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Environmental Awareness and Education: A Key Approach to Solid Waste Management (SWM) – A Case Study of a University in Malaysia

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1. Introduction

Solid waste is defined as generation of undesirable substances which is left after they are used once [1]. Solid waste can also be defined as the useless and unwanted products in the solid state derived from the activities of and discarded by society. It can be classified into three groups: 1) any materials if they are recycled or accumulated, stored, or treated before recycling, 2) being used in a manner constituting disposal, burned for energy recovery, reclaimed, and accumulated speculatively, and 3) a discarded material that is abandoned, recycled, and inherently waste-like.

Actually, waste can be considered as nothing but useful material at wrong place. There is no material in this world, which is not useful in one-way or the other. Also there is no material, which is created out of nothing. It is man's ignorance that he considers certain things as waste and other thing as useful. Just as types of wastes are changing, so must the attitude of people towards waste must change. People must realize that the solution lies in using waste as a resource rather than to be destroyed. Only due to hazardous to human health, some of these undesirable substances cannot be directly reused.

In relating to change in habits, behaviour and participation, 'what people think about waste' [2] is a significantly important aspect of solid waste management [3]. Studies revealed that 89% of participants considered recycling as an acceptable method for disposing of their waste and 57% agreed with the idea of waste collection being charged per bin or per bag to encourage recycling. Only 34% recycled some waste weekly and 9% recycled four times a year or less [2]. The study further discovered that for those who had children aged 5-14 years old, most information about solid waste management received at school influenced their household. This indicates that school campaigns and focused on recycling can increase

awareness and attitudes toward solid waste management among children and their parents. Of relevance on this issue, most of participants agreed that people had a duty to recycle (80%) whilst 60% suggested to avoid buying any goods with too much packaging [4]. Reports on solid waste management recommended that recycling habit needs to be established in relation to sustainability solid waste [5].

2. Background information about Malaysia

Malaysia is located on the South East Asia and there are two distinct parts to this country being Peninsular Malaysia to the west and East Malaysia to the east. The total land area of Malaysia is 329,847 square km (127,350 sq mi) [6]. The Peninsular Malaysia makes up 132,090 square km (51,000 sq mi), or 39.7%, while East Malaysia covers 198,847 square km (76,780 sq mi), or 60.3% of the total land of the country. From the total land area, 1,200 square km (460 sq mi) or 0.37% is made up of water such as lakes, rivers, or other internal waters. Malaysia has a total coastline of 4,675 km (2,905 mi), the two distinct parts of Malaysia, separated from each other by the South China Sea, share a largely similar landscape in that both West (Peninsula) and East Malaysia feature coastal plains rising to hills and mountains. The coastal plains bordering the straits of Malacca are the most densely populated areas of Malaysia, and contains Malaysia's capital, Kuala Lumpur.

In 1992 the World Bank has identified that solid waste is one of the three major environmental problems faced by most municipalities in Malaysia. The amount of solid waste generated went up from 17,000 tons per day in 2002 to 19,100 tons in 2005, an average of 0.8 kilogram per capita per day. Currently, over 23,000 ton of waste is produced each day in Malaysia. However, this amount is expected to rise to 30,000 ton by the year 2020. In the state of Selangor alone, waste generated in 1997 was over 3000t/day and the amount of waste is expected to rise up to 5700t/day in the year 2017 [7].

The amount of waste generated continues to increase due to growing population and increasing development. Modern lifestyle has led to more acute waste problems, convenience products generally require more packaging, careless habits associated with greater affluence lead to greater quantities of waste, as demonstrated by discarded wrappers from the inevitable fast food outlet, and the modern day waste contains a higher proportion of non-degradable materials such as plastics. The waste consists of 45% food waste, 24% plastic, 7% paper and 6% iron. Approximately 95-97% of waste collected is taken to landfill for disposals. The remaining waste is sent to small incineration plants, diverted to recyclers/re-processors or is dumped illegally. However, an alarming 19% of waste ends up in drains, which then causes flash floods and drainage blockage. Today only 5 % of the waste is being recycled, but the government aims to have 22% of the waste recycled by 2020 [8].

Despite the massive amount and complexity of waste produced, the standards of waste management in Malaysia are still poor. These include outdated and poor documentation of waste generation rates and its composition, inefficient storage and collection systems,

disposal of municipal wastes with toxic and hazardous waste, indiscriminate disposal or dumping of wastes and inefficient utilization of disposal site space. Litter at the roadside, drains clogged up with rubbish and rivers filled with filthy garbage definitely indicate that solid waste is a major environmental problem in Malaysia [9].

This situation has been and will be reducing our environmental capacity to sustain life. If the present rate of solid-waste production goes on without effective supervision and disposal methods, there will be a substantial negative impact on the quality of our environment. Furthermore, the lack of awareness and knowledge among Malaysian community about solid waste management (SWM) issues, and being ignorant about the effect that improper SWM has to us has definitely worsened the problem.

However, since 2007 environmental awareness is building up within the Malaysian government as well as in consumers' minds. The government has adopted a National Strategic Plan for Solid Waste Management with emphasis on the upgrading of unsanitary landfills as well as the construction of new sanitary landfills and transfer stations with integrated material recovery facilities. A new Solid Waste Management Bill was adopted by parliament in June 2007. The bill is to drastically change the structure of solid waste management in Malaysia and to open up for the development of a completely new business sector. New concessions on domestic waste management will be introduced, as well as recycling, and handling of specific types of solid waste like plastic, paper etc. is highlighted. Solid waste management is a priority area under the 9th Malaysian Plan, as can be seen by the government setting up a Solid Waste Department which is entrusted to enforce the Solid Waste Management Bill.

3. Awareness and education programme towards SWM

Several universities have successfully implemented a 'greening' university campus [3,10,11]; whereby solid waste management programmes were carefully planned based on key focus and waste characterizations. Paper and paper products represent a huge number component of solid waste due to academic and research activities. It is suggested that paper consumption to be reduced and paper recycling is encouraged [12]. It is also advisable for campus community to use refillable cup to replace a single-use beverage containers [13]. The University of Wisconsin-Madison for instance is the first university that initiated this programme.

Students' awareness about environmental problems and solutions can be increased through education [3]. It is expected that solid waste management activities in university campus involve the students as part of their learning process. The particular skills and knowledge gained from environmental education would help in changing human behaviour towards the environment [14]. Students with some knowledge and skills on environmental education are more motivated to take part in environmental protection activities and plans [15] thus would generate new ideas for the solution of environmental problems. Sharing new informations from their activities with families, other adults, and community probably will have some positive implications on solid waste management practices. Although there are a

number of literatures on solid waste management in term of intergenerational influence and socialization processes, however the practical impacts of environmental education somewhat has been given little attention [3]. Thus, this study is going to fill this research gap.

4. Theoretical framework

Theory of reasoned action (TRA) and theory planned behaviour (TPB) were used in this solid waste management programme as a framework in understanding, explaining and predicting behaviour. These theories are also useful as a guide for designing intervention strategies to maintain or change a particular behaviour. The theory is based on the assumptions that individual behavioural intentions are directly associated with their attitudes. The theory of reasoned action views an individual's intention to perform or not to perform as an immediate determinant of the action. This behavioural intention has two determinants: 1) attitude towards the behaviour, and 2) the subjective norms. The beliefs related on attitude towards the behaviour are called behavioural beliefs whilst normatif beliefs are for the subjective norms [16]. The theory planned behaviour views an individual's determination is influenced by attitude, social support and perceived behavioural control. Thus, it is best to examine human behaviour when participation decisions are voluntary and under an individual control. Therefore, this theory is suitable to predict a student's intent to participate in a specific behaviour in relation to solid waste management [17].

5. Studies regarding solid waste

Before the awareness and education programme can be conducted, two different researches were carried out. The first study was to identify the current waste collection and waste data. Results showed it is estimated that the National University of Malaysia produce an average collection of about 8 ton of solid waste per day [18]. In order to identify the type of waste produce by the university, waste characterization study was conducted. The method used can be referred from the study by Kian-Ghee Tiew, Stefan Kruppa, Noor Ezlin Ahmad Basri and Hassan Basri (2010) [18] of waste characterization research team from Faculty of Engineering and Built Environmental. After sorting, the waste was store in bins which were labeled for different items and later were weighed to determine waste composition. The study has been successful in highlighting the composition and characteristics of the solid waste produced at the university campus. The main components of the waste are organics (43%), plastics (36%) and paper (17%), which is more than 96% of the total solid waste. The average amount of a sample is 108 kg. Striking is the high plastic and organic content and the third most amounts is paper [18].

Most of the waste collected comprises combustible and noncombustible wastes. The combustible waste consists of materials such as paper, cardboard, furniture parts, textiles, rubber, leather, wood, plastic and garden trimmings. Non-combustible waste consists of items such as glass, discarded tins, aluminum cans and food waste. Characteristics of solid

waste can be divided into two: physical and chemical characteristics. The physical characteristics of solid wastes vary widely based on socio-economic, cultural and climatic conditions. The physical qualities of solid waste like bulk density, its moisture content etc., are very important to be considered for the selection of disposal, recycling and other processing methods. Chemical characteristics information of solid wastes such as pH, chemical constituents like carbon content, nitrogen, potassium and micronutrients are important in evaluating processing and recovery options. In addition, the analysis helps in adopting and utilizing proper equipment and techniques for collection and transportation. Identifying both chemical and physical characteristics of solid wastes are important for the selection of proper waste management technology.

Thus both physical and chemical characteristics of the solid waste are important to determine the selection of the final method of waste disposal. Based on this findings the university provide three different bins for the separation at source activities. Each bin is coloured differently, for example green is for organic or biowaste, orange for recyclables and black for residual waste. Before this only one bin is used for all waste.

In the second study, a self-administered questionnaire was used to assess students' awareness, attitudes and perceptions towards the solid waste management. The approach of this research was to analyze problems, create and conduct interventions and then evaluate the effectiveness of interventions. The main tool used in data collection was a structured three part questionnaire specifically designed for this study. The questionnaire covered demographic factors such as year of study and ethnic of the respondent as well as variables related to the respondent's littering attitudes and practices. Examples of statement regarding this variable: 1. I do not care if someone throw litter; 2. I assume waste is not useful and should be thrown away; 3. I do not care if my friends throw rubbish into drains.

Another part of the questionnaire consist of statements regarding the environmental awareness and knowledge of SWM among respondents. Respondents were asked about their knowledge of SWM and programmes conducted by the university in order to create awareness. They were also asked about the source of their information regarding environmental problems.

For the first requirement, simple interactive statistical analysis for size sample calculation was used (Raosoft – sample size calculator) [19] to determine sample size required based on the population size of 5,000 students from the university main campus. Size of sample required at 95% confidence level, a margin of error at 5% was 537. Distribution numbers is estimate for cooperation for questionnaire return at 50%. A much higher number is required to entail sufficient number for survey study. Therefore 600 questionnaires were distributed by convenience sampling.

A total of 589 undergraduate students from eight different faculties at The National University of Malaysia completed the questionnaire forms. There were 458 (77.8%) Malays, 104 (17.7) Chinese, 18 (3.0%) Indians and 9 (1.5%) others. Most of the respondents were first year students (318 = 54%), 180 were second year students, followed by 93 third and fourth year students. Data was analyzed using the Statistical Package for Social Science (SPSS)

computer programme version 10 software. Descriptive statistics such as means and ranges were computed. Test of chi square was performed to determine the relationships between attitude and practices and also between facilities and practices.

Results showed that more than half of the students (64%) had high awareness status concerning SWM. But there was still quite a number of them (36%) which have low awareness status. Only 34.1% of the students showed positive attitude towards SWM whereas another 65.9% showed negative attitude. Regarding perceptions concerning SWM only 40% of the subjects' perception status was positive.

Despite the high status of awareness expressed by 64% of the students concerning SWM, it is not consistent with their attitude and perception. The results of this study showed that more than half of the students (65.9%) have negative attitudes towards SWM. Like wise only 40% showed positive perception concerning SWM. Results from the descriptive analysis were supported by the results of Chi Square which showed that there was no relationship between attitude and practice ($\chi^2=2.452$, $p>0.05$), and also between facilities and practice ($\chi^2=1.618$, $p>0.05$).

Although results indicated that majority of the students showed high status of environmental awareness, however, more than half of the subjects showed negative attitude and perceptions concerning SWM. Behavioural problem: not practicing environmentally responsible behaviour (an inconsistent and highly unbalanced strong "knowing" but weak "doing") because: attitudinal problems, lack of enforcement, lack of monitoring and the students did not understand their roles and responsibilities in environment protection. Hvatum and Kelly (2008) [20] labelled the situation as "you know it, but you don't do it"

Results of this study supports some studies that suggest that there is no relation between education and attitude to the environment [21,22]. Findings of previous studies [23-25] and the findings of Hines, Hugerford and Tomera (1986) [26], also suggest that the level of consistency between environmental attitudes and behaviour is affected by a person's knowledge and awareness, public verbal commitment and his/her sense of responsibility. The transfer from attitudes to behaviour can also be affected by lifestyle; many people, while professing to "correct" attitudes to the environment, are not ready to change their lifestyle in ways that might mean sacrificing certain forms of leisure and comfort for the sake of the environment. Other study has also found a weak and inconsistent relationship between environmental attitudes and behaviour; usually attributable to a reluctance to give up the comforts of modern life [27].

This answers the question as to why in certain circumstances individuals with acquired knowledge act on that knowledge to implement changed waste practices, while in other instances, this acquired knowledge does not lead to change. According to Miller and Morris, (1999:74) [28] "there is a commonly held myth that providing individuals or groups with information will lead them to appropriate personal and organizational actions and performance, but this is far from true." According to Pfeffer and Sutton (2000), while information and knowledge are 'crucial to performance', but knowledge of an issue is often

not sufficient to cause action: "*there is only a loose and imperfect relationship between knowing what to do and the ability to act on that knowledge*" [29]. The inability to transfer knowledge of what needs to be done into action or behaviour which is consistent with that knowledge, is referred as the 'knowing-doing gap' or the 'performance paradox' [29]. While it was believed that the 'knowing-doing gap' was due to a lack of personal knowledge or skills, research conducted suggests that while personal knowledge is important in ensuring action, it is not as important as having management systems and practices in place [29].

6. Education and awareness programmes implemented at the university

We will now share with the readers, programmes launched by the university to create the students' awareness of environmental and waste problems and to educate them how to practice environmentally responsible behaviours. Programmes were also implemented to promote attitude and intention change and actively pursuing sustainable environmental practices among the students. The attempt to encourage, through education and awareness on managing solid waste in the campus that have been implemented will show good and encouraging results as long as the persons and the organization have the ability to assimilate and interpret the knowledge and to convert this learning into impact (to implement change in managing waste). It is hope that knowledge will act as a precursor to action.

Actually, the best way to create awareness and to educate the students, steps had to be taken to include environmental education in the school educational system. This must be the leading approach to address the environmental problems and engendering sustainable development. Knowledge and understanding of the environment are important since a degraded environment means a lower quality of life for all. It is, therefore, the collective responsibility of all human beings to secure a healthy environment not only for present, but also for future generations, so building environmental curricula on this principle becomes a necessity.

The authors hold the view that there is a clear inadequacy in the environmental education paradigm in Malaysian educational curricula as they pertain to solid waste management. For instance, elements of environmental problems was integrated into the subjects of health education, integrated science, agricultural science and geography among others. These approaches are insufficient if environmental protection is to be undertaken sustainably as presently advocated through environmental awareness and educational programming globally.

Environmental education should, therefore, be a fundamental and integral part of education for all members of society. Modern societies, both developed and developing, need environmental education in its formal and informal aspects. Knowledge of the environment, its conservation and threats must be integrated with the development of sensitivity to, and respect for, the natural environment and the formation of proper attitudes towards it. Fundamental education is therefore the kind of education aimed at realizing a sustainable living for mankind as a whole.

The Malaysian curricula need adjustments to allow for the inclusion of standard environmental education and training at the primary, secondary, tertiary, and informal levels. In so doing, the nations and their peoples would prospectively thwart the on-going environmental damage which is a threat to human survival and sustenance both now and in the future due to the lack of proper management of solid waste. Another aspect that is important to highlight because of its practical consequences on environmental education is teacher education. How do we expect a teacher to teach environmental education if he or she has not received the minimal tools to do so?

For example, environmental education nowadays is included in some way in most of the basic education curricula, but teachers are not qualified to teach it. The pedagogical approach and the teacher's interest in environmental issues seem to affect children's learning processes. A major bottleneck of education in general, and environmental education in particular, is teacher training and sensitivity about environmental matters [30].

In the case of the National University of Malaysia, since the students and most of the workers had never been exposed to any proper environmental education before, we develop an environmental and waste awareness and education programme that will help them. The university is committed to protect the environment by developing practices that are safe, sustainable and environmentally friendly and has developed a practical, staged approach to manage waste in an increasingly sustainable fashion. The programme is known as Integrated SWM UKM Campus towards "Zero Waste Campus". This programme has been developed with the aims of: -

- reducing waste produce;
- increasing and maintaining participation in recycling and composting schemes within the university
- raising and maintaining awareness of waste issues;
- promoting the Waste Hierarchy – reduce, reuse, recycle;
- providing a diverse range of ways of increasing education and awareness within the university;
- giving a message that is consistent;
- linking in with regional and national campaigns;

The first step is to identify the target groups which involve the office staffs, students, lecturers, hostel operators, canteen operators, cleaners inside the building, also out door cleaners (cleaning and landscape workers) and security guards. The next step involve information dissemination through waste awareness and education programme given to the target groups by the researchers with the help of staff from *Alam Flora Sdn Bhd* (an agency responsible for SWM in state of Selangor). For each target group, different approach was used to develop waste recycling systems among them.

1. Office staffs

Briefing to office staffs were conducted in stages, whereby the importance of proper SWM, recycling and hands-on guide on how to start recycling programme at the office were given.

2. Lecturers and students

Among the lecturers and students, briefing will also be conducted on a scheduled basis. To create awareness, distribution of leaflets and posters were carried out. Lecturers were encouraged to allocate 5 minutes before the start of lecture to explain on SWM issues. Each faculty needs to organize recycling week and competition on highest volume of recyclables collected among faculty. Recycling facilities were provided at the faculty building to guide and facilitate the students.

3. The hostels

Briefings were also conducted to the hostels operator and we provide enough facilities at strategic locations for separation at source activities. At the end of each semester major spring-cleaning was organized to recover recyclables such as old notes or books.

4. Canteen/cafeteria operators

These operators were explained on how to carry out separation of biowaste and recyclables. They were asked to reduce plastic packaging by encouraging students to bring their own containers to pack their food. This program also introduced composting organic waste to the operators by providing them with composters (Best management practices (BMPS)

for incorporating food residuals into existing yard waste composting operation, 2009) [31] and guide how to start composting by staff of *Alam Flora Sdn Bhd*.

5. Cleaners

Briefing to the cleaners was about separation at source activity. We also discussed the effective modus operandi to do collection and storage of recyclables. The incentives in the form of money were also highlighted.

6. Other related activities

Other related activities conducted were e-waste recycling day, no waste day, flora green message to all staffs and exhibitions and awareness talks regarding the greening of the campus. Souvenirs given such as pens, containers and badges were written with wordings such as "think first before throwing" and the 3R logo. All things associated with this program were green in colour.

However, the more important aspect is the ability of the individuals to assimilate and interpret the information gained from education, building knowledge through a process of learning, which would give them the ability to act. In order to transfer the knowledge into practice or good environmental behaviour the students' perceptions and attitudes have to change. It is hoped that the knowledge gained from the education and awareness programmes given should at least improve the way in which waste is managed within the university.

Since more than 60% of the university's population are students so another seminar was initiated to increase 'awareness of waste'. By attending this short two-hour training course students will be able to:

- Understand what is waste.
- Reduce, re-use, and recycle waste.
- Know about disposal routes for remaining waste.
- Deal with waste safely.
- Know the legal responsibilities for waste.
- Identify the sources of help for those difficult waste questions

We also initiate the formation of the Zero Waste Club whereby the members of the club act as change agent which provide model actions and were responsible to persuade low willingness students to participate in collection and recycling. They used their personal influence to have their friends join the campaigns and activities associated with zero waste activities. We hope that we are in a position to provide strong leadership and example in the development of sustainable communities, by conducting programmes for the students who will be our future leaders.

7. Conclusion

Any environmental programme at a university must be rooted in the belief that the process of paying attention to the environment will have the greatest impact if it becomes an integral part of the educational mission of the institution. The initiative offers a means to connect what happens in the classroom with what is happening immediately outside. Recycling alone will not earn a campus a clean bill of environmental health. Waste reduction and reuse are far more effective ways of reducing environmental impact, and the goal should be a net reduction in the campus waste stream, not simply more recycling. Yet, recycling is among the most visible, measurable, and enforceable of the environmentally sound practices that a campus can undertake. It is also important to make public the commitment to sustainable waste management since universities assume a special societal responsibility, in that they educate the future decision-makers of society. They take on a multiplier function and therefore a significant responsibility. Environmental protection should be the responsibility of all students and employees. The university will only fulfill this task when as many university members as possible identify with the aims of environmental protection and sustainable development, and actively contribute to the implementation of such aims.

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