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A CASE STUDY OF STUDENTS AT THE UNIVERSITI TEKNOLOGI MARA (UITM) SABAH CAMPUS ON SOLID WASTE MANAGEMENT PRACTISE

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Abstract*: The study's objective is to determine the students' level of solid waste management awareness, as well as their level of solid waste management practise in terms of waste segregation, reduction, reuse, and recycling. It is critical to determine the level of solid waste management practise among university students because universities are similar to cities, and any activity in a university can have a direct or indirect impact on the environment, particularly in terms of how they handle their waste. Unfortunately, the majority of existing data and studies on SWM have predominantly concentrated on municipalities. Based on the study overall finding, the study concluded that the students at UiTM Kota Kinabalu are knowledgeable and concerned about solid waste management and these students have a good habit of sorting, reducing, and reusing waste, but they do not recycle enough.*

Keywords*: solid waste management, segregation, reduce, reuse, recycling*

Introduction

Solid waste management (SWM) is a complicated issue with political, socioeconomic, institutional, and environmental dimensions, and it is quickly becoming one of the most pressing issues confronting developing countries as a result of rapid urbanisation. To make matters worse, the gap in environmental knowledge between young and old people in developing countries contributes to environmental issues or waste management issues, resulting in unsustainable development, which has serious consequences in low-income countries (Nowell et al., 2017).

In 2016, the World Bank Group estimated that the global average generation rate of municipal solid waste (MSW) was 0.74 kilogrammes per capita per day, and that total MSW production

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was around 2.01 billion tonnes. In addition, MSW production is expected to grow by 1.5 percent per year, reaching 3.0 billion tonnes by 2030 (Mi, Agamuthu, & Joko, 2020). This demonstrates how quickly waste generation is increasing, and how important it is to manage municipal waste properly. The local government is responsible for managing municipal solid waste management (Abas & Wee, 2014),(Schübeler et al., 1996),(UNEP, 2009). In a developing country like Malaysia, municipal solid waste management is also the responsibility of the local government (MHLG, 2006),(Ping et al., 2008). Since the municipal governments are in charge of solid waste management, they have a critical role in keeping cities clean.

Solid waste management is a discipline concerned with the prevention, control, and management of solid waste generation, storage, collection, transportation, processing, and disposal (Tchobanoglous et al., 1993). The primary goals of solid waste management are to keep the environment clean and sanitary while also reducing the amount of solid waste disposed of in landfills following material and energy recovery (Alkhalidi et al., 2019). However, due to a lack of scientific methods and new approaches, low population coverage, and marginalisation, most solid waste management services are inefficient and weak (Sörme et al., 2019).

Higher education institutions (HEI) must implement Green initiatives to support sustainability goals such as waste reduction, energy efficiency, water conservation, healthy working environments, and clean indoor air (Sonetti et al., 2016). These initiatives have the potential to improve the whole world quality of life while also boosting economic vitality and reducing environmental impact (Mokhtar et al., 2012). Aside from that, higher education institutions are comparable to smaller cities in terms of urban characteristics and population size, so any activities that take place across campuses may have direct or indirect environmental consequences (Alshuwaikhat & Abubakar, 2008).

The rapid development of campus environmental management systems in universities all over the world is also linked to the emergence of the Fourth Industrial Revolution, in which technology plays a critical role. Hence, improving services in a variety of ways has become a high priority for campus stakeholders, whether they are related to the educational process, research, or other areas (Palmer, 1995). The service connected to the state of the campus environment is one of the most essential requests. Today's campus should be able to give a decent environment for learning in the sense of a healthy and comfortable environment. The campus environment plays an important role in the overall management of universities because it is no longer just a place to learn but also a hub for recreational activities such as sports and the arts (Utama et al., 2018).

The implementation of SWM sustainability on the university campus has significant potential for reducing municipal solid waste and serving as an example for the rest of the community (Berchin et al., 2018). Several colleges, including the University of Kansas, Harvard University, Cornell University, the University of Connecticut, and Virginia Tech University (Bahçelioğlu et al., 2020), have accomplished the integration of a sustainable or green campus through solid waste management sustainability strategies. The majority of available data and studies on SWM have primarily focused on local governments, but a little-known study on the evolution of a country's campus waste management practises is worth noting (Alshuwaikhat & Abubakar, 2008),(Zen et al., 2016). As a result, the focus of this paper is on the study of solid waste management practises from a campus perspective. It aimed to achieve the following goals in particular:

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1. To identify the level of solid waste management awareness among students at the UiTM Sabah Campus.
2. To determine the level of solid waste management practises among students at the UiTM Sabah Campus in terms of segregation, reduction, reuse, and recycling.

Literature reviews

Sustainable Solid Waste Management In University

As part of the effort to achieve campus sustainability, effective solid waste management solutions are recognised. The campus is now the focal point for a variety of activities including students, lecturers, employees, and other parties who all contribute to the energy, water, and other resource consumption patterns (Budhiarta et al., 2012). Universities generate a significant amount of municipal solid waste (Saphores et al., 2012) as a result of various activities involving students, lecturers, administrative staff, and other parties. These consumption patterns of energy, water, and other resources have an impact on the environment either directly or indirectly because of various activities involving students, lecturers, administrative staff, and other parties.

Increased air pollution, water pollution, and waste generation, particularly solid waste, are among the consequences, so the university played an important role in environmental preservation (Budhiarta et al., 2012). In fact, solid waste management (SWM) has been identified as a critical component of institutional sustainability in several studies (Awan & Abbasi, 2013), (Tangwanichagapong et al., 2017).

Waste Minimisation

The terms integrated solid waste management (ISWM) and 3R (reduce, reuse, and recycle) have become common among policymakers in the field of solid waste management, but ISMW is frequently confused with conventional municipal solid waste management in many countries (MSWM). ISWM is viewed as an integrated method of managing municipal waste in some countries, with the goal of improving service efficiency and achieving the 3R approach's goals (Paghasian, 2017), (Memon, 2010).The use of 3R initiatives has long been seen as a viable substitute for traditional waste management methods. Numerous studies focus on the advantages of waste minimisation sent to landfills including the factors that influence recycling rates. Despite this, significant gaps in well-educated people's attitudes and actions in response to 3R initiatives, as well as associated MSW stream effects, have remained as roadblocks to campus success (Kelly et al., 2006).

Segregation at source is a solid waste management method that involves separating distinct components present in solid waste at the point of origin in order to encourage resource recycling and re-use while also reducing the volume of garbage that has to be collected and disposed of (Paghasian, 2017). Waste segregation into individual components and collection of each component separately can result in significant systemic changes (Gupta et al., 1998). Beginning September 1, 2015, the Malaysian government has made it mandatory for several states to separate their solid waste at source (Moh & Manaf, 2017).

Reduction aims to reduce waste production by adopting or optimising manufacturers' and industries' production processes, thereby conserving natural resources (Gugssa, 2012). The first solution in the waste management hierarchy is to focus on preventing waste generation by incorporating source reduction strategies into all production processes, a principle known as

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"waste avoidance". Waste prevention is intertwined with enhancing manufacturing techniques and changing manufacturing designs, such as packaging reduction (Samiha, 2013) and persuading users to demand more products with less packaging (Ahmadi, 2017).

Reuse does not imply reprocessing or transforming one type of material into another; rather, it occurs when a material has served its original purpose and has been repurposed instead of being discarded (Gugssa, 2012). Moreover, reuse refers to the use of an item after it has served its original purpose, either for a comparable purpose or for a completely different one. Items can be reused by restoring, reselling, or offering them to charity organizations, which helps to minimise trash. Because the object does not need to be refurbished, reuse is preferable to recycling. Sensible reuse strategies can offer significant social and cultural benefits in addition to environmental considerations (UNEP, 2009). This can be seen in the reuse of bottles (of beverages) or store-bought plastic bags (Williams et al., 2005).

Recycling is the process of repurposing or transforming materials that once served a purpose into new ones (Gugssa, 2012). In developed nations, recycling is just another waste management approach. Inorganic components of MSW (paper, metal, plastic, and glass materials) may be recycled through the recycling process, which involves collection, segregation, and management of waste with commercial value (Williams et al., 2005).

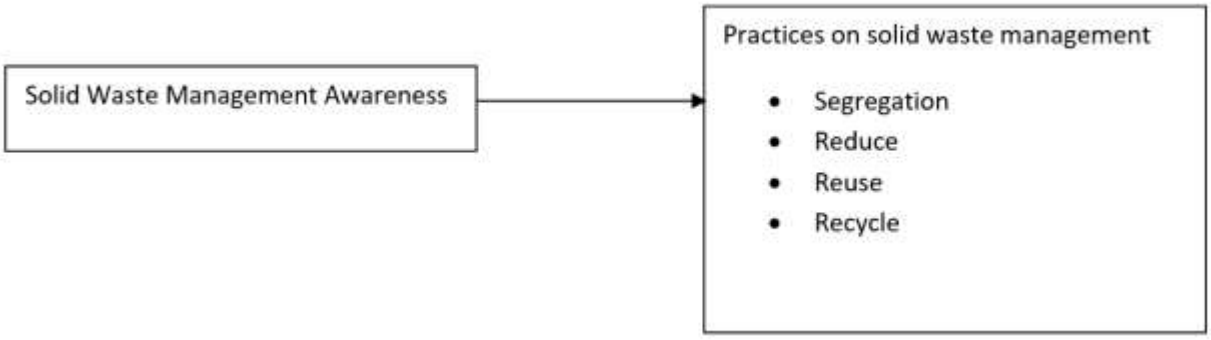

Figure 1: Conceptual Framework

Methodology

A questionnaire is used as a tool to collect primary data. A random sample of 108 students enrolled in the Diploma in Public Administration programme were asked to participate in a survey. The questionnaires are broken down into three sections. Section A inquiries about the respondent's demographic profile. Section B inquiries about student solid waste management awareness, and Section C inquiries about student solid waste management practises. A Likert scale was used to assess student responses in sections B and A. The Statistical Packages for Social Sciences (SPSS) programme was used to analyse the data collected via questionnaires. The questionnaire is adopted from the work of Paghasian (2017), however it was modified to fit with the objectives and context of the study. The questionnaires were analysed using descriptive analysis. The main focus of descriptive statistics was the analysis of frequency percentages, means, maximum, minimum, variance, and standard deviations. In addition, secondary data from existing literature on sustainable solid waste management was used in this study.

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Result and Discussion

The following is the order in which the study's results and discussions of the findings are presented: Students' awareness of solid waste management practises in terms of segregation, reduce, reuse, recycle, and disposal significance of the relationship between students' awareness and solid waste management practises. Table 1 shows the reliability statistic, while table 2 shows the students' level of solid waste management awareness.

Table 1: Reliability statistic

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.886	.890	33

Table 1 shows how Cronbach's alpha was used to test the reliability of solid waste management awareness and practises. The item of solid waste management awareness and practises had a reliability coefficient (alpha) of 0.886, with a N of 33, based on the results obtained. As a result of the Cronbach's alpha measurement being greater than 0.70, the items could be considered reliable.

Table 2: The Awareness in Solid Waste Management of the Students.

	Not Aware	Not to Aware	Aware	Fully Aware	Mean	SD	Var.
1. Policy and Guidelines of SWM	15	21	55	17	2.69	.903	.816
2. Have you aware on any awareness program conducted by local authority/university regarding SWM?	14	21	49	24	2.77	.943	.890
3. Implementation of SWM	11	23	56	18	2.75	.855	.731
4. Importance and benefit of SWM to the environment.	6	9	42	51	3.28	.841	.707
5. Practicing SWM saves money and energy.	6	11	48	43	3.19	.833	.694
6. Purpose of the management of SWM	7	13	47	41	3.13	.866	.749
7. Importance of Waste Minimization like 3R	1	5	45	57	3.46	.633	.400
8. Proper Discipline of SWM	5	16	45	42	3.15	.841	.707
9. Roles of students in SWM	6	14	48	40	3.13	.844	.712
10. Possible illness that you can get whenever trashers are not properly disposed.	1	8	37	62	3.48	.676	.458
11. Importance of recycling		4	37	67	3.58	.566	.320

N = 108

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Table 2 shows the results of the survey on student awareness of solid waste management. As can be seen in the table, item 11, "Importance of Recycling," with a mean score of 3.58, is interpreted as "High." Item 10, "Possible illness that can occur when trashers are not properly disposed of," received a mean score of 3.48 and was interpreted as "High." Meanwhile, the lowest mean score of 2.69 is found for item 1, "Policy and Guidelines of SWM," which is interpreted as "fair."

Table 2.1: Summary on the level of awareness of the students

		N	%
Level of Awaremess of The students on Solid Waste Management in UiTM Kota Kibanabalu	Low	18	12.0
	High	95	88.0
N= 108			

Table 2.1 summarises the results of the assessment of the students' level of awareness of solid waste management. The study's first objective is to identify the level of SWM awareness among students on the UiTM Sabah Campus. It showed that out of 108 students, 88 percent or 95 students have high awareness on solid waste management, 12 % or 18 students had low awareness on solid waste management. This indicates that the majority of the students are well aware about solid waste management. This is supported by previous research, which found that overall students have high level of awareness regarding to SWM (Paghasian, 2017), (Reyes & Madrigal, 2020), (Bartl, 2014).

Table 3: Practices on Solid Waste Management in Terms of Waste Segregation.

	Never	Very Rare	Rarely	Often	Very often	Mean	SD	Var.
1. I segregate biodegradable (paper, banana peels, cardboard, and vegetables) and non-biodegradable (plastic toys, glass, steel, rubber) wastes at school.	13	11	35	27	22	3.31	1.250	1.564
2. I separate recyclable wastes (paper, cardboard, plastic bottles) from non-recyclable (food wastes, leaves, twigs) wastes at school.	7	13	34	34	20	3.44	1.121	1.257
3. I separate non-harmful wastes from toxic and hazardous wastes such as pentel pens, laboratory chemicals, ink, cell batteries and others.	7	7	27	42	25	3.66	1.104	1.218
4. I mix all the garbage in one garbage container.	8	11	17	35	37	3.76	1.237	1.530
5. I segregate recyclable items for collection.	17	19	26	29	17	3.09	1.308	1.711
N = 108								

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The second objective of the study is to determine how students handle solid waste in terms of segregation, reduction, reuse, and recycling. Table 3 depicts the students' solid waste management practises in terms of segregation. The highest mean value of 3.76, as shown in the table, is interpreted as "Good" and corresponds to item 1: "I mix all the garbage in one garbage container." Item 5, "I segregate recyclable items for collection," had the lowest mean value of 3.09, which was interpreted as "fair."

Table 3.1: Summary of Students' Solid Waste Management Practises In Terms Of Waste Segregation

		N	%
Students' solid waste management practice om terms of waste segregation	Poor	5	4.6
	Fair	61	56.5
	Good	42	38.9
N= 108			

Table 3.1 summarises solid waste management practises in terms of segregation. It was discovered that out of 108 students, 56.5 percent (61 students) had good segregation practises, 56.5 percent (61 students) had fair segregation practises, and 4.6 percent (5 students) had poorly segregated waste materials. This indicates that the majority of students have good solid waste separation practises. This finding is backed up by Paghasian (2017), who discovered that the majority of students have good solid waste segregation practises in their studies.

Table 4: Practices on Solid Waste Management In Terms Of Reduce.

	Never	Very Rare	Rarely	Often	Very often	Mean	SD	Var.
1. I borrow, share, and/or rent things that are needed occasionally.	9	12	28	45	14	3.40	1.110	1.233
2. I buy only what I need so that I will not end up throwing away extra food.	3	6	11	41	47	4.14	1.000	.999
3. I pack my lunch in reusable lunchbox so that I did not buy wrapped food at the campus.	9	22	33	23	21	3.23	1.220	1.488
4. I bring water in reusable water bottles than buying water in one used plastic bottles at the campus.	1	6	11	36	54	4.26	.921	.848
5. I am cautious and responsible to every waste I produced.	1	4	20	40	43	4.11	.900	.810
N = 108								

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Table 4 presents the students' practices on solid waste management in terms of reduce. The table presents the highest mean value of 4.26 interpreted as "Very Good" fell on item 4, "I bring water in reusable water bottles than buying water in one used plastic bottles at the campus". The smallest mean value of 3.23 fell on item 3, "I pack my lunch in reusable lunchbox so that I did not buy wrapped food at the campus", interpreted as "fair".

Table 4.1: Summary of Students' Solid Waste Management Practises in Terms of Waste Reduce

		N	%
Students' solid waste management practice in terms of waste reduce	Poor	1	0.9
	Fair	36	33.3
	Good	71	65.7
N= 108			

The students' solid waste management practises in terms of waste reduce are summarised in Table 4.1. It revealed that 65.7 percent (71 students) had good waste-reduction practises, 33.3 percent (36 students) had fair waste-reduction practises, and 0.9 percent (one student) had poor waste-reduction practises. This indicates that the majority of students practise commendable waste reduction practises, which is consistent with the findings of the Paghasian study (2017).

Table 5: The Practices on Solid Waste Management in terms of Reuse

	Never	Very Rare	Rarely	Often	Very often	Mean	SD	Var.
1. I reuse my old materials than buying a new one.	2	8	31	46	21	3.70	.930	.865
2. I reuse grocery bags.	1	9	26	34	38	3.92	1.006	1.012
3. I reuse washable food container.	-	12	12	39	56	4.37	.756	.572
4. I reused scrap paper into memo pads.	11	15	29	25	28	3.41	1.290	1.664
N = 108								

Table 5 presents the students' practices on solid waste management in terms of reuse. The table displayed the highest mean value of 4.37 fell on item 3, "I reuse washable food container.", interpreted as "Very Good". The least mean value of 3.41 fell on item 4, "I reused scrap paper into memo pads", interpreted as "Good".

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Table 5.1: summary of students' solid waste management practises in terms of waste reuse

		N	%
Practices on Solid Waste Management in terms of Reuse	Poor	1	0.9
	Fair	37	34.3
	Good	70	64.8
N= 108			

The summary assessment of students' practise on solid waste management in terms of reuse is shown in Table 5.1. It was discovered that 64.8 percent (70 students) had good solid waste management practises in terms of reuse, 34.3 percent (37 students) had fair practises, and 0.9 percent (one student) had poor practises. This indicates that the majority of students have good solid waste management practises in terms of reuse which also supported in the study of Paghasian (2017).

Table 6: The Practices on Solid Waste Management In Terms Of Recycle

	Never	Very Rare	Rarely	Often	Very often	Mean	SD	Var.
1. I convert or redesign waste materials into a new product.	18	17	32	25	16	3.04	1.289	1.662
2. I make decors out of plastic wrappers and other colorful waste materials.	23	25	27	21	12	2.76	1.296	1.680
3. I ignore the importance of recycling.	22	30	25	18	13	2.72	1.286	1.679
4. I initiate generating income out of waste materials.								
N = 108	28	21	27	16	16	2.73	1.385	1.918

Table 6 shows the students' recycling habits. Item 1, "I convert or redesign waste materials into a new product," had the highest mean of 3.04, interpreted as "Good." Item 3, "I ignore the importance of recycling," received the lowest mean of 2.72, which was interpreted as "Good."

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Table 6.1: Summary on Practices on Solid Waste Management in terms of Recycle

		N	%
Practices on Solid Waste Management in terms of Recycle	Poor	40	37.0
	Fair	47	43.5
	Good	21	19.4
N= 108			

The assessment of students' solid waste management practises in terms of recycling is summarised in Table 6.1. It was discovered that 43.5 percent (47 students), 37 percent (40 students), and 19.4 percent (21 students) of the 108 students surveyed had fair, poor, and good recycling practises, respectively. This suggests that the majority of students do not recycle on a regular basis. Similar findings were found in Paghasian's (2017) study, which concluded that the majority of students only have a fair level of recycling waste materials practises.

Conclusion

The findings of this study were as follows: The students were well-informed. The students had good solid waste management practises in terms of segregation, reduce, and reuse, as well as fair recycling practises. The following conclusions are drawn from the study's findings: Students at UiTM Kota Kinabalu are knowledgeable and concerned about solid waste management. These students have a good habit of sorting, reducing, and reusing waste, but they don't recycle enough.

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