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“Optimizing Innovation in Knowledge, Education and Design”

EXTENDED ABSTRACT



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Assalamualaikum warahmatullahi wabarakatuh,



First and foremost, I would like to express my gratitude to the organizing committee of i-Spike 2023 for their tremendous efforts in bringing this online competition a reality. I must extend my congratulations to the committee for successfully delivering on their promise to make i-Spike 2023 a meaningful event for academics worldwide.

The theme for this event, 'Optimizing Innovation in Knowledge, Education, and Design,' is both timely and highly relevant in today's world, especially at the tertiary level. Innovation plays a central role in our daily lives, offering new solutions for products, processes, and services. By adopting a strategic approach to 'Optimizing Innovation in Knowledge, Education, and Design,' we have the potential to enhance support for learners and educators, while also expanding opportunities for learner engagement, interactivity, and access to education.

I am awed by the magnitude and multitude of participants in this competition. I am also confident that all the innovations presented have provided valuable insights into the significance of innovative and advanced teaching materials in promoting sustainable development for the betterment of teaching and learning. Hopefully, this will mark the beginning of a long series of i-Spike events in the future.

It is also my hope that you find i-Spike 2023 to be an excellent platform for learning, sharing, and collaboration. Once again, I want to thank all the committee members of i-Spike 2023 for their hard work in making this event a reality. I would also like to extend my congratulations to all the winners, and I hope that each of you will successfully achieve your intended goals through your participation in this competition.

Professor Dr. Roshima Haji Said
RECTOR
UiTM KEDAH BRANCH



WELCOME MESSAGE (i-SPIKE 2023 CHAIR)



We are looking forward to welcoming you to the 3rd International Exhibition & Symposium on Productivity, Innovation, Knowledge, and Education 2023 (i-SPIKE 2023). Your presence here is a clear, crystal-clear testimony to the importance you place on the research and innovation arena. The theme of this year's Innovation is "*Optimizing Innovation in Knowledge, Education, & Design*". We believe that the presentations by the distinguished innovators will contribute immensely to a deeper understanding of the current issues in relation to the theme.

i-SPIKE 2023 offers a platform for nurturing the next generation of innovators and fostering cutting-edge innovations at the crossroads of collaboration, creativity, and enthusiasm. We enthusiastically welcome junior and young inventors from schools and universities, as well as local and foreign academicians and industry professionals, to showcase their innovative products and engage in knowledge sharing. All submissions have been rigorously evaluated by expert juries comprising professionals from both industry and academia.

On behalf of the conference organisers, I would like to extend our sincere thanks for your participation, and we hope you enjoy the event. A special note of appreciation goes out to all the committee members of i-SPIKE 2023; your dedication and hard work are greatly appreciated.

Dr. Junaida Ismail

Chair

3rd International Exhibition & Symposium Productivity, Innovation, Knowledge, and Education 2023 (i-SPIKE 2023)

E-SMART 2.0: A SUSTAINABLE BIN FOR E-WASTE DISPOSAL

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ABSTRACT

Under Sustainable Development Goal (SDG) 11 on Sustainable Cities and Communities, e-waste is recognised as a global problem. E-waste production has been studied by numerous scholars and statistics show an increasing trend. It was reported that Malaysians as a whole produce over 365,000 tonnes of e-waste each and every year. The manner in which this e-waste was managed and disposed of has been one of the major concerns to the government, authorities managing the environment and the public at large. Based on the issue, we innovate a product known as E-SMART 2.0. This is a portable and sustainable smart bin that will make it easier for the public to dispose of and sort their small e-waste (i.e. unused handphoned, batteries and small electronic devices) in an environmentally responsible manner. This innovative product may be utilised by numerous stakeholders such as government agencies (i.e., schools, universities, and local government buildings), the private sector, or other waste management authorities to educate the general public to be aware of how to dispose of their e-waste in a sustainable manner. Based on the Social Exchange Theory, the idea of E-SMART 2.0 is to reward each item of e-waste with cash, and the purpose of this incentive is to encourage sustainable behaviour. This bin is portable and can be placed in public areas as well as at public events. It is sustainable, safe, informative and friendly to the environment. Subsequently, it has the potential to promote SDG11 which focuses on sustainable cities and communities and other relevant SDG goals. The implementation of E-SMART 2.0 required partnership from various stakeholders, illustrating commitments towards environmental sustainability. In future, the effectiveness of E-SMART 2.0 needs to be explored on how it transformed the general public to become a sustainable society with sustainable behaviour.

Keywords: E-Waste, Sustainable Community, Sustainable environment

INTRODUCTION

E-waste is electronic products that have reached their end-of-life (EOL) or have simply been disposed of by consumers (Rau et al., 2020). This type of waste came in various forms, sizes and categories originating from public consumption and technological advancement. Globally, e-waste becomes a significant concern with an increase in the use of electrical and electronic (E&E) equipment. This will lead to e-waste production as E&E devices have been massively produced due to consumers' demands (Kumar et al., 2017). In 2022, unused computers and laptops constituted 50% of the total e-waste in Malaysia, followed by television (20%) and handphones (16%) (Department of Environment Malaysia, 2022). These statistics indicate the importance to discover the best way to dispose of e-waste in Malaysia that is convenient for the public. If recycled, this e-waste can be sold for a profit. Unfortunately, most e-waste is recycled in the unregulated informal sector (including in Malaysia) which is risky to the consumers (Perkins et al., 2014).

Preliminary research conducted by our group in 2022 indicated that 50% of UiTM students equally have and don't have knowledge of how to dispose of e-waste in a proper way. Nevertheless, more than half of the respondents (66.7%) were aware of the impact of e-waste on the environment (Please refer to Figure 1).

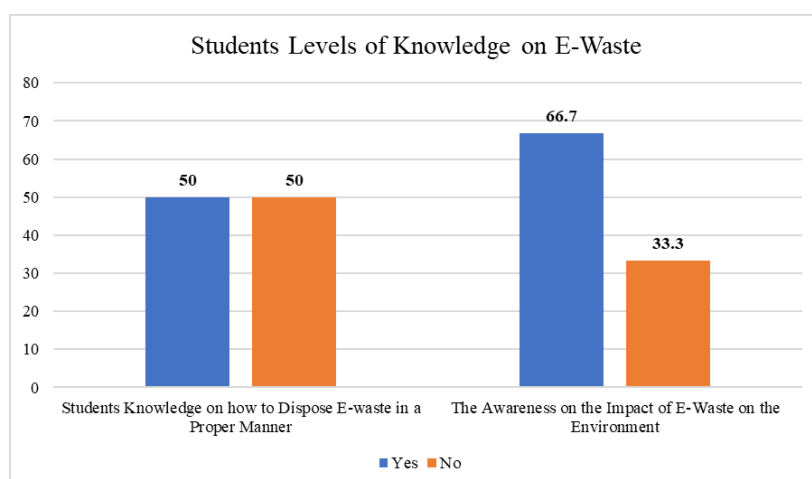


Figure 1. Student's Level of Knowledge on E-Waste

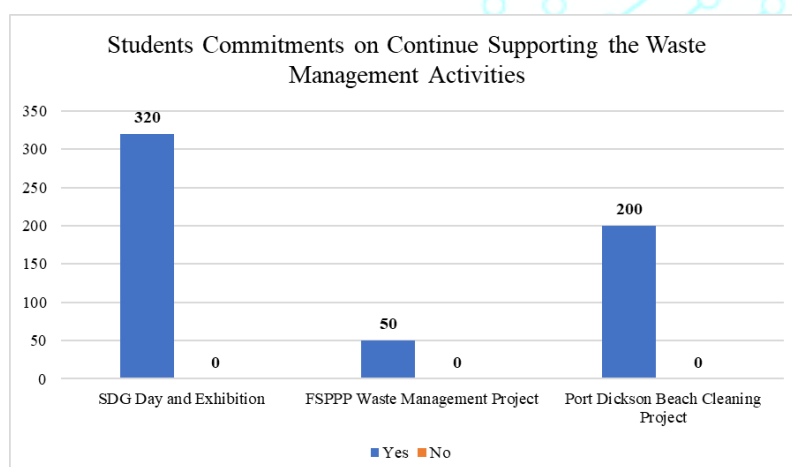


Figure 2. Student's Commitments on Waste Management Activities

From this pilot study, our team has extended our environmental advocacy initiative by conducting SDG Day and Exhibition, FSPPP E-Waste Collection Campaign and Beach Cleaning Programme held in Pantai Cahaya Negeri, Port Dickson collaborating with various government agencies and private sectors (Please watch the news coverage at <https://www.youtube.com/watch?v=CMymBTqLyAU&t=0s>). This is one of our effort in creating awareness of separating the available waste from e-waste at UiTM and community levels. Figure 2 portrays the willingness of the programme respondents to continue supporting waste-management activities.

The overall past findings suggest that UiTM students are committed to waste management activities and ought to be the driving force behind environmental preservation efforts in their institutions and communities in order to cultivate the ideals of sustainable communities. Since e-waste is recognised as a global problem, managing e-waste in Malaysia's context will support SDG 3,6,8,11,12 and 14 progressions (Department of Environment Malaysia, 2022). Therefore, in providing sustainable solutions in e-waste management, we innovate a product known as E-SMART 2.0. This is a portable smart bin that will make it easier for the public to dispose of and sort their e-waste in an environmentally responsible manner. By referring to the Social Exchange Theory, each e-waste item will be rewarded with cash to encourage a transition towards sustainable behaviour.

OBJECTIVES AND THE DESCRIPTION OF THE PRODUCT

Our group has innovated a product named E-SMART 2.0 with the aims; a) to educate the public on managing e-waste in a sustainable way; b) to provide a convenient way of disposing of e-waste that could be easily available throughout public spaces and c) to encourage the public to dispose of e-waste by giving incentives and rewards. This product was named E-SMART 2.0 with the following description (Refer to Table 1).

Table 1. E-SMART 2.0 Description


 <p>E-SMART 2.0 TOWARDS SUSTAINABLE WORLD</p>	<p>E: Represent electronic which refers to waste bins that only receive e-waste. S: Represent size whereby the product size is not too big which is suitable for small e-waste items. M: Represent movable in which the bin is portable and can be stationed in any public space. A: Represent attractive with vibrant colour and SDG Logo. R: Represent reward whereby trade our e-waste with cash. T: Represent traceable in which the bin has a tracking system.</p>
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Table 2. E-SMART 2.0 Prototype and Features


Currently, the E-WASTE 2.0 is still a prototype product. Our group is still in the process of creating the actual E-SMART bin. Table 2 summarised the novelty, functionality, usefulness and practicality of E-SMART 2. Subsequently, the E-SMART 2.0 prototype and its features were illustrated in Table 3.

Table 2. The Novelty, Functionality, Usefulness & Practicality of E-SMART 2.0

Novelty	Functionality, Usefulness & Practicality
<p>ii There is limited facilities or waste bin for the management of e-waste in the general public space. E-SMART 2.0 provide this sustainable solution.</p>	<p>ii Easily accessible in a public area, user-friendly and Eco-friendly (Suitable for placement in schools, universities and local government buildings as a</p>

<ul style="list-style-type: none"> i E-SMART 2.0 is portable, has a practical design, and is appropriate for placement in public places or public spaces. i E-SMART 2.0 offering Education for Sustainable Development (ESD) via interactive information platform i The process of separating e-waste, particularly small items, from other types of waste is simplified and will be rewarded (income generating) for the general public. 	<ul style="list-style-type: none"> i beginning) i Suitable for small e-waste such as unused handphones, batteries and small electronic devices i Income generation to providers and the general public i Provide education and information via interface and screen i The interface is simple and straightforward. i Convenient for all categories of users
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Table 3: E-SMART 2.0 Prototype and Features



The followings are the features of the E-SMART 2.0 bin. It was equipped with an attractive interface on the display screen:

- Price rate** – The price rate of every electronic item will be listed and displayed. In deciding on the price rate, our group has collaborated with SW Corp Negeri Sembilan as our partner in the waste management campaign at FSPPP Seremban Campus which will be led by our group throughout 2023.
- Advertisement** – Environmental advertisements will be displayed to educate the public. This advertisement area is also open to any businesses to promote their green product and services.
- Fun Facts** – It gives facts about the advantages of recycling and e-waste disposal.

AWARDS, RECOGNITION, PUBLICATION & INTELLECTUAL PROPERTY







Figure 3. Awards, Recognition and Intellectual Property Obtained by E-SMART 2.

In 2022, E-SMART 2.0 received a bronze award at the Invention Innovation & Design Exposition (IINDEX 2022), organised by the Universiti Teknologi MARA (UiTM) and the gold medal in the Student Invention & Innovation Competition (SIITC 2022), organised by the Faculty of Administrative Science and Policy Studies. E-SMART 2.0 also received intellectual property recognition from the Business Innovation & Technology Commercialisation Centre (BITCOM) UiTM on 2nd November 2022 under the “copyright” categories (Please refer to Figure 3). Prior to this innovation, one of our members has also published a review of literature on youth and the sustainability trend (Read: Mohd Yusof & Ariffin, 2021)

CONCLUSION

Since more people are now concerned about how to recycle e-waste in a standardised and secure way, the E-SMART 2.0 bin will offer the public a sustainable solution to dispose of e-waste. Various categories of the community, especially the young people will be more likely interested in this mechanism as they will receive incentives for their sustainable behaviour. However, the E-SMART 2.0 implementation required commitments from various agencies (i.e. universities and local government), while investment in this eco-friendly innovation is welcome from waste management corporations, government organisations, and private businesses. This will interpret the sustainability (and SDG) vision into a reality.

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