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Users Perception towards the Development of E-Waste bin

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Abstract: The rapid growth in the worldwide use of electronic items has made e-waste a critical environmental concern for many nations. Toxic e-waste can pollute the environment and harm humans. This apparatus is a complex construct of thousands of toxic substances, including brominated compounds, poisonous gases, toxic metals, biologically active substances, and plastic additives. Due to the circumstances, the main goal of the study is to create and build an e-waste bin for phones, cables, batteries, power banks, etc. that is safe and good for the environment. The study also aims to determine the usage of the e-waste bin at Politeknik Sultan Salahuddin Abdul Aziz Shah (PSA) in term of four dimensions which are visual design, tutorial approach, applicability, user of satisfaction. This study used ADDIE Instructional Design (Analyse, Design, Build, Implement, and Evaluate) for the development of the product. This quantitative study used questionnaires to obtain data from 150 PSA community members. The majority of respondents found that the e-waste bin's visual elements, aspect of applicability, and aspect of application met or exceeded their expectations. The average item values show that the e-waste bin exceeds the community's expectations for how much joy and satisfaction it brings. Most community in PSA dispose of their e-waste responsibly in the bin. This study should help local authorities, waste collection businesses, and waste electronic organizations develop, locate, and promote small e-waste bin collections.

Keywords: *Users perception, ADDIE Model, E-Waste Bin*

1.0 INTRODUCTION

Waste Electronic Equipment or also popularly referred to as E-waste, is an emerging global environmental issue that is steadily gaining prominence. The use of E-waste disposal is increasing from year to year alongside its global population. The short lifespan of electronics and poor e-waste recycling behavior are the main contributors to the steadily increasing of e-waste generated. The upsurge in E-waste quantities is raising concerns as a trend is expected to propagate for an extensive period due to the swift emergence of new technologies and affordable electronic products (Ferronato & Torretta, 2019).

In addition, the waste overflow issue occurs frequently because of the uncollected waste on time, leading to air pollution; wild insects and animals will consume and collect the overexposed waste, which can include both organic and inorganic waste that can be harmful to the environment and to human health (Ivan, 2021). One of the difficulties in Malaysian trash disposal choices is the issue of garbage sorting. Contamination can be avoided through proper trash sorting, the efficacy of which is determined by individual behaviour and hence can be influenced through training and education (Low et al., 2016). Unregulated E-waste, or electronic waste disposal may be harmful to human and the

environment because e-waste contains toxic substances and heavy metals. In Malaysia, e-waste management is still in its early stages, including the e-waste recycling system (Ahmad Faisal et al., 2014; Kalana, 2010). The main problem relating to e-waste in Malaysia is the poor attitude of Malaysians towards e-waste recycling (Ho et al., 2015; Kalana, 2010). In addition, there are still many flaws in the management and disposal control mechanisms for these appliances, despite the increase in the usage of electrical and electronic appliances, in line with population growth. Hence, this study aims to determine the usage of the e-waste bin at Politeknik Sultan Salahuddin Abdul Aziz Shah (PSA).

2.0 LITERATURE REVIEW

The occurrence in Malaysia mirrors that of other countries. Most studies presented that there is an adequate awareness regarding e-waste among the Malaysian population, but they also appeared to lack knowledge in terms of managing them. Afroz et al. (2012) and Akhtar, Masud, and Afroz (2014) in Kuala Lumpur found that respondents were aware that electrical and electronic appliances may cause environmental difficulties. Kalana (2010) discovered that Shah Alam residents were well-versed in e-waste.

However, most respondents were unaware of proper e-waste disposal procedure. Nur Sumaiyyah, Gautam, and Mohd Badruddin (2015) argued that consumers were oblivious of the proper way in handling e-waste despite local authorities, such as those in Selangor, have commenced separating solid waste on September 1, 2015, in accordance with the Solid Waste and Public Cleansing Management Act 2007 (Act 672) (Department of National Solid Waste Management, 2015). Thus, research on designing and implementing e-waste bins in PSA communities is crucial to solving those concerns and problems in the context of knowledge, attitudes, and practices. The government, non-governmental organizations, authorities, and community can use the concerns and problems studied to build a more sustainable community.

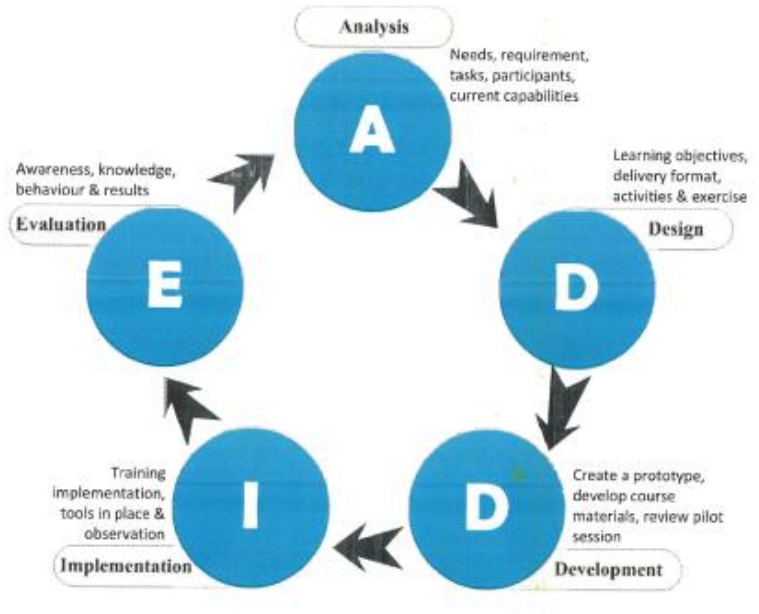
3.0 METHODOLOGY

In this study, the researcher applied two types of research methodology; i) ADDIE model to guide the development of e-Waste Bin; ii) Quantitative research (Level of Usage).

3.1 ADDIE Model

ADDIE is an instructional design model (ISD) that is commonly utilized for training programs among instructors, software developers, and university principals (Yeh & Tseng 2019). Iswati (2019) outlines the model's five stages as follows: analysis, design, development, implementation, and evaluation shown in Figure 1. It recommends making changes after each phase to reduce mistakes and encourage constant development (Quigley, 2019). The first step in building a product is to observe and analyze the product for any room of improvement. During this step, experts are required to list the possible target demographics to be reached with said product. After a thorough discussion, the primary demographic will be the undergraduates, lecturers, and professors who are commonly present on the grounds of PSA daily. Experts are required to analyze the consumer's benefits in utilizing the product. The presence of a bin or a container solely for the purpose of disposing e-waste may aid in the reduction of pollution and allow the general consumers to dispose their old electronic devices or gadgets.

Figure 1 : Process of the application by the Analysis, Design, Development, Implementation, Evaluation (ADDIE) model



This phase clarifies organizational challenges and learning course objectives (Mazhar, 2018). During this time, researchers will be surveying the proper materials to launch a

beneficial product. How can we create a product with better security than other bins to reduce the theft of disposed e-waste? How can we ensure that our target audience keeps the knowledge to properly utilize the product we created? Researchers are also required to evaluate the convenience and efficiency of the product. After a brief discussion with the team, an improved idea of the waste bin has been established.

The next step is the design phase. All objectives and methods to evaluate the progress presented at this stage. This systematic process ensures that all activities are conducted in accordance with a systematic strategy or combination of procedures designed to achieve the project's goals. Researchers requires to select a set of materials before they commence on the design process. During this stage, Course developers will design the program after assessing the scenario. They must consider knowledge-bridging activities, media, order, and course structure (Apostolopoulos, 2018). The researchers may determine the optimal configuration for the product. In the future, everything will be simple and straightforward. Therefore, the researchers decided to implement the concept of a digitally secured e-waste bin. As a precaution against identity theft and to prevent loss, many people are now securely wiping their devices before disposing of them.

In this phase of the development process, the researchers require the involvement of the general consumers and evaluators. At this stage, it's common practice to flag some sections for future attention as errors. This phase implements course design and ideas (Apostolopoulos, 2018). Storyboards help teams construct courses with several components (Quigley, 2019). In addition, an audience analysis in the first phase will determine which specific features require priorities to attract the target demographic. The researchers have a reflector in place to ensure that the product remains crystal clear throughout time, and all members of our division provide full contribution during development. The researchers will successfully handle the cooperation with all possible contributions to the project's success.

The technology will be used in the fourth phase of this deployment to examine the long-term benefits of our product. The assessment plan allows us to select the optimum execution approach. Researchers demonstrate the group's engagement and work across the board, and we appreciate each member's efforts. Before releasing a product to the public, researchers undertake investigations, create, design, and test it to ensure its quality. After careful consideration and planning, the program is either uploaded to a learning management system (LMS) or presented in person. During the implementation phase, researchers can see

and act on input on products, components, and materials. This may become apparent during the implementation phase, when dealing with any issues and implementing any essential new features into the product is critical. After the course has been designed and thoroughly evaluated, it can be implemented for students (Gutierrez, 2018). The researchers also completed every step required to create this electronic garbage container.

The Addie method's final phase is evaluation. Final testing determines what, how, why, and when the project was completed. The assessment stage determines whether the project's goals were attained and what steps are needed to increase its efficiency and success. A big part of the Evaluation stage is analyzing feedback from students and people on the course development team. By accounting their opinions, the course may be improved. More testing of the program may also be conducted to determine if there are any new training requirements or new various methods of lessons (Quigley, 2019). For this study, it is important to determine whether the e-waste disposal issue has been resolved and if the product's goals have been attained. The researcher prepared a survey to evaluate the product rating based on consumer's perception of the e-waste bin in terms of its utility procedure, quality and maintenance. Finally, the assessment and submission results evaluation report will be written accordingly (3.2 Data and Research Technique Analysis).

3.2 Data and Research Technique Analysis

The second objective of this study is to determine the usage of e-waste bin among community at Politeknik Sultan Salahuddin Abdul Aziz Shah (PSA). The quantitative research was used in the study to make the research more accurate and to meet the study aims. The questionnaires are distributed using simple random sampling via google forms and it includes questions about their demographic, general information and the usage dimensions of e-waste bin among community in PSA. These variables were reliable according to their Cronbach alpha values of.700–.800 in the questionnaire survey. Community of Politeknik Sultan salahuddin Abdul aziz Shah makes up the population. Based on total population of 2907 total community the expected samples of 350 respondents are sufficient for good generalization of this study (Krejcie and Morgan, 1970). Out of the 350 questionnaires distributed to the 200 sets were returned. Data cleaning was done for cleaning major outliers and removing cases with many non-responses. After the data cleaning process, only 150 completed questionnaires were used.

All variables are measured using 1 to 5-point Likert scales questionnaires. Questionnaires assess users perception in term of visual design, tutorial approach, applicability, user of satisfaction. All the variables items were adapted from previous related studies (Muslimin,, m. S., Nordin, N.M & Mansor, A.Z. (2017). The concept 'Usage' is not an independent term meaning its formation depends upon several factors related to implementation of the bin. The factors are visual aspects, tutorial appoach, aspect of applicability and user satisfaction. The reliability test was conducted to ensure that each of the scales used was evaluated in order to determine the study's internal consistency. Table 1 shows the Cronbach's alpha for the scales. The numbers imply a high level of trustworthiness. A dependability coefficient of not less than 0.7, according to (Nunnally, 1978) is usually appropriate.

Table 1: Results of the Reliability Test

Dimension		No. of Item	Cronbach Alpha
Visual Aspect	The e-Waste Bin design graphics are appropriate. The color used for e Waste bin are appropriate. The e-Waste Bin contents are well organized. The e-Waste Bin display is user-friendly. The size of e-Waste Bin is appropriate	5	0.913
Tutorial Approach	This e-Waste Bin can more easily explain statistics for research. This e-Waste Bin allows users to gain a better understanding of the awareness of electronic waste. The users are free to use this e-Waste Bin at any time. This e-Waste Bin can save users time when they can direct throw their electronic products rather than find an electronic waste drop of point. The information provided is both interesting and captivating.	5	0.917
Aspect of Applicability	e-Waste Bin uses the right terms and concepts. e-Waste Bin content concepts are illustrated with a realistic manner. The language used to describe e-Waste Bin is appropriate for users. e-Waste Bin content is fit for the research audience. e-Waste Bin works well, and it is easy to use.	5	0.937
User Satisfaction	I am very satisfied with using this e-waste Bin. I would like to recommend this e-Waste Bin to my friend.		

	This e-Waste Bin is very well meeting my needs. This e-Waste Bin is very valuable. This e-Waste Bin is very useful.	5	0.940

4.0 DATA ANALYSIS AND FINDINGS

The results of the survey were examined through SPSS (Statistical Package for the Social Sciences). To ensure accurate coding and entry, data were cleaned and evaluated for frequency. Statistics used to describe a dataset, such as mean, percentage, and frequency.

4.1 Demographic Profiles

Table 2 displays the profiles of repondents for this study.

Table 2: Demographic Profiles of the Respondents

Demographic Profiles	Frequency	Percentage (%)
Age		
18 - 23 years old	98	65.0
24 - 29 years old	18	12.0
30 - 35 years old	4	3.0
36 - 41 years old	3	2.0
42 - 47 years old	11	7.0
Above 47 years old	16	11.0
Gender		
Male	56	37.0
Female	94	63.0
Race		
Malay	117	78.0
Indian	29	19.0
Chinese	3	2.0
Other	1	1.0
Occupation		
Student	112	75.0
Lecture	15	10.0
Staff	23	15.0

Table 1 indicates research respondents. Seven age groups. 98 respondents (65%) are 18–23. 18 (12%) 24-29-year-olds followed. The 30–35-year-olds had 4 (3) responses, and the 36–41-year-olds had 3 (2%) responses. 42–47 had 11 (7%), 54+ had 9 (6%), and 48–43 had 7 (5%). The number of responses shows a considerable gender discrepancy, with 56 (37%) male

respondents and 94 (63%) female respondents. There are a total of 150 replies. According to their work, 112 (75%) of the respondents are students. This is followed by staff, which got responses from 23 people (15%). The next thing is a talk, to which 15 people (10%) have responded.

4.2 Descriptive Analysis

Descriptive statistics were also produced for each item and dimension. As stated in Table 3 by Malhotra(2004), the three levels of categories can be broken down into the following tiers according to the mean.

Table 2: Means Valuation Table.

Valuation Table	Mean
High	3.5 - 5.0
Average	2.5 - 3.4
Low	1.0-2.4

Table 4 displays the descriptive statistic for the usage of ewaste bin in term of visual aspect, tutorial approach, aspects of applicability and users satisfaction.

Table 4: Descriptive Statistic for Each Dimension

DIMENSION	ITEMS	MEAN	SD	LEVEL
Visual Aspect	The e-Waste Bin design graphics are appropriate.	4.60	.624	High
	The color use for e Waste bin is appropriate.	4.71	.562	High
	The e-Waste Bin display is user-friendly.	4.63	.618	High
	The e-Waste Bin contents are well organized.	4.70	.565	High
	The size of e-Waste Bin is appropriate	4.60	.714	High
Tutorial Approach	This e-Waste Bin can more easily explain statistics for research.	4.51	.84	High
	This e-Waste Bin allows users to gain a better understanding of the awareness of electronic waste.	4.69	.555	High
	The users are free to use this e-Waste Bin at any time.	4.69	.590	High

	This e-Waste Bin can save users time when they can direct throw their electronic products rather than find an electronic waste drop of point.	4.75	.533	High
	The information provided is both interesting and captivating.	4.66	.589	High
Aspect of Applicability	e-Waste Bin uses the right terms and concepts.	4.63	.586	High
	e-Waste Bin content concepts are illustrated with a realistic manner	4.65	.555	High
	The language used to describe e-Waste Bin are appropriate for users.	4.65	.636	High
	e-Waste Bin content is fit for the research audience.	4.81	.611	High
	e-Waste Bin works well, and it is easy to use.	4.71	.555	High
User Satisfaction	I am very satisfied with using this e-waste Bin	4.63	.640	High
	I would like to recommend this e-Waste Bin to my friend	4.63	.584	High
	This e-Waste Bin is very well meeting my needs.	4.60	.676	High
	This e-Waste Bin is very valuable.	4.67	.573	High
	This e-Waste Bin is very useful.	4.73	.527	High

5.0 DISCUSSION AND CONCLUSIONS

Table 4 shows all the items for each dimension presents the high mean which are above 4.5. Most of the respondents agreed with the visual aspects, tutorial approach, aspect of applicability and they are satisfied with the usage of e-waste bin. Based on the mean value of each item, the results indicate that the ewaste bin provides extreme joy and self-satisfactory to the community in line with their needs. Community is satisfied as a result of the fact that e-Waste bin has been designed to be extremely valuable and useful for scientific research; the provided information is also accurate. This study is essential to the community in PSA and also Malaysian population. The findings of this study is in line with the study conducted by Afroz et al. (2012) and Akhtar, Masud, and Afroz (2014). These studies demonstrate that the Malaysian population possesses vast knowledge regarding e-waste, but they lack in the aspect of management. The respondents were aware that electrical and electronic appliances had caused environmental difficulties. Kalana (2010) found that Shah Alam residents were well-versed in e-waste.

However, most respondents were unaware of proper e-waste disposal. Nur Sumaiyyah, Gautam, and Mohd Badruddin (2015) argued that consumers were unaware of the proper way to treat e-waste, even though local authorities, such as those in Selangor, have begun separating solid waste on September 1, 2015, in accordance with the Solid Waste and Public Cleansing Management Act 2007 (Act 672) (Department of National Solid Waste Management, 2015). E-Waste bin can reduce greenhouse gas emissions and save the environment. Recycling e-waste will help e-waste collection companies collect valuable materials to be recovered and reused to manufacture new products.

Conclusively, the ewaste bin is currently one of the waste bin that is expanding at a rapid rate across the globe. The production of electronic equipment is one of the main sources of heavy material that is currently known. They may be harmful to the environment without an efficient system in place for their collection, reuse, and recycling. In addition, the e-waste may help to inspire the development of a program to raise awareness about e-waste bin among community in schools, college an higher institutions.

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