

Food Waste Awareness and Responses at the Primary School Level

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Food waste is a major component of waste generated in Malaysia. Daily generation of food waste at school is depending on the number of students. In Malaysia, some schools have more than 1000 students. In average, Malaysians waste a total of 17,007 tons of food waste per day. Therefore, it is important to educate and create awareness at the young age about food waste. This paper highlights the awareness and responses of primary school children towards food waste generated in their school. The objective of this study is to transfer and disseminate knowledge on food waste to the school community. This study is part of the food waste campaign conducted at the school from March to October 2023. In this campaign, a series of activities were implemented, including talks, hands-on sessions, audits, composting and innovation related to food waste. Students selected for this campaign range in age from 10 to 12 years old. Based on observations and results from a questionnaire survey, it can be concluded that the children showed high level of awareness regarding the impacts of food waste on the personal, social and environmental aspects. In conclusion, this campaign and awareness program is successful and should be continued in the future as part of the sustainable solution for food waste management at primary school level.

Keywords: Environment; Food waste; Primary school; SDG

I. INTRODUCTION

It is estimated that around 30% to 40% of Malaysia's waste composition is food waste (SWCorp, 2021). In average, Malaysians waste a total of 17,007 tons of food waste per day. Managing food waste is a big challenge in Malaysian environment, and it has now become one of the priority areas of the government (DOSM, 2022). Food wastes will end at the landfill. Rotten food at the landfill produces methane, which is a greenhouse gas even more potent than carbon dioxide. About 6% to 8% of all human-caused greenhouse gas emissions could be reduced if we stop wasting food.

Food waste is a serious issue since it jeopardises sustainability and the environment. Scholars classify food waste according to the phases of waste production, including pre- and post-consumer food waste (Prescott *et al.*, 2019). Waste happens at two levels: production level waste and consumer level trash. Food waste is not only a major issue in

the hotel and tourism sector (Okumus *et al.*, 2020), but also school cafeterias (Smith & Cunningham-Sabo, 2014; Adams *et al.*, 2016).

Food waste generation at consumer level is inevitably related to human behaviour. Kamaruddin *et al.* (2019) found there is poor public awareness and low civic consciousness of environmental preservation and protection due to a poor understanding of and education on environmental issues. One of the approaches to modifying human behaviour is by instilling the correct values at an early age through education. Rohana *et al.* (2013) revealed that exposure to environmental education activities, whether in the classroom or outside of the classroom, affects the level of knowledge and awareness of students towards the environment. However, effective environmental education relies more on the teachers, but the cooperation of the school, parents, and community (Abdullah *et al.*, 2013).

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Environmental education includes knowledge, comprehension, environmental awareness, and learning about the environment that involves human interaction with the environment. It has been part of the Malaysian national education curriculum since the 1980s (Malaysian Ministry of Education, 1998). However, the emphasis of environmental education was more on the secondary school level. Furthermore, it is not taught as a single subject but is implemented through a range of subjects such as Geography, Morals, Education, Life Skills and Science (Muhd Ibrahim, Durairaj & Marlizah, 2016).

Other than formal education, many campaigns related to food waste reduction have been conducted through social media and mass media by government agencies, non-governmental organisations (NGOs), private companies, and institutions. Many initiatives were conducted by SWCorp and local authorities for public education and awareness. In this project, the collaboration with the university and school community is highlighted. These campaigns aim to increase public awareness of the issue and how it is related to Sustainable Development Goals (SDG) No. 12: Responsible Consumption and Production. However, the effectiveness of these campaigns is often not clear due to the lack of methodical measurement.

The school food environment varies internationally, with countries including Australia, Canada, New Zealand, and South Africa providing food and beverages for purchase via canteens or tuck shops, and others including the United Kingdom (UK), and the United States (US) providing meals via school lunch programs (L'Abbe *et al.*, 2013; Yoong *et al.*, 2015). In Japan, the schools provide lunches to all children, except those who require special meal requirements that cannot be fulfilled by the school under the School Lunch Program (Horikawa *et al.*, 2023). Meanwhile, the schools in Malaysia provide food and beverages for purchase via canteens.

The majority of food waste studies conducted in educational settings focused on the use of food waste as a proxy for nutritional loss. There is a lack of academic research on the effectiveness of food waste campaign on the awareness level and the responses of the school children pertaining to the impacts of food waste on their personal, social and environment aspects.

In light of the above issues, a university community outreach programme is designed to transfer and disseminate knowledge on food waste to the school community as part of the social responsibility. A specific campaign module was created targeting a group of primary school children. Since primary school children in Malaysia have limited time for extracurricular activities, the campaign is designed to be conducted in stages to ensure that these children could get the maximum benefit from it. The effectiveness of the campaign is then evaluated based on the awareness level and responses from children using a survey.

II. MATERIALS AND METHOD

The present study is conducted in a Malaysian public primary school, which has selected “sustainability” as the priority area of the school. This echoes the 2030 Agenda, which confers to education a strategic value to address the challenges that we face as a society through its SDG 4 (Quality Education) and SDG 17 (Partnership for Goals) (UNESCO, 2024). The food waste campaign and the study are expected to help the school community to increase their understanding of the SDG theme and embrace it in the school initiatives.

The school has approximately 2,000 children, which are divided into two learning sessions, the morning and the afternoon session. The daily food waste weight generated in the selected school is in the order of 100–300 kg. In the present study, the food waste campaign focuses only on students in the morning session. A total of 118 students ages between 10 to 12 participated in the study. The students were selected from STEM club and Environmental club students.

The campaign takes into consideration the academic term and learning schedules and is integrated to be part of the student co-curriculum activity. The activities were conducted from March 2023 to October 2023 as summarised in Table 1.

Table 1. Summary of activities from March to October 2023

Month	Period (week)	Activity	Participant
March	4	Introduction to sustainable food waste solution	Teachers
April - May	8	Hands-on EM preparation	Teachers and school children
June - July	8	Improved composting with innovation	Teachers and school children
August - October	12	Zero-waste campaign and food audit	School children

However, the conventional composting method takes one to three months for the food waste to be degraded. On the other hand, an improved composting method takes less than one month for the biodegradation process to be completed.

The hands-on training session from April to May was conducted for the purpose of knowledge transfer about the preparation of effective microorganisms (EM), an eco-friendly approach for the acceleration of composting processes. During the training session, all materials were prepared for the teachers to produce the EM themselves in the laboratory following the procedure. The hands-on training on EM preparation increased the teachers' understanding of the process and allow them to do it in practical way.

From June to July 2023, a composting workshop was conducted for parents and students together with the teachers on the conventional composting method and an improved composting method. The improved method used a fabricated drying machine for food waste. All the food waste was dried at 80–90°C for 3- 5 hours, depending on the waste conditions. After a cooling period at 56°C, the dried food wastes were mixed with EM. The mixture was then stored at room temperature for composting to take place under an aerobic process. Therefore, enough oxygen and good mixing are necessary for the EM to degrade all the food waste because EM is a group of effective microbes that live and survive in aerobic conditions.

In addition, innovation and digitalisation were introduced in the campaign. The children learned to use a sensor developed for measuring the moisture content and pH of the composted material and implemented it throughout the campaign period. There were five groups of students, and each group was provided with a kit for testing the quality of the composted materials.

During the campaign period, food wastes from food preparation and processing were separated into organic and non-organic wastes. Non-organic wastes that contain plastic were recycled; organic food wastes were collected and composted. The composted material was then used to fertilise the vegetable garden in the school.

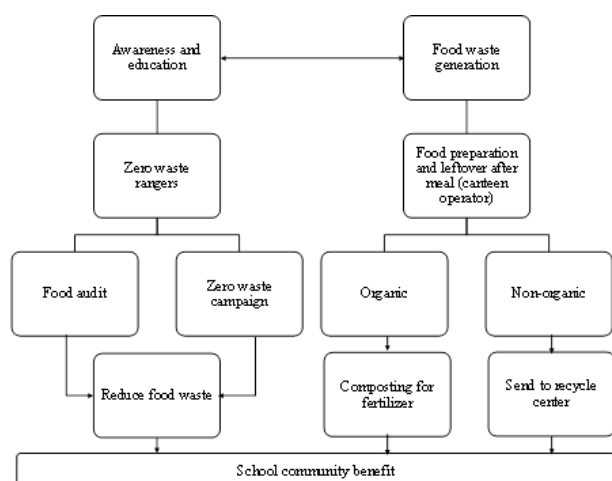


Figure 1. Sustainable food waste solution in school

The activities began with the training for the school teachers in March 2023. The teachers were taught about food waste generation through disposal methods and the impact of food waste on personal, social, and environmental aspects. The training provided insight on how the school community could help find a sustainable solution through initiatives in food waste reduction and composting as illustrated in Figure 1.

A. Food Waste Composting

Composting was chosen in this campaign to reduce food waste because it significantly reduces the amount of waste in landfills and can reduce the treatment costs and carbon emissions (Ashrap & Cathey, 2019). Composting converts food waste into nutrient-rich compost. Composted materials improve soil health, enhance water retention, provide essential nutrients to plants, and reduce the need for chemical fertilisers. It also provides a local resource for gardening (EPA, 2020; WEF, 2023).

B. Food Waste Reduction

While composting turns food waste into a beneficial resource instead of sending it to a landfill, it does not address food, the fundamental issue of food waste generation. Hence, another approach introduced in the campaign targets food waste reduction in the school. A food-saving zero-waste campaign was conducted to avoid food waste generation in the form of leftovers.

Starting in August 2023, the students were educated to participate in a food audit system. They were provided with a small calendar where they ticked if they could finish their food and had no leftovers on the day. The children were awarded a small gift as motivation for them to support the zero-waste campaign. In addition, 20 students were appointed as zero-waste rangers to help with the monitoring process. Zero-waste rangers help to tick the calendar and advise other students to finish the food.

C. Survey on Campaign Effectiveness

To evaluate the effectiveness of the campaign, this study used a quantitative method. A set of questionnaires adapted from Yen *et al.* (2022) was developed and distributed to the school children to evaluate their level of awareness and their responses in October, at the end of the campaign.

The questionnaire was divided into three categories: personal, social, and environmental impacts of food waste as summarised in Table 2. Data analysis was conducted using a Microsoft Excel spreadsheet. The personal category in the questionnaire assessed the children's behaviour towards food and the food waste they produced. The social category assessed the children's emotions and feelings towards food and food waste. The environment category assessed their awareness on the impact of food waste to the environment and health.

Table 2. Summary of questionnaire

Category	Items
Personal Impact	Buy food in the school cafeteria Bring your own food for lunch Take too much food during lunch Consumed all food and no leftover Afraid of becoming fat because eating too much food during lunch Eating too much lunch makes you sleepy Feeling guilty for not finishing food during lunch Separate food waste from plastic waste Know and be aware that wasting food is a bad habit
Social Impact	Feeling angry if other students take too much food during lunch may not be enough for other students Feeling angry if other students take too much food during lunch and do not finish it Feeling annoyed at a student who takes too much food Mocking students who do not spend the food they take because of too much Knowing there are other people who have no food and will get sick because there is no food You like the way other student wasting food Your parents teach you not to waste food
Environmental Impact	You are aware that food waste will have negative impact on the environment You know, unmanaged food wastes can bring disease to humans You are separating food waste with plastic You feel comfortable and happy to recycle the food waste You think recycling food waste can reduce the impact on the environment and humans You think food waste is good for our earth Campaign related to food waste are being carried out in your schools Campaign related to food waste in schools are interesting

III. RESULT AND DISCUSSION

All the teachers and students participated in the respective stages of the campaign enthusiastically throughout the 8 months period.

A. Food Waste Composting

Using the improved method introduced, the school is able to produce the compost effectively in less than a month. The children maintained regular monitoring of the composting process using the innovation. The total compost produced in the campaign is estimated to be about 100 kg. The composted material was then used to fertilise the vegetable garden in the school.

The school community then participated in a competition for sustainable schools. The school was invited to showcase their initiative in Education for Sustainable Development (ESD) to delegates from 24 nations under UNESCO auspices.

B. Food Waste Reduction

During the food audit period, most of the students happily participated and achieved full ticks on their calendars for the food audit and received a reward for motivation. For the highest ticks collected in the calendar, they received a special gift. And for all participants, they received a small gift of appreciation. Observations were made of the leftover food generated in the bin. The quantity of food waste was significantly reduced during the campaign from 3 bins to only 1 bin every day. The Zero-waste rangers and teachers monitored this situation.

C. Survey Results

Figure 2 shows the awareness and responses of the school children to the personal impact of food waste. Based on the survey findings, about 88% of the children purchase their lunches from the school cafeteria or canteen, another 12% probably did not purchase anything. About 33% of the children bring food from home, and they may also purchase food from the cafeteria. Note that children from low-income families are given free lunch at the school.

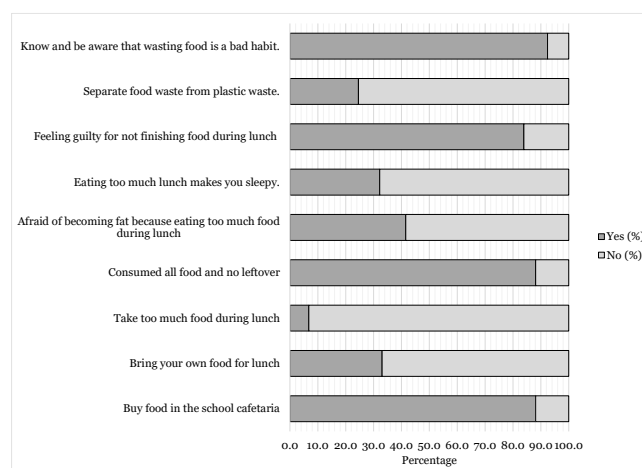


Figure 2. Personal impact of food waste

The survey shows that over 90% of the children finished their food and they feel bad if they do not. This shows that the children exhibit a strong understanding of the negative habit of wasting food. However, the kids would rather not eat too much in order to prevent falling asleep in class. Only 25% of the children engage in separating plastic garbage from food waste.

Figure 3 shows the awareness and responses of school children on the social impact of food waste. In the social impact analysis, the children showed anger toward those who took too much food during lunch. They have concerns that the food may not be enough for others. The children also feel angry and annoyed at those who took too much food and could not finish it. However, they showed a low tendency to mock them. The children are concerned about many other children in the world who suffer because of lack of food. Therefore, they dislike the attitude of wasting food. Most parents play an important role in instilling the value at home.

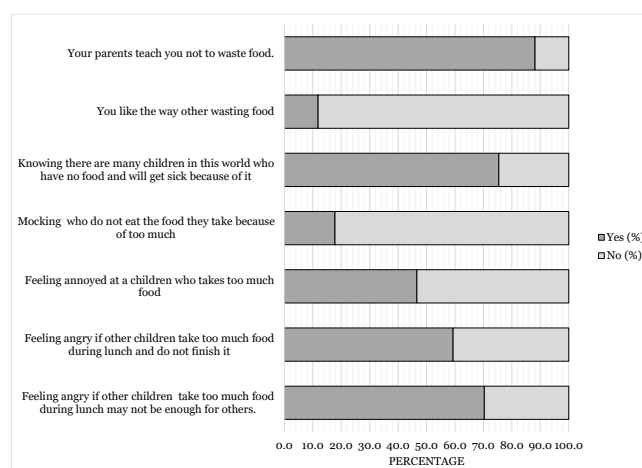


Figure 3. Social impact of food waste

Figure 4 shows the awareness and responses of the school children on the environmental impact of food waste. The responses on environment impact of food waste show the students are aware that food waste is not good for the earth and that food waste recycling will help to reduce its negative impact on the environment and humans. There are 65% of the children who tried to separate food waste from plastic waste; 67% of the children know and are aware that the mismanagement of food waste can cause disease in human. The majority of the children are happy with the activities throughout the campaign and agreed that it is beneficial and provides new insight to them.

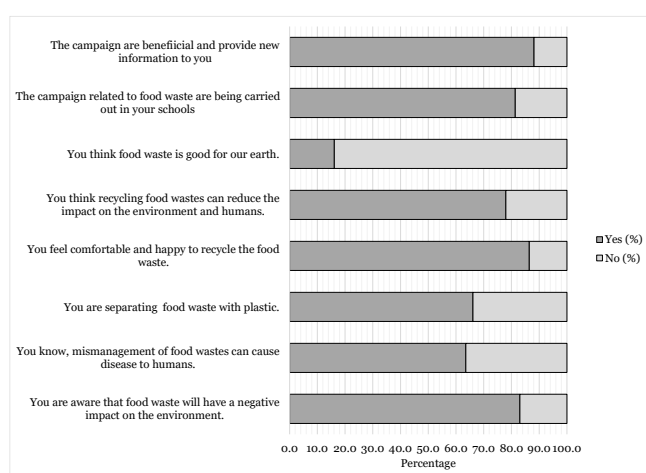


Figure 4. Environmental impact of food waste

D. Students' Feedback

In the survey, the students are also given the opportunity to provide their opinions. The following are some of the comments received:

- i. Everyone should take only the amount of food they need.
- ii. Everyone should avoid wasting food.
- iii. The leftover or wasted food should be separated and recycled.
- iv. Everyone should finish eating all their food.
- v. The school should frequently conduct awareness programs.

IV. CONCLUSIONS

The evaluation of a primary school food waste campaign revealed a high level of awareness and positive response among children regarding the impacts of food waste on personal, social, and environmental aspects. The campaign effectively educated and empowered students to address food waste issues through engaging activities, including talks, hands-on sessions, composting programs, and innovation. The students are able to apply the improved composting method using EM to produce fertiliser that is then used in the school garden. Food waste generation has also been reduced considerably by one-third on a daily basis. Collaboration among schools, teachers, parents, and external stakeholders was crucial in fostering environmental education and promoting responsible consumption practices.

Despite the campaign's success in prompting favourable changes in student behaviour, ongoing awareness programs are needed to maintain progress and reinforce the message of waste reduction. The children's support for initiatives like the segregation and re-utilisation of food waste demonstrates their eagerness to adopt sustainable practices and promote environmental responsibility, highlighting the potential of young learners to drive positive change in their communities.

V. FUTURE WORKS

Future research on food waste awareness campaigns in primary schools could explore ways to improve effectiveness and sustainability. This could be achieved through long-term studies that track behavioural change over time, using mixed

methods approaches that combine surveys and qualitative interviews. Additionally, involving stakeholders in participatory action and promoting interdisciplinary collaboration could also contribute to the success of these campaigns.

The objectives of the study would involve evaluating the enduring effects on behaviour, examining the influence of teacher training and interdisciplinary collaboration, and researching the wider societal and environmental consequences. By embracing this methodology, researchers can acquire an in-depth understanding of the long-lasting nature of behaviour modification, pinpoint the underlying factors that contribute to its efficacy, and create customised

interventions that are culturally appropriate and specific to the given context. This cooperative and multidisciplinary approach can be a guide for creation and execution of more efficient food waste education programs in elementary schools, ultimately promoting sustainable behaviour modification and environmental responsibility among students.

VI. ACKNOWLEDGEMENT

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