	< 24 years old	77	28.4
	25-34 years old	56	20.7
	35-44 years old	39	14.4
	45-54 years old	64	23.6
	> 55 years old	34	12.9
Education background	Higher Education	85	31.4
	High School	146	53.9
	Primary School	25	9.2
	No Formal Education	15	5.5
Marital status	Single	92	33.9
	Married	170	62.7
	No information	8	3.0
Household numbers	1-5 persons	181	66.8
	6-10 persons	85	31.4
	>11 persons	5	1.8
Type of residents	Strata Houses	22	8.1
	Twin house/Bungalow	14	5.2
	Terrace	212	78.2
	Village	18	6.6
	Townhouse	5	1.8
Occupation	Government Sector	18	6.6
	Private Sector	82	30.3
	Self Employed	49	18.1
	Housewife	55	20.3
	Student	50	18.5
	Pensioner	17	6.3
Income	< RM 1500.00	57	21.0
	RM 1501.00 - RM 3000.00	48	17.7
	RM 3001.00 - RM 4500.00	36	13.3
	> RM 4501.00	26	9.6
	No income / No stated / Not related	103	38.0

Table 2
List of adopted items from the previous study related to waste and E-waste management

Items	Sources
Demographic background	
Gender	Almasi et al. (2019), Laor et al. (2018), Seng et al. (2018)
Age	Almasi et al. (2019), Laor et al. (2018), Seng et al. (2018)
Education background	Almasi et al. (2019), Laor et al. (2018), Seng et al. (2018)
Marital status	Almasi et al. (2019), Laor et al. (2018)

Table 2 (*continue*)

Items	Sources
Household size	Almasi et al. (2019), Laor et al. (2018)
Occupation	Almasi et al. (2019), Laor et al. (2018)
Income	Almasi et al. (2019), Laor et al. (2018), Seng et al. (2018)
Residential type	Almasi et al. (2019)
	Knowledge items
B1	
B2	Song et al. (2012)
B3	Akhtar et al. (2014), Sivathanu, (2016)
B4	Akhtar et al. (2014), Sivathanu, (2016)
B5	Akhtar et al. (2014)
B6; B7	Ahmad et al. (2015), Chibunna et al. (2013)
B8	Wang et al. (2011)
B9; B10	Babaei et al. (2015), Malik et al. (2015)
B11	Sivathanu, (2016), Stoeva and Alriksson (2017)
B12; B13; 14	Almasi et al. (2019), Tiep et al. (2015)
	Attitude items
C1	Almasi et al. (2019), Stoeva and Alriksson (2017)
C2	Almasi et al. (2019)
C3	Almasi et al. (2019)
C4	Sivathanu (2016), Stoeva and Alriksson (2017)
C5	Tiep et al. (2015)
C6	Almasi et al. (2019)
C7	Stoeva and Alriksson (2017)
	Practices
D1 (D1A-D1G)	Kalana (2010), Malik et al. (2015), Sivathanu (2016), Song et al. (2012), Stoeva and Alriksson (2017), Tiep et al. (2015), Wang et al. (2011)
D2	Akhtar et al. (2014)
D3	Tiep et al. (2011)
D4	Song et al. (2012)
	Sources of information
Television	Ahmad et al. (2015), Almasi et al. (2019), Malik et al. (2015)
Internet	Ahmad et al. (2015), Laor et al. (2018), Malik et al. (2015)
Radio	Ahmad et al. (2015), Almasi et al. (2019), Laor et al. (2018)
Newspaper	Ahmad et al. (2015), Almasi et al. (2019), Laor et al. (2018), Malik et al. (2015)
Friends	Ahmad et al. (2015)
Institution (College and University)	Ahmad et al. (2015)
Family	Ahmad et al. (2015)
Poster	Almasi et al. (2019), Laor et al. (2018)
Talks (Discussion)	Malik et al. (2015)
	Satisfactory level
Satisfactory of public on E-waste management	Babaei et al. (2015), Seng et al. (2018), Stoeva and Alriksson (2017)

were significantly linked to the items in the questionnaire. Among all the elements of demographic backgrounds, the level of education reported the most significant p-value <0.05 with most of the KAP items. Pearson's chi-square (p-values) was used to test the demographic background with the KAP items. The results of the analysis show that 12 out of 14 knowledge items, 5 out of 7 attitude items, and 7 out of 10 practice items were reported as being significantly associated at the 0.05 level with the level of education. This study was conducted from 16th July 2018 and lasted approximately 6 months, which included the preparation, distribution, and collection of the questionnaire and the analysis process.

RESULTS

Knowledge of E-waste Recycling

To determine the knowledge of respondents on E-waste recycling, 14 items from the knowledge section were developed in section B, which resulted in 12 items associated with the level of education. The descriptive statistics based on the percentage of respondents for each item were computed and the results are reported in Table 3.

The data in Table 3, shows that knowledge varies according to the differences in the level of education between respondents. The respondents with a high educational background recorded the highest percentage of responses that agreed with most items asked in Section B, compared to the respondents with a lower educational background (high school, primary school, and no educational background). For the question on the definition of E-waste, 82.4% of respondents with a high educational background agreed that E-waste was defined as electrical and electronic equipment that was due to be disposed of since the equipment was no longer used by the

Table 3
Association between the level of education and knowledge on E-waste recycling

Items		Sig* (X^2)
B1	Definition of E-waste	0.000
B2	The content in electrical and electronic equipment such as toxic and hazardous materials	0.000
B3	The effects of E-waste on the environment	0.001
B4	The effects of E-waste on public health	0.003
B5	E-waste generation in Malaysia continues to rise	0.000
B6	Advantages of E-waste recycling	0.000
B7		0.003
B8	Legislation regarding E-waste	0.000
B9	E-waste management	0.000
B10		0.000
B11	Location of the E-waste collection centre	0.216
B12	Method to dispose of E-waste	0.005
B13		0.002
B14		0.358

waste generator. Hence, this electrical and electronic equipment contain toxic and harmful substances (83.6%), which is responsible for the possibility of E-waste posing a risk to the environment (81.2%) and human health (81.2%). Respondents with a high educational background also agreed that E-waste recycling worked as a possible solution to reduce the disastrous impact of E-waste on the environment and human health (88.2%), and would help to reduce the usage of raw materials (82.4%). Furthermore, 83.5% of respondents with high educational background agreed that E-waste could not be disposed of together with domestic waste, and thus, E-waste should be processed at designated premises (87.1%). Respondents with a high educational background also agreed that trade-in services were provided by certain mobile phone and computer manufacturers (69.4%).

Certain items in the questionnaire show a significant difference between the educational backgrounds and knowledge of the increase in E-waste generation and the availability of collection services and facilities. Respondents with a high school education were the group that was reported as having the highest percentage of respondents who agreed that E-waste generation had increased nowadays (70.5%); and that telecommunication companies provided E-waste collection facilities for the public to dispose of their E-waste (41.8%). For item B8 with a significant p-value < .05(.000), 46.9% of the 271 respondents agree with this statement. Out of that 46.9%, 62.4% of respondents with a high level of education knew that E-waste was controlled by a national law under the Environmental Quality Act (Scheduled Wastes) Regulations 2005 First Schedule (Regulations 2) code SW 110, which is administered by the Department of Environment (DOE).

Regarding item B11, 31.7% of the total respondents knew the nearest recycling collection centre for E-waste from their house. Analysis of the data also showed that there was a significant difference between male and female respondents with a significant p-value < .05(.001), regarding their knowledge of the nearest recycling collection centre. Out of that 31.7%, 62.7% (54) of the respondents were male. However, gender is not the most significant factor influencing the KAP on E-waste recycling.

Item B14 reported that 62.4% of the total number of respondents were not aware that rewards would be given if they disposed of their E-waste through the company. There was a notable difference with a significant p-value < .05(.002) between respondents' age and their awareness of the existence of rewards from a distributor or seller of electrical and electronic products if they disposed of their E-waste through the company (57.1%). Respondents aged less than 24 years old tended to have better knowledge regarding this compared to other age levels.

Attitude on E-waste Recycling

Similar to the knowledge (K) section, to determine the attitude of respondents on E-waste recycling, 7 items were developed

in section C. In this section, 5 items are associated with the level of education (p-value < .05). This indicates that the attitudes of respondents differ significantly depending on their level of education. Table 4 shows the results of the chi-square analysis between the level of education among respondents and their attitude on E-waste recycling.

Based on Table 4, the group with a higher educational background was reported as having the highest percentage of respondents that had a good attitude compared to respondents with other levels of education. Respondents with a higher educational background were ready to segregate their waste (89.4%), to take part in an E-waste recycling campaign (88%), to recycle E-waste if the incentive was provided (71.8%) and to send off their E-waste to the nearest authorized E-waste collection centre (85.9%). Respondents with a high school educational background were reported as the biggest group of respondents who would ensure that their electronic devices such as mobile phone and laptop are always the most up to date in terms of style and technology (56.8%). However, this attitude is not a good attitude, as it will increase the amount of E-waste. To reduce the environmental impact, it is strongly suggested that old mobile phones and laptops be traded into the seller when upgrading to new devices. In this attitude section, items C6 and C7 showed no significant links with any of the listed demographic variables.

Practices on E-waste Recycling

Similar to the previous categories (knowledge (K) and attitude (A)), practices (P) on E-waste recycling items are also developed for section D. The results of the descriptive statistics and p-value are given in Table 5. Regarding item D1, the disposal practices of E-waste were all significantly linked to the level of education (p-value < .05) except for item D1E and D1G. The results indicate that respondents with a higher educational background showed the highest percentage. Respondents with a higher educational background reportedly chose the following actions in managing their E-waste; sell (85.9%), trade-in (82.4%), send to the nearest authorized E-waste collection centre (67.1%), send

Table 4
Association between the level of education and attitude on E-waste recycling

Items		Sig* (X^2)
C1	Segregation of waste	0.013
C2	Participation in a recycling campaign	0.000
C3	Incentive towards our participation	0.020
C4	Willingness to manage E-waste	0.000
C5	Upgrading the electrical and electronic gadget	0.000
C6	Willingness to reduce the amount of E-waste	0.189
C7	Willingness to manage the E-waste	0.201

to the scrap collection centre (64.7%) and store their E-waste at home (64.7%). Even though respondents with a higher educational background were reported as the group with the highest percentage in practising the proper disposal of E-waste, not all of the practices were considered an appropriate method of disposing of E-waste. This shows that there is a lot of potential for improvement as far as the method of disposal is concerned. There was a significant difference between the respondents based on their educational background where the p-value < .05(.000) showed that respondents with a higher educational background (88.2%) encouraged their family members to dispose of their E-waste properly. Besides that, the same group of respondents also tended to repair their broken electrical and electronic products (81.2%).

Items D1(E), D1(G), and D4 do not indicate any significance regarding the educational background of the 271 respondents. Items D1(E) and D1(G) do not indicate any significance regarding any element of demographic background, while item D4 indicates a significance regarding the income of the respondents. With the reported p-value < .05(0.029), 53.5% of the 271 respondents agreed that they simply threw away their broken electrical and electronic appliances.

DISCUSSION

A reasonably high proportion (54.6%) of the public in Port Dickson indicated satisfaction with the E-waste management in their area, and (45.4%) were not satisfied. This satisfaction of respondents was significantly linked with the level of education with a p-value < .05(.002) regarding the educational background, respondents with a high school education background were reported as having the highest percentage (63%). This level of satisfaction is important, as it can serve as a reference for the stakeholders to improve the E-waste management on a regular basis.

Respondents in Port Dickson were reported as demonstrating a significant relation between KAP and level of education (p-value < .05). This finding is similar to

Table 5
Association between the level of education and practices on E-waste recycling

Items			Sig* (X^2)
D1	D1A	Ways to dispose of and manage E-waste	0.007
	D1B		0.000
	D1C		0.000
	D1D		0.009
	D1E		0.361
	D1F		0.025
	D1G		0.383
D2	Encouraging family members to dispose of E-waste properly		0.000
D3	Repairing broken electrical and electronic appliances		0.011
D4	Simply throwing out the broken electrical and electronic appliances		0.078

Laor et al. (2018), stated that the level of education affected the KAP on solid waste management in Northern Thailand. This shows that KAP among respondents varies according to their level of education. There are a few studies conducted in Malaysia related to E-waste. For example, Kalana (2010) found that respondents in Shah Alam had a good level of knowledge regarding E-waste, and respondents in Kuala Lumpur also reported similar results (Afroz et al., 2012; Akhtar et al., 2014). However, in both studies, the researchers had identified that practices on E-waste disposal still needed to be improved. Another study conducted in Selangor by Mahat et al. (2019) found that the respondents had a good level of knowledge and attitude regarding E-waste disposal, but posed a medium level of practise.

As was observed from this research, respondents with a higher education level had a higher percentage of KAP on E-waste recycling compared to groups with other education levels. This shows that education is effective in encouraging the public to be a pro-environmentalist, to have a better understanding of their roles in helping the environment, and to promote and increase awareness of their community regarding environmental issues. As the role of the public is key in supporting sustainable waste management, the development of education and practical E-waste management should begin at the earliest stage such as in primary school (Jekria & Daud, 2016; Jereme et al., 2015; Kalana, 2010; Mahat et al., 2016; Sharifah et al., 2018).

Although respondents with a high educational background have a good level of knowledge on E-waste recycling, the public should be equipped with the facts and information related to E-waste recycling. The information can be provided through mass media, social media, and a wide range of sources to ensure that the public is well informed and will be more aware of this issue. The government, NGOs, and any other accountable bodies are responsible for delivering the information to the public.

As stated earlier, knowledge is the facts, descriptions, information, and skills about a topic that can be received through education and experience (Babaei et al., 2015). Attitude is how a person feels and thinks about something (Babaei et al., 2015) thus, it also works either positively or negatively as a psychological emotion on the practices of an individual (Jekria & Daud, 2016). Knowledge can influence a person's attitude and a good level of knowledge will lead to a good level of attitude. Attitude cannot be changed easily, but by increasing the level of knowledge, attitude can eventually be changed (Desa et al., 2011). This shows that a good synchronization of knowledge and attitude will create a good outcome. Compared to respondents with lower educational background, respondents with a high education level are more willing to segregate their waste, to participate in E-waste campaigns, to recycle their E-waste, and ready to send their E-waste to the registered collection centre.

Since there are several suggested methods for disposing of E-waste, the

practices section underlines a few of these to determine how the respondents in Port Dickson disposed of their E-waste. It was reported that respondents with a high educational background tended to sell or trade-in, sent it to the registered collection centre, or to the scrap materials centre, or to keep at home.

Selling, trading-in, and sending E-waste to the registered collection centre are the acceptable methods of disposing of E-waste. However, sending E-waste to the scrap materials centre and keeping E-waste at home are not appropriate methods for disposing of E-waste. This shows that the high level of knowledge and the positive attitude among the respondents with a high educational background do not necessarily lead to good practises, since the correct practices in handling E-waste are still in need of improvement.

Furthermore, respondents with a high educational background were reported as the respondents most likely to repair their broken electrical and electronic equipment compared to respondents with low educational backgrounds. Even though the practises element involves action based on knowledge and attitude (Babaei et al., 2015), it still depends on psychological and social factors (Desa et al., 2011). Practically, this group of the public might have knowledge regarding repairing the broken equipment, but this practice could be dangerous and harmful. Thus, it should not be practised by the public.

With the significant p-value < .05, respondents that have a high educational background tend to encourage their family members to be responsible for managing their E-waste, by recycling devices properly. This group of respondents reported the highest percentage compared to other educational backgrounds. This shows that respondents with good information and knowledge of the facts tend to share this information and encourage their family. The results of the preferred sources of information are shown in Table 6.

Based on Table 6, the preferred source of information regarding E-waste is the television (56.5%), followed by the internet (49.8%) and radio (38.4%). Even in the era of social media and the digital world,

Table 6
Respondents' preferred sources of information regarding E-waste

Sources of information	Frequency	Percentage (%)
Television	153	56.5
Internet	135	49.8
Radio	104	38.4
Newspaper	99	36.5
Friends	90	33.2
Institution (College and University)	86	31.7
Family	85	31.4
Poster	61	22.5
Talks (Discussion)	42	15.5

mass media, for example, television is still relevant as a good medium of information provider to the public. However, regarding posters and talks, both require improvement. Stakeholders, such as the government, and NGOs need to produce more posters related to the disposal of E-waste to reduce the amount of paper used, digital or electronic poster that can be easily shared through social media or any formal platform, can be used. For talks, a regular and on-going approach need to be taken by the responsible bodies to share insights regarding E-waste. This can be concluded at schools focusing on students and teachers, for example.

CONCLUSION

In a conclusion, this research which was conducted among the local community in Port Dickson has reported that level of education is a significant indicator in measuring different levels of knowledge, attitude, and practices of the local community regarding E-waste recycling.

As a mean to reduce the amount of E-waste dumped in the landfill, E-waste recycling activities should be promoted and practised among the public. Since the level of education has become the most relevant factor in this research, the high significance of knowledge in raising awareness among the public regarding the importance of E-waste recycling in creating and maintaining environmental well-being and sustainability are observed throughout this study.

In addition, the public should be provided with information on E-waste recycling that demonstrates the advantages of recycling the E-waste, the proper ways of managing the E-waste, the correct steps for segregating the waste, the registered E-waste collection centre, and the correct process to recycle the E-waste. All the accountable bodies such as the government, with assistance from NGOs, need to play an important role in ensuring the accessibility of the public towards sufficient and correct information. The public also should play a role in ensuring the management of E-waste by starting to recycle such waste.

Advertising the impact of E-waste on the environment and human health would be one of the ways to educate the public in practising a sustainable lifestyle for example, by reducing the number of purchases they make and less updating their devices based on the latest trends. It is also important to highlight how to handle the E-waste properly, not by storing it at home but instead sending it to the nearest E-waste collection centre or using E-waste recycling bins.

ACKNOWLEDGEMENT

The authors would like to thank UMRG - Sustainability (RP027B-18SUS), University of Malaya for providing financial support for this study.

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