AN INVESTIGATION ON KNOWLEDGE, ATTITUDE AND PRACTICE AMONG STUDENTS OF UNIVERSITY MALAYA TOWARDS SOLID WASTE MANAGEMENT

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ABSTRACT

Nowadays, solid waste management has become a challenging issue globally. In Malaysia, solid waste management is one of the three major environmental problems which require urgent actions. New planning, in order to manage solid waste, is greatly rely on public participation, and most of the environmentally friendly plans should be tackled at individual level. As a result, students would be good representatives of society and young generation, in which any environmentally research on this group would be a great help for the future planning. A cross sectional study was designed to investigate the level of Knowledge, Attitude and Practice (KAP) among students in University of Malaya (UM). A questionnaire consisted of seven sections, as per the theory of planned behaviour, has been spread among 399 students. Investigations indicated that some factors namely age, gender, educational level and income influenced the KAP level among students. According to the results, The KAP level was significantly higher among female compared with male. Also, younger students aged between 18 and 25 have a lower level of KAP compared with other age groups. Another finding of this Work was that, as the income increased, the KAP level also became higher; however, this trend happened only up to the income level of RM10000/month. KAP drastically dropped among groups consisted of salary of more than RM10000/month. Results suggested that, there were also positive relationships between intention and the level of attitude, perceived behaviour control and subjective norm ($R^2 = 46.3\%$); among all variables, attitude was the main predictor (B=0.58). The study showed that the overall KAP level among students was acceptable. Students practiced waste management

(waste reduction/reuse recycle) regularly but they believed that recycle bins located in university campus were not easily accessible and that could be a barrier of proper waste management Finally, further investigation is needed to study the level of KAP in Malaysian society and its relationship with levels of income.

ABSTRAK

Pengurusan sisa pepejal menjadi isu yang mencabar di seluruh dunia sejak akhir-akhir ini. Di Malaysia, pengurusan sisa pepejal merupakan salah satu daripada tiga masalah alam sekitar yang memerlukan tindakan segera. Perancangan baru bagi mengurus sisa pepejal sangat bergantung kepada penglibatan awam dan sebahagian besar rancangan mesra alam harus ditangani bermula di peringkat individu lagi. Sehubungan itu, pelajar boleh menjadi wakil yang tepat bagi golongan masyarakat dan generasi muda yang mana sebarang penyelidikan alam sekitar berkaitan kumpulan ini akan membantu perancangan masa depan. Kajian keratan rentas dirancang untuk menyelidik tahap Pengetahuan, Sikap dan Amalan (KAP) dalam kalangan pelajar Universiti Malaya (UM). Satu soal selidik terdiri daripada tujuh bahagian, mengikut teori tingkah laku yang dirancang telah diagihkan kepada 399 pelajar. Penyelidikan menunjukkan bahawa beberapa faktor seperti umur, jantina, tahap pendidikan dan pendapatan mempengaruhi tahap KAP di kalangan pelajar. Berdasarkan keputusan, tahap KAP dalam kalangan wanita jauh lebih tinggi berbanding lelaki. Selain itu, pelajar-pelajar muda yang berusia 18 hingga 25 tahun mempunyai tahap KAP yang lebih rendah berbanding dengan kumpulan-kumpulan usia yang lain. Penemuan ini menunjukkan bahawa apabila pendapatan seseorang meningkat, maka tahap KAP juga menjadi lebih tinggi, namun corak aliran ini hanya berterusan sehingga mencapai tahap pendapatan RM10000 sebulan. Manakala, KAP berkurang secara drastik dalam kalangan kumpulan gaji yang melebihi RM10000 sebulan. Keputusan menunjukkan bahawa, terdapat hubungan positif diantara niat dan tahap sikap, kawalan tingkah laku dan norma subjektif (R^2 =

46.3%); yang mana sikap adalah peramal utama diantara semua pemboleh ubah (B = 0.58). Kajian menunjukkan bahawa tahap KAP keseluruhan di kalangan pelajar boleh diterima. Kajian lebih lanjut dan terperinci perlu dilakukan untuk mengenalpasti tahap KAP dalam kalangan pelajar di Malaysia dan hunbungannya dengan pendapatan. Walaupun pelajar mengamalkan pengurusan sisa (pengurangan sampah / kitar semula/ penggunaan semula) secara berkala tetapi mereka percaya bahawa tong kitar semula yang terletak di kawasan kampus universiti sukar diakses dan boleh menjadi penghalang ke arah pengurusan sisa yang tuntas. Akhir sekali, penyelidikan lanjut diperlukan untuk mengkaji hubungan diantara tahap KAP masyarakat Malaysia dengan pendapatan.

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LIST OF ABBREVIATIONS

KAP: Knowledge, Attitude and Practice

UM: University of Malaya

MSW: Municipal Solid Waste

TPB: Theory of Planned Behaviour

3Rs: Reuse, Reduction at source and Recycling

ABC: Action plan for a Beautiful and Clean Malaysia

MHLG: Ministry of Housing and Local Government

DOE: Department of Environment

MOH: Ministry of Health

SWPCMC: Solid Waste and Public Cleansing Management Corporation

ZWC: Zero Waste Campaign

SPSS: Statistical Package for Social Science

SWM: Solid Waste Management

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CHAPTER 1: INTRODUCTION:

1. Introduction

Nowadays, solid waste has become a challenging environmental issue globally as a result of population growth, urbanization, industrialization and changing in lifestyle. Particularly, developing countries are witnessing a significant growth in waste generation. Solid waste management (SWM) is the essential key in order to address arising issues from solid wastes. Proper management of solid waste is not possible without having real data. Based on United Nations Environmental programme, the solid waste generation was about 7 to 10 billion tonnes annually which 2 billion tonnes of the waste generated was contributed by municipal solid wastes. In year 2010, traditional high-income countries generated almost half of the waste generated globally which the trend has been predicted to shift to Asia by year 2030 (Programme, 2016). As the global sustainable development goals have been set to encourage sustainable development and consumption, SWM is considered to be an important challenge globally to comply with sustainable development goals.

1.1. Solid Waste Management in Malaysia

Solid waste management is one of the three major environmental challenges in Malaysia (Hassan, Rahman, Chong, Zakaria, & Awang, 2000).Rapid urbanization and ever growing rate of population have accelerated the solid waste generation in Malaysia. According to World Bank (2011), normally in developing countries, approximately 33 up to 66% of municipal solid wastes are not being collected and more than half of the populations are not being served. Urban residents are the main waste generators in

Malaysia. 71% of Malaysian populations are urban residents that Selangor is the third most urbanized state in Malaysia after Kuala Lumpur and Putrajaya (Department of Statistics, 2011). Each urban resident in Malaysia generates about 1.9 kg/day of solid wastes while 0.65 kg/day of by each Malaysian rural resident (Hamatschek, Entwicklungszentrum, Tee, & Faulstich, 2010). Since year 2000, the population of Malaysia increased by 2% annually and reached about 32.5 million people in year 2018 (Department of Statistics Malaysia, 2018).

The generation of solid waste in Malaysia was 1.1 kg/capita each day in 2017 (Kamaruddin et al., 2017). The composition of municipal solid waste (MSW) relies on many factors namely family income, life style and geographical location. Studies showed that MSW in Malaysia consisted of food (45%), plastic (24%), paper (7%), iron (6%), glass (3%) and others (15%) as shown in Figure 1.1 (Government, 2010; Wan and Kadir, 2001). Aja and Al-Kayiem (2013) predicted that the waste generated in Malaysia by year 2020 will be exceeding 30518.5 tons/day (O. Aja & Al-Kayiem, 2013).

Therefore, a proper solid waste management is crucial for Malaysian government to reduce its impacts on environment as well as in terms of financial. Considering that Malaysia is aiming to become a developed country by year 2020, with respect to sustainable development goals, we need clear data regarding the waste generation, knowledge and practice among Malaysian residents.

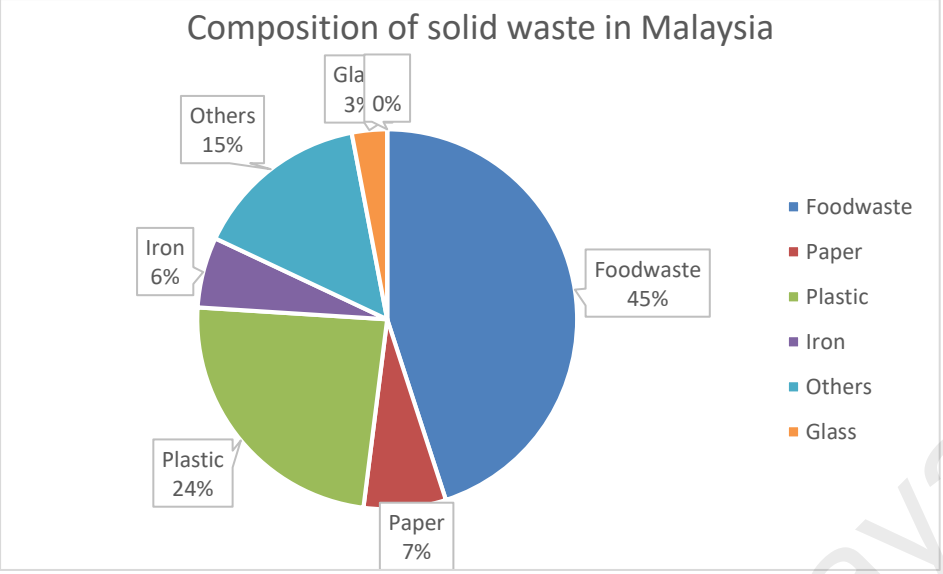

Figure 1.1: Composition of solid waste in Malaysia

Source: Ministry of Housing and Local Government (MHLG, 2010)

1.2. Problem Statement

Malaysia is witnessing a rapid growth in population, economy and urbanization. Following that, the amount of solid waste generation has been increased significantly over the past few decades; starting from year 1996 until 2009, Malaysia has undergone 100% increment of municipal solid waste generation (Wan & Kadir, 2001). As a result, solid waste management is considered as one of the major challenges faced by municipalities in Malaysia (Hassan et al., 2000; Sharifah, Khamaruddin, Mohamad, and Saharuddin, 2018). In year 2017, each Malaysian generated an average of 1.1 kg of solid waste per day (Kamaruddin et al., 2017). Investigation in Malaysia confirmed that among all generated wastes generated, approximately 95% of collected wastes were sent to landfill sites while the remaining 5% were recycled or disposed of illegally (O. Aja & Al-Kayiem, 2013). On the other hand, waste disposal technologies such as incinaration or landfilling are ultimate waste solutions which are neither sustainable nor environmental friendly (Ali, 2008b).

Currently, due to many arising waste disposal problems, Malaysian government is shifting the method of handlingwastes from throw-away culture to conserving (Ali, 2008b). It cannot be denied that solid waste management is one of the programs which help institutions in achieving sustainability. Considering the fact that most of the environmental friendly plans particularly solid waste management should be tackled at individual level (Desa, Kadir, & Yusooff, 2011), in order to achieve a proper solid waste management, firstly we have to be acquainted with the current status of knowledge, attitude and practice among different individuals in society. Secondly, an upgrade of overall knowledge among the residents is very much needed (Sharifah et al., 2018). In order to implement each of the concepts mentioned above, the best target would be students as they are a good representative of the knowledge, attitude and behaviour among variety of people in society. The level of KAP among students indicates the effectiveness of education on waste management methods. At he same time it represents the level of KAP among society members. The future plans on waste management strategies are greatly rely on public participation (Yusof, 2004). In fact, no waste management strategy would be effective without a public participation, thus, undoubtedly it goes well when public starts to aware it (Yusof, 2004). Malaysian government has introduced the action plan for a beautiful and clean country; the government brought about a recycling campaign but failed to achieve an efficient result mainly due to minimal public participation (Samsudina & Dona, 2013). Many researches indicated that the level of education has a direct effect on individual cooperate in waste management (Samsudina & Dona, 2013). Therefore, this Work aimed to investigate the level of KAP among students in University of Malaya; it is an oldest university in Malaysia with the best ranking among universities in Malaysia.

1.3. Research Objectives

General Objective:

- To investigate the level of knowledge, attitude and practice of solid waste management among UM students.

Specific Objectives:

- To examine whether or not educational level, gender, salary and age affect the KAP level among students.
- To investigate whether or not attitude, subjective norm and perceived behavioural control affect the intention among students towards solid waste management.
- To examine the effectiveness of recycling bins located in the university campus in terms of accssesibility and usage.

1.4. Hypotheses:

Based on the Theory of Planned Behavior (TPB), this Work formulated the following hypotheses with the help of the psycological elements of this theory:

- There is a significant difference in the level of KAP among students of different ethnicity.
- There is a significant difference in the level of KAP among male and female students.
- Higher education level leads to a better level of KAP in solid waste management.
- The level of KAP is different among male and female students.
- The higher one's salary level is, the higher a KAP level.
- Intention has a positive relationship with practice.

1.5. Significance of the study:

The findings of this Work will be of great benefit to the following:

- University of Malaya: this Work provided data on the current status of KAP level among students. Also, the finding of this Work helped the university to obtain feedback on it's zero waste campaign as well as the recycling plans. The results of this Work will steer UM for a better approach towards sustainability.
- Society: considering the fact that most of the environmental friendly plans start at the individual level and students are the young representatives of the society, the success of every plan in society greatly relies on their participation. Thus, this Work provided useful basic information for those who wish to conduct environmentally friendly plans.

1.6. Study Outline:

Chapter 1:

This chapter started with a general introduction of solid waste, followed by its current status in Malaysia. The objectives and hypotheses of this Work were also explained in this chapter.

Chapter 2:

It reviewed the literature of solid waste and brought upon some basic definitions. This chapter also reviewed the status of solid waste management and policies in Malaysia and other developing countries.

Chapter 3:

It explained the step-by-step research approach and questionnaire design. Moreover, in this chapter, all methods used for analysis were described as well.

Chapter 4:

In this chapter, all the results and findings were established, followed by the interpretation and discussion.

Chapter 5:

The general conclusion of the study and some reccomendations were elaborated in this chapter.

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CHAPTER 2: LITERATURE REVIEW

2. Literature Review

2.1. Solid Waste

Solid waste can be simply defined as any unwanted solid material which is discarded by the society. Solid waste can be classified into three main groups; municipal solid waste, hazardous waste and agriculture waste (Sabri and Suhada, 2015; Wan and Kadir, 2001).

2.2. Municipal Solid Waste

Municipal solid waste is a subcategory of solid waste which includes residential, institutional, industrial and commercial wastes but excluding excreta (Yousuf and Rahman, 2007).

2.3. Waste Management

Waste management refers to actions taken by human such as collecting, transporting, processing, recycling or disposal of, to treat waste in a safe manner for human and the environment. Waste management strategies are vary based on the volume and types of waste. For example, waste management techniques for industrial waste is different from waste generated from household and the same goes for rural and urban wastes. Following that, when it comes to waste management it is important to take into account the source of waste as well as type and its amount (Mukisa, 2009).

2.4. Hierarchy of Waste

The Hierarchy of waste is popular in the 80's and today it is being widely used as a tool for solid waste management. The hiearchy of waste can simply be defined as the priority given to different management options. In years 1979, the waste hierarchy was first introduced in Europe and in year 2008 it has been finalized as the hierarchy which has been widely used nowadays. As shown in Figure 2.1, the hierarchy of waste consists of

five steps which prioritize prevention of waste, followed by reuse, recycle, recovery and landfill. The three middle steps are popularly known as 3Rs (reuse, reduce at source, and recycle) (Commission, 2012; Van Ewijk and Stegemann, 2016).

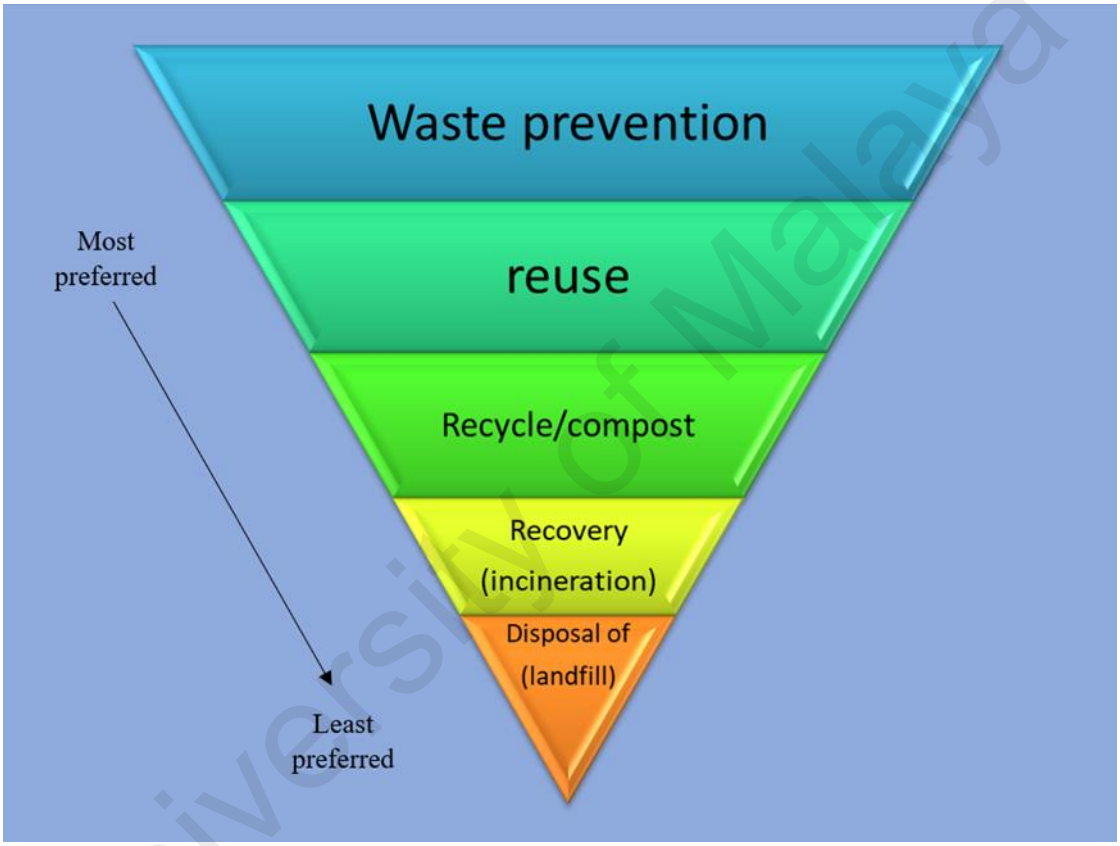

Figure 2.1: The hierarchy of waste

Source: EU waste framework directive

2.5. Solid Waste Management Strategies

Solid waste management practices consist of seven major elements as follows:

2.5.1. Generation of Waste

This stage is important as it contains vital information for waste monitoring and management planning. All activities that resulted in understanding the status of solid waste generation rate, composition, volume and probablity of change over time are belong to this group.

2.5.2. On Site Activities

On site activities include handling, storing and processing at the point of generation. Handling of waste is considered as all management related activities untill storing step. There are two types of storage. First is the temporary storage in household that people throw the waste in it temporarily. Second one is communal storage in public places. Lastly, processing is refered to composting and source seperating to prepare the wastes for further management activities such as recycling or disposing of at landfills.

2.5.3. Collection

Collection refers to the process of picking up the waste from generation point and transfering it to the disposal sites or facilities.

2.5.4. Seperation and Processing

Seperation of mixed wastes normally be done in special places other than generation points.

2.5.5. Transfer and transport

In this step, the waste is being transferred from public storage facilities to disposal sites (Gawande, 2015).

2.5.6. 3Rs

3Rs are under the waste hierarchy of control and it stands for reduce, reuse and recycle of wastes. 3R means that prevention and source reduction have the priority over the reuse and recycle followed by the ultimate disposal (Ali, 2008b).

2.5.7. Disposal

Disposal is the ultimate element in waste management which is normally associated with landfilling. Although only sanitary landfilling is safe for human and environment, unfortunately in many developed countries, sanitary landfilling is replaced with illigal dumping, open burning or open landfilling (Gawande, 2015).

2.6. Municipal Solid Waste Generation in Developing Countries

Those countries which have low or middle income are considered as developing countries. During the past 30 years, most of the developing countries were experiencing a rapid urbanization. Ths, the rate of municipal solid waste generation is predicted to increse in future; the range of municipal solid waste generation in developing countries is between 0.3 to 1.44 kg/person each day. Among them. Maldives showed an exception with 2.48 kg/person per day of waste generation due to its high tourism activities (Sabri & Suhada, 2015).

2.7. Waste Disposal in Malaysia

2.7.1. Landfilling

A landfill ia an engineered and well designed land to burry the wastes in a way without harm to the surrounding environment and underground water. Landfilling is the major disposal technique in Malaysia which covers 80% of the whole collected wastes. The current problem regarding the landfilling in Malaysia is the limited landfilling site's capability and the difficulties to build new sites due to land scarcity and other economic issues (O. C. Aja & Al-Kayiem, 2014). A study on 115 landfilling sites in Malaysia indicated that 73 sites were open dumped, 71 were semi sanitery and only 11 sites were practising sanitary landfilling (Wan and Kadir, 2001). The existing landfilling sites in Malaysia is shown in Table 2.1. The landfill sites are classified into four main levels as follows:

Level 0: Open dumping

Level 1: Controlled tipping

Level 2: Controlled landfill with bund and daily cover soil

Level 3: Sanitary landfill with leachate recirculation system

Level 4: Sanitary landfill with leachate treatment system

Unfortunately, open dumping is a common practice in Malaysia at 48% of landfills while only 5% of the sites are sanitary. Most of the sanitary land filling sites (level 3 and level 4) are located in Selangor while many other states such as Sarawak, Sabah, Kuala Lumpur and Labuan have no sanitary landfills (Ali, 2008b).

Table 2.1: Existing landfilling sites in Malaysia

States	Number of Landfills	Waste Received (tone/day)	Landfill Level				
			Level 1	Level 2	Level 3	Level 4	Level 5
Johor	18	1,082	10	6	2	1	0
Melaka	4	1,062	2	0	1	1	0
Negeri Sembilan	11	727	7	3	1	0	0
Selangor	14	2285	0	7	1	1	5
Pahang	14	895	5	3	2	3	1
Terengganu	8	707	2	4	1	0	1
Kelantan	12	424	10	1	1	0	0
Perak	19	1,450	9	6	3	1	0
Kedah	10	893	3	2	4	0	1
P. Penang	2	1,400	0	0	1	1	0
Perlis	1	100	0	0	0	0	1
Sarawak	36	1,000	20	14	2	0	0
Sabah	20	851	15	4	1	0	0
KL	1	600	0	0	0	0	0
Labuan	1	12	0	1	0	0	0
Total	171	13,491	83 48%	51 30%	21 12%	8 5%	9 5%

Source: Ali, 2008

2.7.2. Recycling and Composting

As mentioned above, landfills in Malaysia have limited capabilities; this problem together with land scarcity become a challenge regarding to the waste disposal. Therefore, recycling of inorganic waste and composting of organic waste should be familiarized in waste management to adress these issues. Recycling is reusing, remanufacturing or repairing the finished product which are supposed to be disposed of. Recycling not only prevents landfills from becoming overloaded but also provides raw materials that consume less energy during the manufacturing process (O. C. Aja & Al-Kayiem, 2014). The Ministry of Housing and government had launched a recycling plan in 1993 but was unsuccessful due to lack of public participation (Ali, 2008b). In year 2000, the plan had been relaunched and it projected that by 2020 the recycling rate in Malaysia will hit 22% (Table 2.2)(Ali, 2008b). Although large amounts of waste in Malaysia are recyclable but only five percent of the total are seperated and recycled (O.

C. Aja & Al-Kayiem, 2014). Over 20000 tones solid wastes are generated daily in Malaysia consist of 30% are recyclable and 70% biodegredable (Hassan et al., 2000). Even though recycling technique has been introduced many years ago in Malaysia, but it still not achieve its optimum level of efficiency due to lack of public awareness (O. C. Aja & Al-Kayiem, 2014). 50% of the total wastes that would be generated in 2025 are predicted to be food wastage which has a high potential for composting. Therefore, a good recycling/composting plan based on the actual data gathered by researchers would be a great assistance towards the efficient waste managemnt specifically in Malaysia (O. C. Aja & Al-Kayiem, 2014).

Table 2.2: Recycling rate projection in Malaysia from year 2001 until 2020

Year	Total waste generated (tonnes/year)	Recycling(%)
2001	160,600	3
2002	164,615	4
2003	168,730	5
2004	172,949	6
2005	177,272	7
2006	181,704	8
2007	186,247	9
2008	190,903	10
2009	195,676	11
2010	200,567	12
2011	205,582	13
2012	210721	14
2013	215,989	15
2014	221,389	16
2015	226,924	17
2016	232,597	18
2017	238,412	19
2018	244,372	20
2019	250,481	21
2020	256,743	22

Source: Ali, A. O. (2008),"Attitude of Malaysian on Recycling of Municipal Solid Waste: Case Studies in The Major Towns of The East Coast and North Malaysia.

2.7.3. Incineration

Theremal treatment consists of many methods namely pyrolysis, melting, vitrification and sintering but when it comes to municipal solid waste, incineration is the most common thermal treatment (Sabbas et al., 2003). Incineration is the controlled combustion of the waste in high temperature in order to strilize or reduce the waste volume. It is not only concidered as an environmental friendly method but also a potential of energy recovery. Investigations showed that the municipal solid waste production could be between 1500 and 2600 kcal/kg (O. C. Aja & Al-Kayiem, 2014).

2.8. The Importance of Public Participation

The major part of environmental problems have a root in individual behavior. Attitude is the tendency of self which has a direct effect on individuals' respond to all situations. The attitude towards the environment is related to an individual concept and the level of which an individual percieves him/her self as an integrated part of the surrounding environment (O. C. Aja & Al-Kayiem, 2014). Zurbrugg (2003) reported that all steps in solid waste management from generating to sending the waste to the disposal facilities were depended on public awareness and participation (Zurbrugg, 2003). Mukisa (2009) published that the success of any waste management plan was totally depending on the public participation in which without it, solid waste management was not only difficult but also costly (Mukisa, 2009). Although, in Malaysia, hierarchy of waste has been introduced and used since year 1990 but only five percent of the total collected wastes are being recycled. Investigations indicated that the level of knowledge among residents has a direct effect on their behaviour towards environment (O. C. Aja and Al-Kayiem, 2014; Haron, Paim, and Yahaya, 2005). A study on the relationship between knowledge and environmental attitude and practices among Selangor residents showed that the level

of education has a positive direct effect on the environmental knoweledge among them. On the other hand, the level of knowledge positively affected the environmental behaviour and practices among residents (Haron et al., 2005). A study introduced environmental education and law enforcement as powerfull tools in order to raise social conciousness towards environmental impacts (O. C. Aja & Al-Kayiem, 2014).

2.9. Solid Waste Policies in Malaysia

Since year 1992, Malaysia was committed to improve its solid waste management as part of Rio Decleration (Moh & Manaf, 2014). Later on in 1998, the action plan for a Beautiful and Clean Malaysia (ABC plan) has been set by Ministry of Housing and Local Government (MHLG) with the aim of managing the MSW in a way that sounds environmentally and economically (Moh & Manaf, 2014). In Malaysia, solid waste has been classified into three major parts and each part is put under the responsibility of different departments as follows; MSW is under the responsibility of MHLG, the Department of Environment (DOE) is managing the schedule or hazardous waste and clinical waste is being managed by the Ministry Of Health (MOH). Under the 8th Malaysian plan, there are four main goals regarding the waste management: waste minimisation, promotion of reuse, developing a recycling orientation, and implimentation of pilot projects for recycling. Following that, in the 9th Malaysian plan along with an emphasise on previous plan goals, the department of National Solid Waste Management under the MHLG is responsible of managing the Municipal Solid Waste (Zainu & Songip, 2017). In year 2007, a new act named Solid Waste and Public Cleansing Management Corporation (SWPCMC, 2007) has been set to be a milestone in MSW management (Zainu & Songip, 2017). Before this act was gazetted, the local authotities were responsible for solid waste management whereas, after the

implimentation of this act, the federal government of Malaysia took the responsibility from the local authorities. Under the SWPCMC act, waste reduction, reuse, recycle and energy recovery are taken into account. Also, some waste treatment methods such as waste to energy instruments and thermal treatment plants have been introduced for use in the future (Ajzen, 1991).

2.10. Waste Collection in Malaysia

Collection is defined as gathering, sorting and storing the wastes for the purpose of transporting them to a waste treatment stations (Commission, 2012). Waste collection is considered as the most expensive step in waste management system (Sakawi, 2011). The local authorities are responsible of collection, transportation and disposal of the generated wastes in Malaysia. Normally, wastes are collected from every household which known as door-to-door collection service. The frequency of waste collection is once every 2 days from households and daily from commercial buildings. However, the waste collection service in low-income areas is not properly managed and some landfilling sites are not sanitory or not well designed (O. C. Aja and Al-Kayiem, 2014). An investigation indicated that proper planning which identified the area of improvement was a way towards a better solid waste management (O. C. Aja and Al-Kayiem, 2014).

2.11. Municipal Solid Waste Management Challenges in Developing Countries

Rapid urbanizing cities in the world, specially in developing countries, are facing serious problems regarding the solid waste management due to rapid increasing rate of population growth and waste generation. This issue will negatively affect the capability of the authorities to provide a proper waste management services (Sabri and Suhada,

2015). Zurburgg (2003) reported that uncontroll dumping was a common practice in developing contries which led to water, air and land pollutions (Zurbrugg, 2003). Hassan et al. (2000) reported that currently in Malaysia there was no proper periodic record of the solid waste generation rate. However, a few studies and records have been done but limited to high income states such as Selangor, Kuala Lumpur and Johor (Hassan et al., 2000). The solid waste composition is affected by different factors such as socio-econimic condition of the area and a level of industrialization (Singh, Singh, Araujo, Ibrahim, and Sulaiman, 2011). In Table 2.3, the composition of waste in low and high income asian coiuntries is tabulated. The proportion of organic waste is higher in low income countries while the percentage of recyclable material is higher in high income countries. It is because of the occurance of the recycling in every stage of the system which consequently only a small portion of the recyclable material remains for the disposal (Sabri and Suhada, 2015). Another issue regarding municipal solid waste management in developing countries is the limited amount of financial resources. When it comes to municipal solid waste management, local authorities mch more prefer to distribute a majority of the financial resources to high income areas which pay more taxes every year. Consequently, lower income areas will not receive proper services (Zurbrugg, 2003). Based on the World Bank (2011), approximately 80% of waste management facilities such as collection and transport facilities needed maintenance or were out of service (World Bank, 2011). Public participation is another challenge in today's world particularly in developing countries. As mentioned before, public participation is a key element of an efficient solid waste management. Thus, choosing a right method for waste management based on the nature of the solid waste, location and public characteristic is a great challenge for authorities (Mukisa, 2009).

Table 2.3: Waste composition in low-income and high-income Asian countries

Parameter (%)	Low-income country	Medium-income country	High-income country
Organic	40_85	20_65	20_30
Paper	1_10	1_30	1_40
Plastic	1_5	2_6	2_10
Metal	1_5	1_5	3_13
Glass	1_10	1_10	4_13
Rubber, Leather, etc..	1_5	1_5	2_10
Other	15_60	15_50	2_10

Source: Singh et al., 2011

2.12. Theory of Planned Behavior

Over the past two decades, there has been a growing interest towards using the social behavior model in different parts of science to predict social behavior. In 1991, the Theory of Planned Behaviour (TPB), developed by Icek Ajzen became a major framework for understanding and prediction of human behavior (Tobolova, 2015). The TPB provides a reliable framework for research on the factors that influence human behavior and has been applied successfully in many studies (Tonglet, Phillips, and Read, 2004). Based on this theory, one's behavior is a direct result of his/her intention, and it relies on three factors as stated below (Fielding, McDonald, and Louis, 2008; Tobolova, 2015).

- Attitude : it is an individuals evaluation towards a behavior based on emotion, feelings and emotions. Attitudes are normally stable, however, they might change over a long period of time.

- Subjective norm : the individuals perception of people's influence on him/her to perform or not to perform a behavior.
- Perceived behavior control: the individual perception of his/her ability to perform a behavior.

Although other factors like demographics might also affect an individual's behavior, but these factors indirectly influence behavior and they can be reached through the component of the model (Tonglet et al., 2004). The interrelation of all the components of TPB was summarized in the Figure 2.3.

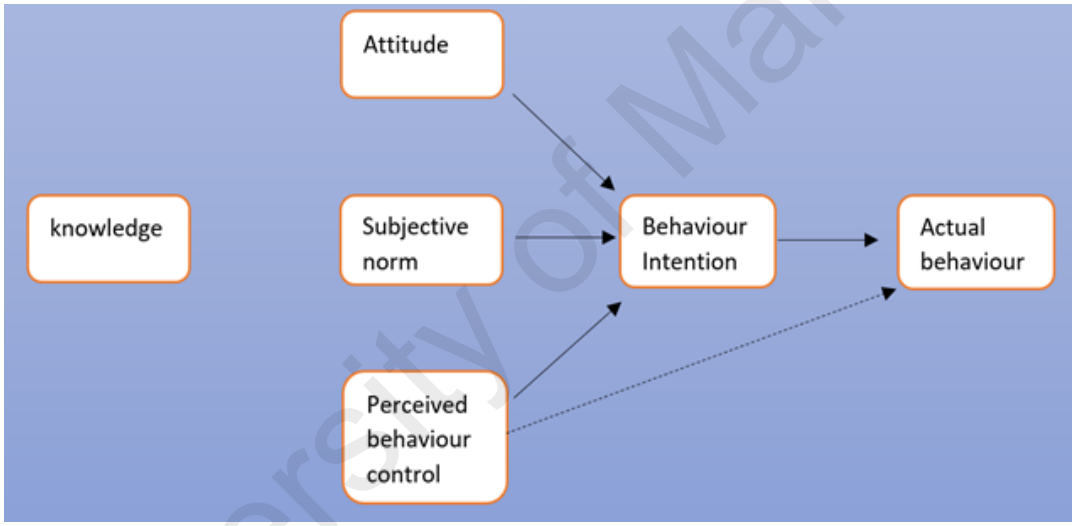

Figure 2.3: Theory of planned behavior

Source: Ajzen,1991

2.13. KAP

Environmentalism has become an important issue over the past three decades due to the environmental damage, caused by anthropogenic production systems. 1970s is considered as a time in which public awareness on environmental issues arises (Ahmad, Juhdi, and Shaikh Awadz, 2010). Following that, back in 1990s, studies indicated that consumers who had more environmentally awareness were more likely to buy environmentally friendly products (Roberts and Bacon, 1997; Shetzer, Stackman, and Moore, 1991). However, many management methods have been developed so far but the role of public awareness, socio economic background and attitude of the public are greatly important as well (Yusof, 2004). Environmental concern is an attitude which helps in preserving the environment indirectly through a person's intention. Anderson (1999) reported that any future development was greatly relied on the public's attitude. In order to reduce environmental and health impact which have already been imposed to the world, the development of guidelines and policies have to be followed by upgrading community's attitude through awareness programmes and campaigns (Anderson, 1999). The best approach to improve the waste management system in a certain country is by improving people's awareness on 3Rs in which the effectiveness of it is already proven in many countries such as Japan and Denmark (Yusof, 2004). Malaysia's annual recycling rate was 5%, compared with America at 52%, still has a long way to go (Yusof, 2004). Yosof (2004) reported that waste reduction was a best way to properly manage the waste and lack of public awareness was the major challenge faced by Malaysia (Yusof, 2004).

There are many environmental researches have been done to investigate the level of KAP among different groups in society. In 2015, Babaei and his fellow researchers investigated the level of KAP among a city residents and the relationship between

demographics and SWM practices. The result of the work showed a relationship between demographics such as education and income level with SWM practices (Babaei et al., 2015). Another study in Urban Kampala indicated that there was a positive relationship between awareness and the level of participation in source seperation and recycling (Banga, 2011). Abila and Kantola (2013) conducted a study on the public knowledge on environmental impact of waste mismanagement. They found that Nigerian residents have a very good knowledge regarding the impact of waste mismanagement on health and ecotoxicity but they have very poor knowledge on the impact of waste mismanagement on Eutrophication (Abila & Kantola, 2013). In Malaysia, many investigations have been done regarding the environmental KAP level. A study on the household recycling awareness indicated that most of the respondents were aware of the recycling method but most of them or about 90% were unsatisfied with the current waste management methods which as a result of lack of facilities or proper location of the facilities (Ali, 2008a). In addition, there were also researches on the KAP level among students. A study by Desa et al. (2011) aimed to investigate the level of KAP among first year students of Universiti Kebangsaan Malaysia. Findings of the work suggested that the level of KAP was moderate among students and there was a need to enhance the environmental knowledge and attitude among them (Desa et al., 2011). Another interesting research has been done to examine students' behaviour before and after interventions. The work reported that there was improvement in student's behavior towards the waste management after the intervention (Tobolova, 2015). Sharifah et al. (2018) studied the recycling attitudes among engineering students of UiTM, Malaysia. The research found a significant relationship between gender and knowledge among students. The work also explored the reasons that might act as a barrier towards using the recycle bins located in university campus area. Among all the

reasons presented by respondents, majority of the students believed that recycle bins were not easily accessible and also they did not know where to recycle the waste (Sharifah et al., 2018).

2.14. Area of Study

University of Malaya or UM is the oldest university of Malaysia, located in the South East of Kuala Lumpur. The university occupies 372.12 hectare of area. Currently, 21,055 students are studying at UM, whom 12,128 are undergraduate students and 8,927 are postgraduate (Malaya, 2018). University of Malaya is one of the pioneers in research and actively participates in the international sustainability plans. Zero waste campaign is one of many UM's moves towards sustainability ((UM), 2018).

2.14.1. Zero Waste Campaign (ZWC)

It is estimated that the wastes generated by universities in Malaysia are approximately 10-20% of the total annually generated wastes. ZWC as shown in Figure 2.2 aims to achieve a zero waste emission to the landfill. With the help of ZWC, University of Malaya is not only contributing to environmental sustainability plans but also provides opportunities for further researches in related fields. ZWC also aims to reach 20% of recycling rate per month by year 2020.

Figure 2.2: University of Malaya Zero Waste Campaign (ZWC)

Source: University of Malaya, 2018; www.um.edu.my

In 2011, a composting centre was established in UM. This campus is equipped with a 1-tonne-capacity weighing scale, RO-RO bin and several recycle bins located in various parts of the university campus area to make the separation easier at its source, as shown in Figure 2.3 (UM, 2018).

Figure 2.3: Recycle bins located at UM campus areas

From year 2011 until 2017, ZWC prevented the dumping of approximately 700 tonnes of solid waste at the landfills; 275 tons food wastes, 55 tons green wastes, 75 tons used clothes, 162 tons wood wastes and 122 ton recyclable materials. As a result, RM 15,000 (gained by selling the second hand clothes) has been donated to charities (UM, 2018). Since 2011, ZWC has been providing training for 10,000 individuals from local and international organizations.

CHAPTER 3: METHODOLOGY

3. Methodology

This Work is a qualitative questionnaire-based research which as stated in Section 1 until Section 3, the aim of this Work was to investigate the level of student's participation in solid waste management. The cross sectional study has been adopted in order to examine different variables and responds at a single point of time (Bryman, 2016).

3.1. Research Design

A questionnaire consist of seven sections, as per the theory of planned behavior, has been designed (Ajzen, 1991). With the help of TPB, the sections included demographic information, knowledge, attitude, subjective norm, perceived behavioral control, intention and actual behavior. Based on this theory, one's behavior is a result of a person's intention, and intention is related to attitude, subjective norm and perceived behavior control, as shown in Figure 3.1 (Ajzen, 1991). Most of the questions were following Likert's Scale from 1 (strongly disagree) to 5 (strongly agree) and some questions, especially regarding demographic and knowledge, were designed as multiple-choice. The questionnaire was a mixture of questions adopted from other related studies and some of them have been developed by the author of this Work.

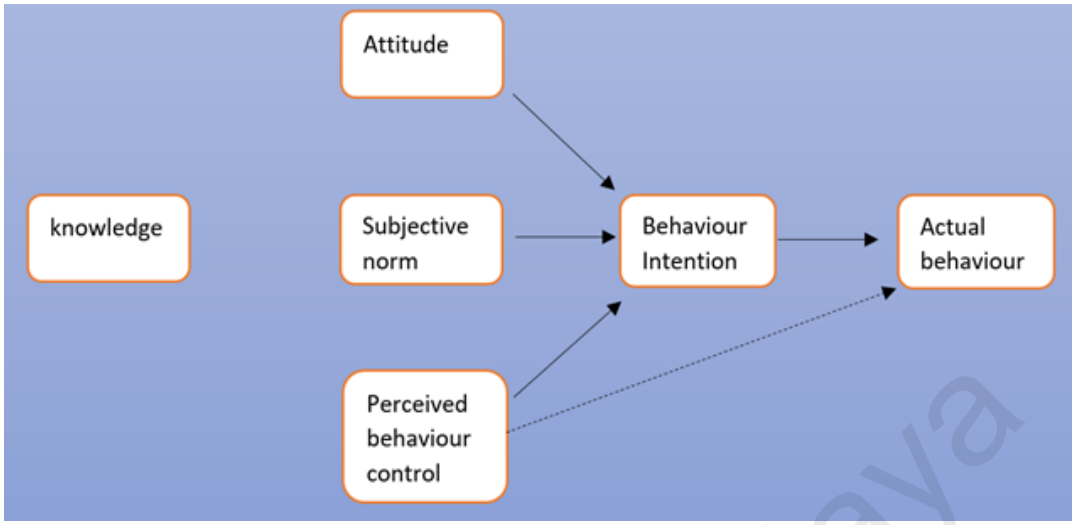

Figure 3.1: The planned behavior method
Source: Ajzen, 1991

3.1.1 Demographic Information

Demographics section sought data about participants' age, gender, ethnicity, and the duration of staying in Kuala Lumpur, marital status, size of the family, salary, educational level and occupation.

3.1.2 Knowledge

There were 10 questions in this section consisted of five multiple-choice and scaled questions respectively. The first six questions were developed by the researcher of this Work to examine the overall knowledge of students about solid waste management such as waste separation and recycling. Three of multiple-choice questions ("How do you know about solid waste management?"; "Which 3R method you are familiar with?"; and "In your opinion which 3R method is the most selective solution for solid waste management?") were to investigate the source of students' knowledge on waste management namely 3R method. Two questions ("Which household material can be recycled"; and "In your opinion which one considers as household solid waste") were

to examine respondents' practical knowledge towards solid waste management. The 7th question examined the environmental knowledge of the respondents which was adopted from a research by Tobolova (2015). 8th question was adopted from a research by Philippsen (2015) to inquire whether or not university has provided enough information on solid waste management (Philippsen, 2015). The 9th question (I know how to throw the waste as per labeled on recycle bins in university campus.) was aimed to investigate the level of student's knowledge on using the recycle bins located in the university campus. The students' awareness on economical benefits of recycling was tested by the last question.

3.1.3 Attitude

This section consisted of 10 questions; their sources were summarized in Table 3.1. This section scrutinized the student's mindset about solid waste and it was testified with key words such as important/ responsible/ interested and etc. The first three and sixth questions were adopted from the work of Tobolova (2015); the research on believes of students towards the environment and significance of solid waste management (Tobolova, 2015). Two of the questions (Each student should manage his/her own waste, each student should manage his/her own waste; I always try to reduce the amount of solid waste I'm producing) examined the feeling of being responsible towards solid waste (Philippsen, 2015). Finally, the last question (I believe by managing solid waste I can save money) which to explore thoughts of respondents towards economical aspects of solid waste management has been testified (Tonglet et al., 2004).

Table 3.1: Attitude questions and related sources

Attitude	
By managing solid waste, we will take a huge step forward in reducing water/air pollution.	,Tobolova, M. (2015)Tonglet et al.2004
each student should manage his/her own waste.	Philippsen, Y. (2015)
I believe that waste recycling is important.	Tobolova, M. (2015)
I am responsible to separate the waste I generated.	Philippsen, Y. (2015)
I always try to reduce the amount of solid waste I'm producing.	Tobolova, M. (2015)
I believe by managing solid waste I can save money.	Tonglet et al.2004

3.1.4 Subjective Norm

There were five questions in the subjective norm part of the questionnaire. The questions contained the key words such as "my family", "my friend", "people who are important to me/my neighbor". The questions were asked to investigate the level of subjective norm and they were adopted from the work of two researchers as tabulated in Table 3.2 (Philippsen, 2015; Tonglet et al., 2004).

Table 3.2: Subjective norm questions and related sources

Subjective norm	Source
My family members practice waste segregation	Philippsen, Y. (2015)
Most of the people who are important to me, encourage me to reduce my solid waste	Tonglet et al.,2004
Most of the people that are important to me, practice waste management	Tonglet et al.,2004
I would practice waste management more if I know my family/friends/neighbors are doing it	Philippsen, Y. (2015)

3.1.5 Perceived Behavioral Control

This part of the questionnaire included eight questions. Each questions and its source were summarized in Table 3.3. The questions were in a negative form to represent the barriers towards the waste management practices in student's mindset. The first three questions were adopted from the research by Tonglet et al. (2004), and they reflected the time/space and complication restrictions (Tonglet et al., 2004). The 4th and 8th questions were regarding the accessibility and usage of the recycle bins located in the university campus (Knussen and Yule, 2008; Philippsen, 2015). Two of the questions (I would reduce waste generation if I knew how to do; and I am fully informed about waste recycling) focused on the information barriers, adopted from the work of Ghani et al. (Ghani, Rusli, Biak, and Idris, 2013). The final question (I would recycle more if the waste would be collected from my door by local authorities.) was adopted from the research by Barr et al. (Barr, Ford, and Gilg, 2003).

Table 3.3: Perceived behavior control questions and their related sources

Perceived behavior control	Source
Waste separation takes too much time.	Tonglet et al.2004
Waste segregation is too complicated.	Tonglet et al.2004
Waste separation occupies too much space.	Tonglet et al.2004
using the recycle bins ,located in university campus, is too complicated	Philippsen, Y. (2015)
I would reduce waste generation if I knew how to do.	Ghani etal., 2013
I am fully informed about waste recycling.	Ghani etal., 2013
I would recycle more if the waste would be collected from my door by local authorities.	S. Barr et al.,2003
Recycle bins located in university campus are not easily accessible.	Knussen & Yule,2006

3.1.6 Intention

This section consisted of six questions which investigated the intention of respondents towards practicing solid waste management. The questions contained some keywords related to intention such as “I intend to”, “I plan to” and “I decide to”. The questions and sources were summarized in Table 3.4 (Fielding et al., 2008; Ghani et al., 2013; Tonglet et al., 2004).

Table 3.4: Intention questions and their related sources
Table 3.4:

Intention	Sources
I practice waste management because, I care about my family's health and wellbeing.	tonglet et al.,2004
I intend to manage solid waste because I want to protect the environment.	tonglet et al.,2004
I will practice waste management better if I gain something in return.	Ghani et al.,2013
I plan to reduce my solid waste generation in next two weeks.	Feilding et al.,2008
I intend to reuse my solid waste generated in next two weeks.	Feilding et al.,2008
I truly plan to recycle my solid waste generated within the next two weeks.	Feilding et al.,2008

3.1.7 Behavior

Behavior section of the questionnaire consisted of six questions to investigate the actual behavior of the students towards solid waste management as shown in Table 3.5. The first, second and last question tested the participant's real practice towards reduction at source, reuse and recycle of the waste which, adopted from the study by Ghani et al. (2013). A third question (I regularly sell my household waste to the waste collectors) was adopted from the research by Tobolova (2015) and it investigated whether the respondents were participating in waste management rewarding programs (Tobolova, 2015). Two of the questions (I normally throw the waste, as per labeled on the recycle bins located in the university campus; and I usually bring my household waste to the recycling stations) were developed by the researcher of this Work to testify the usage level of recycle bins provided by the university.

Table 3.5: Behavior questions and their related sources

Behaviour	Sources
I always attempt to reduce the amount of waste wherever I can.	Ghani etal., 2013
I regularly reuse some part of my household waste for other useful purposes.	Ghani etal., 2013
I regularly sell my household waste to the waste collectors.	Tobolova, M. (2015)
I have nevr recycled any parts of my household waste.	Ghani et al.,2013

3.2. Validation and Pilot Study

After the design phase, the questionnaire validation has been done. For validating the questionnaire, two experts in the same field (environmental engineering) and one statistical analyzer have cross checked the questionnaire and commented on that. After some corrections in order to ensure the questionnaires were clear enough and easy to understand, a pilot study was done by distributing the questionnaire among 30 students in the most crowded areas of the university which were main library and restaurants located in International Student Center (ISC). Minor changes have been done after obtaining results of the pilot study.

3.3. Sampling

A paper-pencil based questionnaire has been randomly distributed among students at different faculties. Before respondents filling up the questionnaire, the purpose of the study has been described to them. They were also explained that there was no right or wrong answer. The number of participants was 399. The sample size calculation has been calculated based on two different articles titled “Determining Sample Size” by University of Florida (1992) and “Determining Sample Size for Research Activities” by

University of Minnesota (1976) (Israel, 1992; Krejcie and Morgan, 1970). There were two tables provided by the mentioned researchers for the sample size based on the following formulas respectively:

$$n = \frac{N}{1 + N(e)^2}$$

n = sample size,

N = population size, and

e = level of precision

and

s = X2NP(1 - P) f CP(N - 1) + X2P(1 - P)

s = required sample size;

X" = the table value of chi-square;

N = the population size;

P = the population proportion;

d = the degree of accuracy expressed as a proportion (.05)

In both calculations, the maximum variability was 50% with 95% confidence and 5% level of precision. The sample sizes, suggested in the mentioned studies were 394 and 379, respectively. Eventually, this Work appointed 399 students from different fields as respondents.

3.4. Analysis

All the analyses have been done with the help of Statistical Package for Social Science (SPSS) version 23.00. Analyses consisted of six sections as described below:

3.4.1. Reliability

Reliability study has been done for each section (knowledge, attitude, subjective norm, perceived behavior control, intention and behavior). The alpha value should be more

than 0.7 which means the results is reliable (Nunnally & Bernstein, 1994). If it is below 0.7, shown from the bottom named "scale if Item deleted" (under the reliability analysis), the suggestion to delete item will be indicated. This indicator helped the researcher in determining the questions that were not reliable enough and need to be changed or deleted.

3.4.2. Descriptive Analysis

Descriptive analysis has been done to obtain the mean, standard deviation and the frequencies for each item.

3.4.3. Leven's Test

The homogeneity of variances has been tested by running the Levene's Test. If the significant level the test was greater than 0.05, the variability of scores among different groups is considered as similar, and vice versa (Tobolova, 2015).

3.4.4. ANOVA Test

In this test, the null hypothesis is tested, that the mean values for two or more samples in the research population must be the same. If the P value is less than 0.05, the hypothesis is rejected, but the alternative is accepted.

3.4.5. Linear Regression

Linear regression is meant to examine whether there is a relationship between dependent and independent values. In this case, this test calculates the percentage of each independent variable (predictor) affecting the dependent.

CHAPTER 4: RESULTS AND DISCUSSION

4.1. Results of Pilot Study

Reliability study has been tested on knowledge, attitude, subjective norm, perceived behavior control, intention and behavior. All the results (alpha value) were more than six except for perceived behavior control and behavior which after calculated by SPSS (scale if item deleted), two of the questions have been deleted; “I am fully informed about waste recycling” and “I have never recycled any parts of my household waste” were deleted from perceived behavior control and behavior sections.

4.2.Main Results

4.2.1. Demographic Composition of Sample

The demographic composition of this Work has been done by descriptive analysis. All the results were summarized in Table 4.1. Additionally, the demographic composition and interpretation of age, gender, salary and educational level were shown in Figure 4.1 until Figure 4.5.

Table 4.1: Demographic composition of the samples

Demographic Information		
Variable	**Number**	**Percentage**
Gender		
Male	170	43%
Female	229	57%
Age		
18-25	274	69%
26-31	82	21%
32-39	37	9%
40-47	6	1%
Ethnicity		
Malay	216	54%
Chinese	87	22%
Indian	16	16%
Others	78	20%
Educational Level		
Undergraduate	270	68%
Master student	80	20%
PhD candidate	45	11%
Post PhD	4	1%
Occupation		
Government	24	6%
private	8	2%
Housewife	4	1%
Business owner	14	4%
Full time student	329	82%
Others	20	5%
salary		
Under 1999	310	78%
2000 to 5999	51	13%
6000 to 9999	26	6%
More than 10000	12	3%

4.2.1.1. Gender

The study consisted of 399 respondents; 170 male and 229 female (Figure 4.1). The majority number of them (69%) were aged between 18 and 25 years old and only 1% were aged between 40 and 47 years old (Figure 4.2).

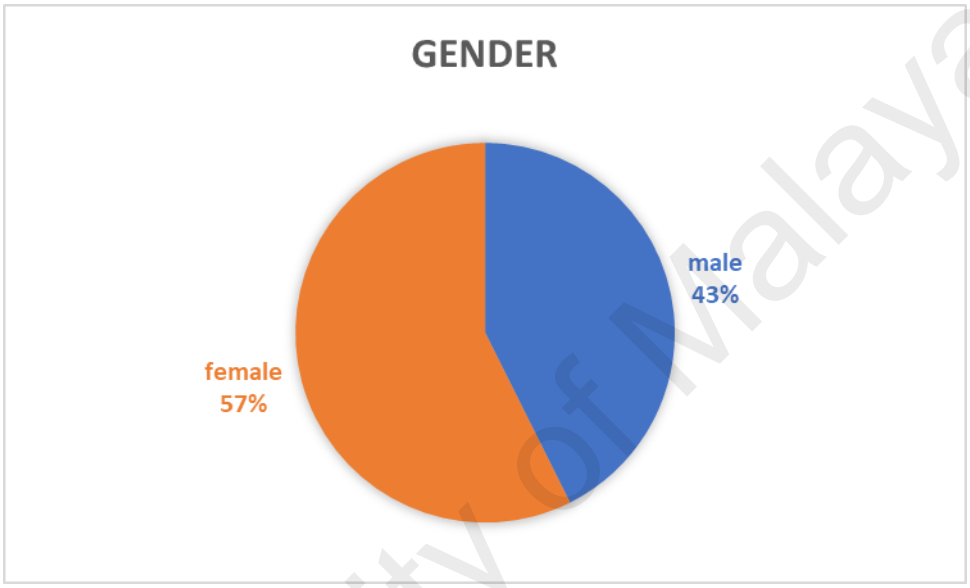

Figure 4.1: The composition of genders

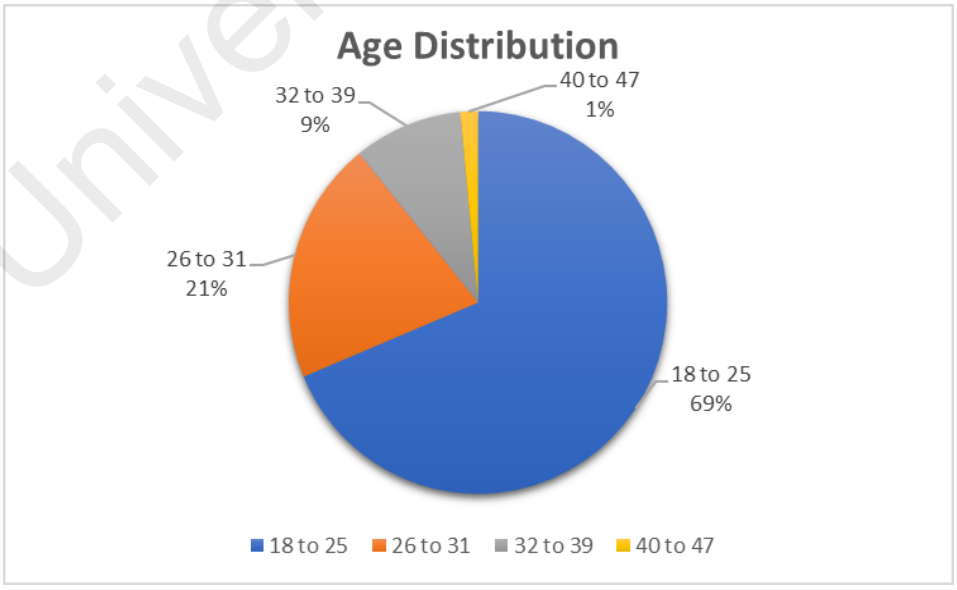

Figure 4.2: The age distribution of the samples

4.2.1.2. Education

As indicated in Figure 4.3, among 399 students whom participated in this Work, 270, 80, 45 and 4 respondents were respectively undergraduate, master, PhD and Post PhD candidates.

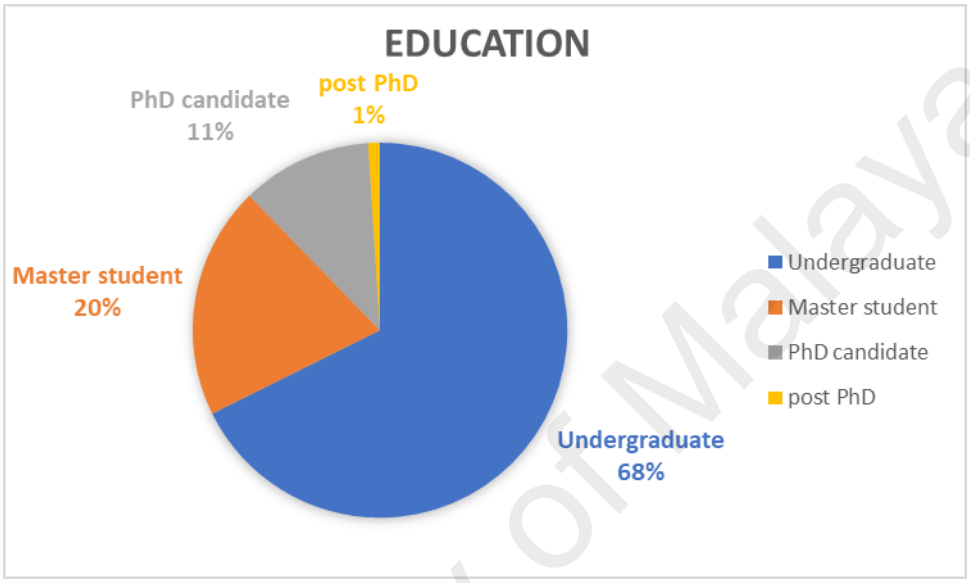

Figure 4.3: The educational level of the samples

4.2.1.3. Salary and Occupation

Among 399 students, most of them (82%) where full time students, and the rest were govermant servants (6%), private sector workers (4%), business owner (2%) and other jobs. The proportion of the salary also illustrated that the majority number of the students (78%) gained less than RM1999/month while 15% of the participants' income were between RM2000 and RM5999, and 7% of them gained more than RM6000. At a quick glance, it was clear that the results of salary and occupation supported each other. The percentage of each work category was relatively the same as the levels of income. For example, majority of the respondants were full time students and also the majority level of income was below RM1999. On the other hand, 12% of students stated that they were

working in government sector, private sector and owned a business as tabulated in Figure 4.4. In Figure 4.5, 9% of the students gained more than RM6000 per month.

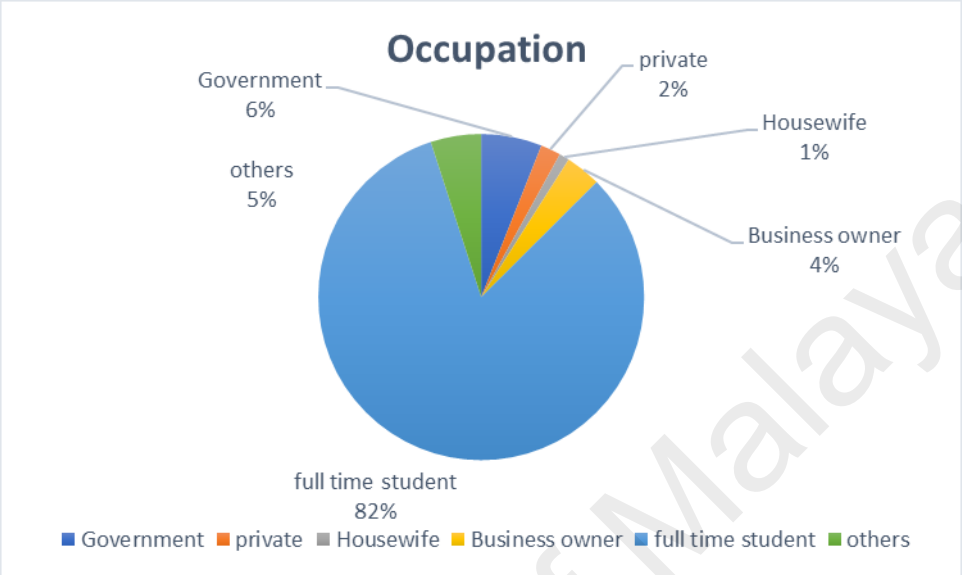

Figure 4.4: Occupation distribution of the samples

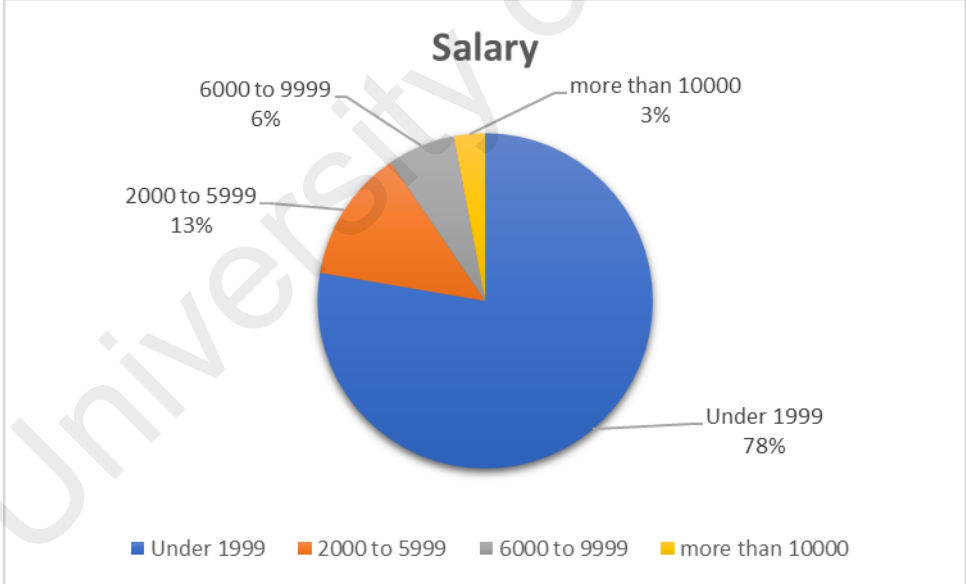

Figure 4.5: Salary distribution of the samples

4.3.Reliability Study

Reliability study has been done on knowledge, attitude, subjective norm, perceived behavior control, intention and behavior section. The variability results were summarized in Table 4.2. All the variables' alpha values were above 7.00, thus, they were reliable.

Table 4.2: Reliability results

Reliability Results	
Section	Cronbache's Alpha
Knowledge	0.72
Attitude	0.7
Subjective Norm	0.86
Perceived Behavior Control	0.74
Intention	0.74
Behavior	0.85

4.4.Descriptive Analysis

4.4.1. Knowledge

As stated in methodology, this part of study consisted of five multiple-choice and scaled questions respectively. The bar chart 4.6 indicates the number and percentage of respondents regarding the source of their knowledge about solid waste management. Education and internet at 31% and 28% respectively played the highest roles in spreading the knowledge among students in University of Malaya which were far higher than the third place which was television at 12%. Radio at only 4% ranked the lowest among all sources. Respondents have been asked to choose the most preferable solid waste management methods towards municipal solid waste. Majority number of

students (43%) believed that all the methods (waste reduction, waste reuse and waste recycle) were equaly important while 31% of them stated that waste recycling was the most selective solution. 15% and 11% of total respondents respectively preferred waste reuse and waste reduction.

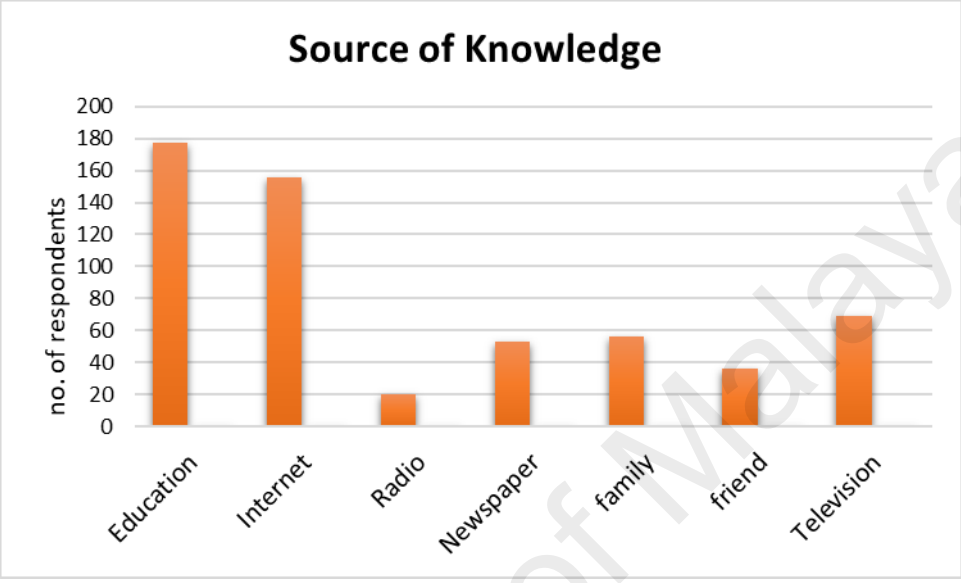

Figure 4.6: Source of participants' knowledge

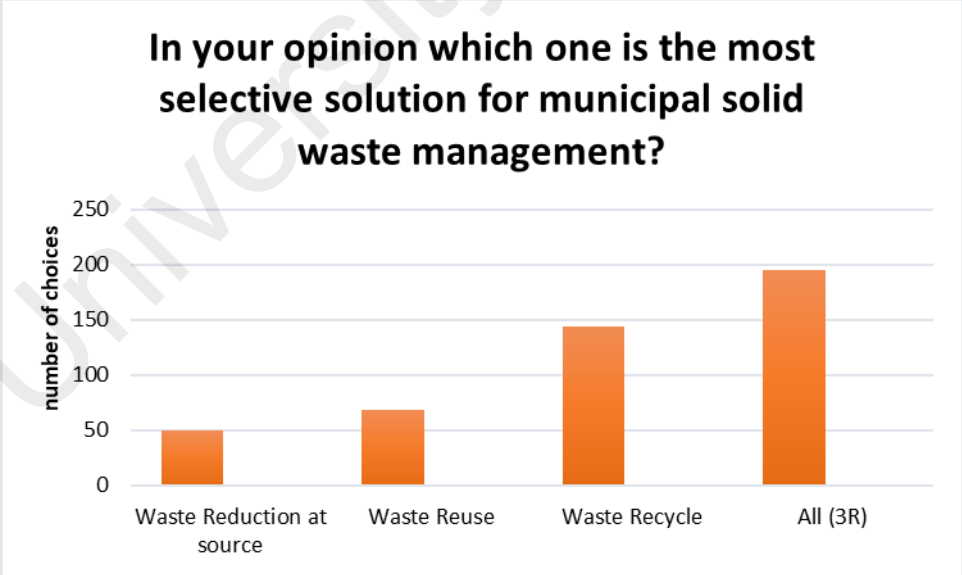

Figure 4.7: Bar chart of the most selective solution for municipal solid waste management

Two other multiple-choice questions in the knowledge section examined the students' knowledge about waste recycling and waste reuse. Figure 4.8 and Figure 4.9 show the percentage of the answers for each question. Respondents were asked to answer as many as possible. For the question "In your opinion which one is household solid waste", 33% answered "all above" which was the highest among all the other choices. Plastic bottles dedicated 20% of all choices at the second place, followed by glass bottles and cans at 16%. Cloth and furniture respectively were preferred by 9% and 6% of respondents. Figure 4.9 shows the proportions of the question "In your opinion which one of the following material can be recycled? (choose as many as you can)". Glass bottles and paper bags were the most favoured answers at respectively 36% and 34%.

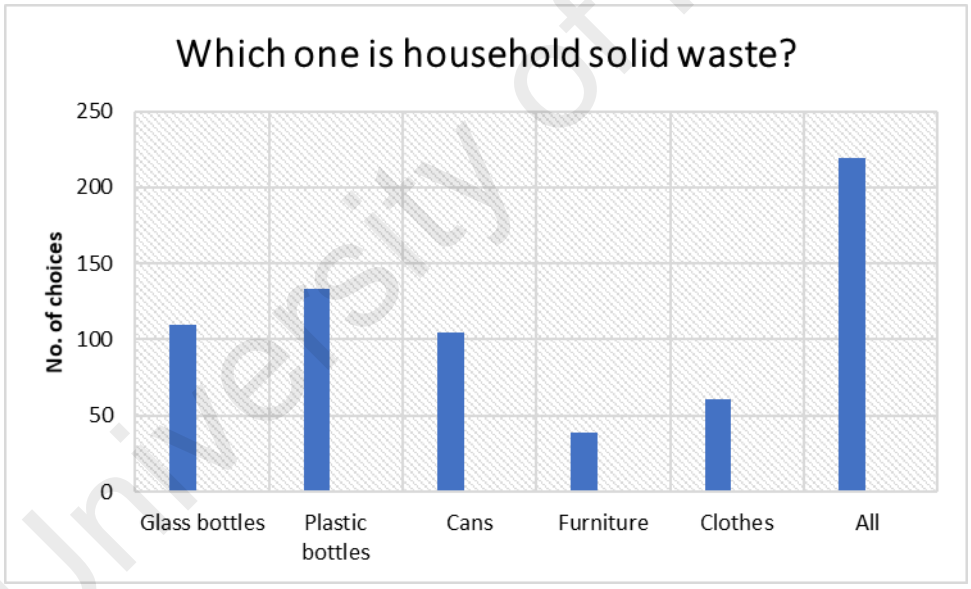

Figure 4.8: Bar chart of participant's answers towards the question "Which one is household solid waste?"

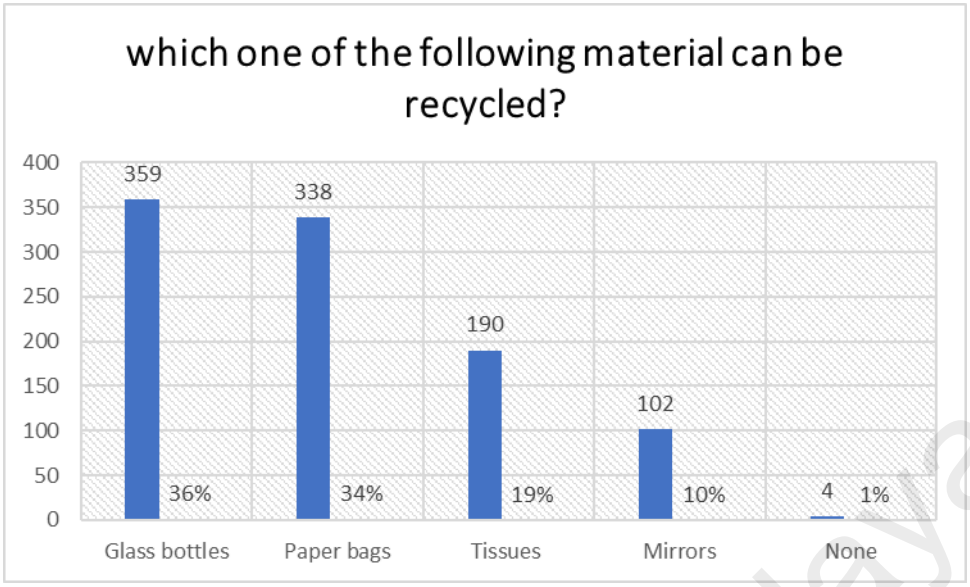

Figure 4.9: Bar chart of participant's answers towards the question "which one of the following materials can be recycled?"

4.4.2. Attitude

The results of this Work showed that majority of the students have a good level of attitude. The mean scored more than 3.5 for all questions which meant students agreed or strongly agreed with the statement; participants have a right mindset towards municipal solid waste management in University of Malaya.

4.4.3. Subjective Norm

Descriptive analysis in this section be evidence for students' opinion towards subjective norm which was approximately nuetral for most of the questions. In this section, majority of students agreed that they would practice solid waste management more if their family members or friends were also doing it (M=3.91).

4.4.4. Perceived Behavioral Control

In this section, majority of the students agreed that recycle bins in the university campus areas were not easily accessed (M=3.54). This Work also showed that participants disagreed with the statement that waste segregation was too complicated but neutral with the statement of waste seperation took too much space/time yet they would recycle more if the waste being collected from their place by local authorities (M=3.93). This results clearly confirmed that participants were not struggling with waste seperation but they found it difficult to bring their seperated waste to the recycling stations.

4.4.5. Intention

The descriptive analysis results pointed out that most of the respondents were highly intended to practice waste management.

4.4.6. Behavior

This section examined the actual behavior of the respondents. The result of this section truly confirmed the descriptive results of perseived behavior control. Based on the results, students normally practiced waste reduction and reuse (M=3.86, strongly agree) but they scored neutral (M=3.04) for the question: “I usually bring my waste to recycling station”. The result proved that students normally practiced waste management (3Rs) but it was rather difficult for them to transfer the waste to the nearest recycling stations.

4.5.Variance

4.5.1. Independent T-Test

The independent T-test has been run to compare the student's opinion towards the study variables (knowledge, attitude, subjective norm, perceived behavior control, intention and behavior) in respect with genders, please refer Table 4.3 and Table 4.4. Based on Table 4.4, there were significant differences between male and female in terms of followings:

- **gender:** there was a significant difference between male (M=3.99, SD=0.55) and female (M=4.11, SD=0.46), P=0.02 in terms of knowledge; gender really affected student's general knowledge. This Work's result suggested that female students were more knowledgeable than the opposite gender towards municipal solid waste management in University of Malaya, (refer Table 4.3). In addition, based on the Table 4.4, there was a significant difference between male (M=4.03, SD=0.45) and female (M=4.16, SD=0.52), P= 0.008 regarding the attitude. Results suggested that the level of attitude was more significant among female compared with male (Table 4.3). However, the difference in practice was not significant between both genders even though female students practiced solid waste management slightly better than male students.

Table 4.3: Mean and standard deviation of gender groups towards all variables

Group Statistics					
gender		N	Mean	Std. Deviation	Std. Error Mean
Knowledge_mean	male	170	3.9941	0.55913	0.04288
	female	229	4.1135	0.46419	0.03067
ATT_mean	male	170	4.0265	0.44953	0.03448
	female	229	4.1568	0.52139	0.03445
Subjective_mean	male	170	3.3871	0.65854	0.05051
	female	229	3.4716	0.64816	0.04283
Pbehavior_control_mean	male	170	3.3206	0.54514	0.04181
	female	229	3.2289	0.68190	0.04506
Intention_mean	male	170	3.6961	0.53336	0.04091
	female	229	3.7344	0.68374	0.04518
Behavior_mean	male	170	3.5000	0.60069	0.04607
	female	229	3.5485	0.66038	0.04364

Table 4.4: The result of Independent T-test for gender groups

Independent Samples Test										
	Leven's Test for equality of variances			t-test for Equality of Means						
				t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		f	sig.						Lower	Upper
Knowledge_mean	Equal variances assumed	2.322	0.128	-2.328	397	0.020	-0.11942	0.05131	-0.22028	-0.01855
	Equal variances not assumed			-2.265	323.424	0.024	-0.11942	0.05272	-0.22315	-0.01569
ATT_mean	Equal variances assumed	9.825	0.002	-2.615	397	0.009	-0.13030	0.04982	-0.22824	-0.03236
	Equal variances not assumed			-2.673	388.156	0.008	-0.13030	0.04874	-0.22613	-0.03447
Subjective_mean	Equal variances assumed	0.035	0.851	-1.280	397	0.201	-0.08456	0.06607	-0.21444	0.04533
	Equal variances not assumed			-1.277	361.061	0.202	-0.08456	0.06622	-0.21479	0.04568
Pbehavior_control_mean	Equal variances assumed	5.468	0.020	1.443	397	0.150	0.09164	0.06351	-0.03322	0.21650
	Equal variances not assumed			1.491	394.796	0.137	0.09164	0.06147	-0.02921	0.21249
Intention_mean	Equal variances assumed	10.731	0.001	-0.606	397	0.545	-0.03827	0.06319	-0.16250	0.08595
	Equal variances not assumed			-0.628	396.007	0.530	-0.03827	0.06095	-0.15810	0.08155
Behavior_mean	Equal variances assumed	3.142	0.077	-0.753	397	0.452	-0.04847	0.06435	-0.17499	0.07804
	Equal variances not assumed			-0.764	380.980	0.445	-0.04847	0.06346	-0.17324	0.07630

4.5.2. ANOVA

The ANOVA test has been run for all factors including age, ethnicity, salary, occupation, education, size of family and the duration of stay in Kuala Lumpur in terms of knowledge, attitude, subjective norm, perceived behavior control, intention and behavior. The result of ANOVA test agreed that there were significant differences between the different groups especially age, education salary.

4.5.2.1. Age

Based on the results there were = significant differences among different age groups in terms of the following variables:

- Attitude (F(3,395)=3.415, P=.018),
- Intention (F(3,395=4.521,P=0.004) and
- Behavior (F(3,395=3.377,P=0.018)

As the significant values were below 0.05, there was a statistically significant different opinion among different age groups towards the mentioned variables. The descriptive analysis results suggested that the age group of "18 to 25 years old" with the following mean:

- Attitude: 4.06
- Intention: 3.64
- Behavior:3.48

has lesser degree of agreement in the mentioned variables (attitude, intention and behavior) than other groups. However, the level of variables was not significantly different among other groups but all in all students aged between 26 and 31 have slightly more level of agreement in all variables.

4.5.2.2. Educational Level

The ANOVA test results for the level of KAP in different educational level were summarized asshown in Figure 4.10. The results of the study indicated that there was a significant difference opinion among the students with different educational level in terms of intention (F(3,395=5.308, P=0.001). Based on the descriptive analysis, the level of intention was recorded lower among undergrads (M=3.64) but higher among master students (M=3.95) than other groups (undergrad, PhD and Post PhD candidates). Additionally, the level of practice, subjective norm, perceived behavior control were slightly higher among master students. These results were clearly supported by ANOVA results in the previous section (age group) as students aged between 26 and 31 have a higher level of agreement in most of the variables; thus, the mentioned age group matched with the master level of education.

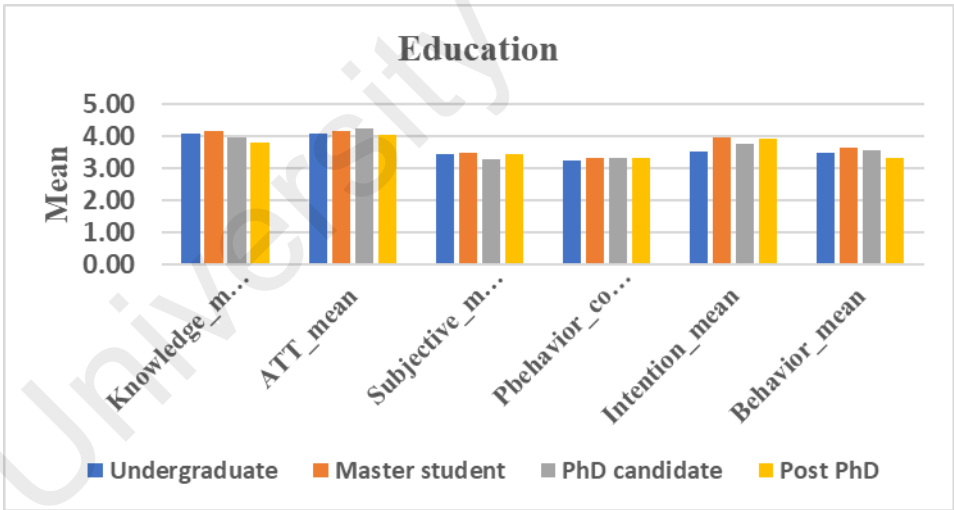

Figure 4.10: The comparison of variables based on educational level

4.5.2.3. Salary

The ANOVA test in this Work suggested that there was a significant difference among the students with different levels of income in terms of:

- Subjective norm (F(3,395)=3.58, P=0.014,
- Perceived behavior control (F(3,395)=5.35, P=0.001 and
- Intention (F(3,395)=4.33, P=0.005

As the significant value levels were below 0.05, there was a statistically significant difference among students with different income level towards mentioned variables. The descriptive analysis results (Figure 4.11) suggested that those students with a salary less than RM2000 have less level of agreement in perceived behavior control (M=3.2) and have the lowest intention (3.6) to practice solid waste management compared with other groups. On the other hand, as the level of income increased (up to RM10000/month), the level of agreement on all variables also increase in most of the cases. Those students with income more than RM10000/month were not following the same trend as others. However, their knowledge was slightly higher than other groups even though levels of agreement on all other variables suddenly dropped and were in 3rd or 4th place (Figure 4.11).

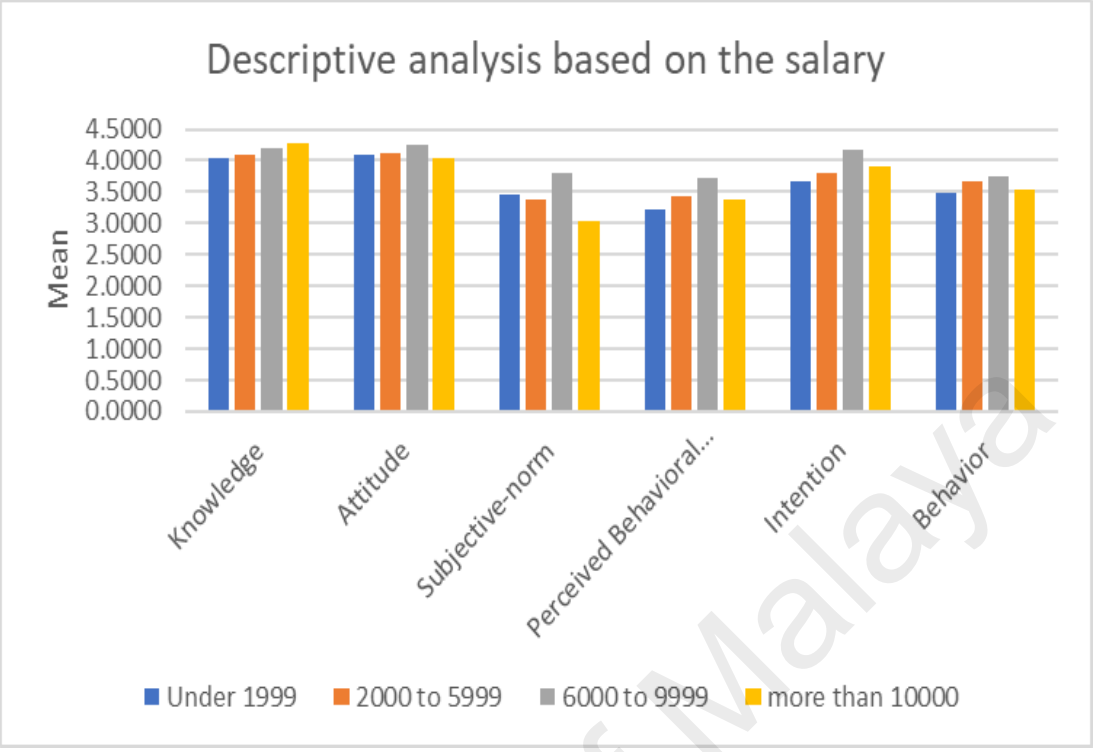

Figure 4.11: The mean comparison of variables based on the salary

4.6. Correlation

Linear regression has been run in order to investigate the relation between dependent variable (intention) and independent variables (attitude, subjective norm, perceived behavior control). The Rsquared amount showed that intention was 46.3% in average affected by attitude, knowledge and subjective norm. The results were summarised in Table 4.5. Based on the table, there is a linear regression between intention and all the variables ($P<0.05$). Based on the results, there was a positive relationship between independent variables and intention. Among all the variables, attitude was the main predictor ($B=0.58$), meaning that if the attitude increased by one unit, the intention will be increasing by 0.58. Subjective norm and perceived behavior control also confirmed to be contributing to the total intention variability by 8% and 7% respectively. The correlation between intention as an independent variable on behavior (dependent

variable) was also calculated (Table 4.5. Results of this Work suggested that there was a linear regression between behavior and intention by 54% which proved that a person intended to participate in waste management activities was more likely to practice better than those with lesser intention.

Table 4.5: Linear regression results for independent variables in respect with intention

Coefficients[a]						
Model		Unstandardized Coefficient B	Std. Error	Standardized Coefficient Beta	t	Sig.
1	(Constant)	-0.059	0.226		-0.263	0.793
	Attitude_mean	0.576	0.057	0.458	10.058	0.000
	Subjective_mean	0.084	0.041	0.088	2.047	0.041
	Pbehavior_control_mean	0.079	0.037	0.079	2.150	0.032

Dependent variable: Intention_mean

Table 4.6: Linear regression result for independent variable (Intention)

Coefficients[a]						
Model		Unstandardized Coefficient B	Std. Error	Standardized Coefficien Beta	t	Sig.
1	(Constant)	1.511	0.163		9.262	0.000
	Intention_mean	0.542	0.043	0.533	12.536	0.000
a. Dependent Variable: Behavior_mean						

4.7.Disscussion

This research aimed to investigate the level of knowledge, attitude and practice of municipal solid waste among UM students.

The theory of planed behavior has been selected for the current study as this theory proved its success in environmental psychology. The results of this Work showed that an implementation of this theory was rather successful in studying KAP towards waste management. The questionnaire was designed as per elements in the theory of planned behavior.

The results confirmed the following hypotheses of this Work:

- **There is a significant difference in the level of KAP on solid waste management among male and female**

This Work indicated that the levels of knowledge, attitude and intention were significantly different among male and female students in UM. Based on the results, female students were significantly more knowledgeable and have a higher level of attitude compared with male students.

- **The higher one's salary, the higher KAP levels**

This hypothesis can not be approved nor accepted by this Work. Results suggested that as the amount of salary increased, the level of KAP also increased up to RM10000/month. However, surprisingly, results specified that the level of KAP dropped for those who were paid more than RM10000/month. This could be because of the fact that the proportion of those who with RM10000 and above per month were only 4% of the whole respondents. Consequently, further research should investigate the relationship between salary and environmental behavior.

- **Intention has a positive relationship with practice**

As per the research by Ajzen (1991), intention is the main predictor of behavior. This Work also supported this method and signified that intention positively affected the actual behavior.

However, the following hypotheses have not been confirmed by the results of this Work:

- **There is a significant difference in the level of KAP among students with different ethnicity**

This Work proved that there was no significant different among students with different ethnicity. It could be because the population of this Work was hemogenic as all of respondents were students.

- **Higher education level leads to a better level of KAP in solid waste management**

Surprisingly, there was no significant difference in KAP level between higher graduate students and lower graduate towards solid waste management. Although the level of intention was significantly higher among master students than other groups but in terms of other variables, there was no significant different. The levels of practice, subjective norm and perceived behaviour control were slightly higher than other groups. Therefore, surprisingly, results failed to indicate direct relations between educational level and the level of KAP.

The correlation analysis found that attitude, perceived behavior control and subjective norm acted as the main predictors of intention. In this Work, attitude was the main predictor of intention while perceived behavior control and subjective norm contributed far lesser than attitude as predictors for intention. This results were supported by

previous studies such as reports done by Davies, Foxall, and Pallister (2002); and Tonglet et al. (2004).

Social norm is the social pressure or responsibility the person feels or believes to certain extend others want a person to participate in a particular task (Ajzen, 1991). In this Work, most of the students were neutral about subjective norm questions, however, they strongly believed that 3Rs were considered as a good behavior in their society. Also, students believed that if they realized that their family members or friends practiced waste management, they would also paticipate even more intensively. A study in NTNU university supported the result of this Work towards subjective norm (Tobolova, 2015). According to the results, the levels of waste reduction, reuse and recycle were high among UM students but they favoured the seperated waste to be collected from their place. Therefore, the waste collection system might be a barrier towards a proper municipal solid waste management that further research must investigate the pre and post behaviors towards solid waste management with different waste collection systems.

CHAPTER 5: CONCLUSION

The main objective of this Work was to investigate the KAP level among UM students towards solid waste management. The theory of planned behavior was employed for this purpose (Ajzen, 1991).

The result of this Work confirmed an acceptable level of knowledge among students towards solid waste management. Descriptive analysis indicated that the level of attitude was high, but seemingly, the majority number of students have a neutral opinion towards subjective norm except for this fact that they believed the behavior of their family/friends has a positive direct effect on their behavior. According to the descriptive analysis results, although students perceived implementing 3Rs was not complicated nor time consuming and does not require too much space, however, the recycling bins were not easily accessible in university campus. They would practice 3Rs more agressively if the wastes were collected from their door to door. Thus, University of Malaya must revisit its solid waste collection methods.

The T-test results specified that the levels of knowledge and attitude were significantly higher among female students compared with male students. However, the level of actual practice was almost the same; female practice solid waste management slightly better than male.

Based on the ANOVA test, levels of attitude, intention and behavior were significantly lower among students aged between 18 and 25 compared with other age groups. Moreover, this group also scored less levels of agreement for most of the variables while students aged between 26 and 31 scored the highest. The ANOVA test result for

education group also supported the previous results, which based on that, undergraduate students (could be related to the individuals aged 18-25) ranked significantly lowest compared with other groups in terms of intention. Master students (could be related to the individuals aged 26-31) scored the highest in most of the cases. Correlation study indicated that there were linear relationships between the intention as a dependent variable and independent variables (attitude, subjective norm and perceived behavior control). The main predictor of intention in this Work was attitude. In addition, the relationship between intention as an independent variable and the actual behavior as a dependent variable has been confirmed by this Work to support the theory of planned behavior by Ajzen (1991).

5.1. Recommendations

5.1.1. Recommendations for University of Malaya

The results of this Work validated that students were already practicing 3Rs and they were familiar with the labelled recycle bins in the university campus but unfortunately, according to them, the bins were not easily accessible in the university campus. Therefore, University of Malaya should manage and relocate the recycle bins in a way that is more accessible or add more recycle bins in the campus area for a better accessibility. Furthermore, during the data collection through friendly conversation with the respondents, they stated that the main library produced the largest amount of waste paper but the number of recycle recycle bins located there was limited and less accessible by many people. From the conversation, I learned that it would be a great if University of Malaya provide a few recylcled paper stations (one side printed papers etc.) around the library so that student could reuse the papers from the stations for printing, drafting and so on.

5.1.2. Recommendations for Further Research

Further research needs to investigate the level of KAP in the society and its relationship between the amount of salary or occupation. Moreover, pre and post investigations would be sufficient when it comes to examine the KAP level within a period of time (longitudinal study) among groups to testify whether providing more accessible recycling stations or door to door waste collection service would improve the level of actual behavior. Therefore, the study of human behavioral change is vital for future environmental planning.

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