



Waste Disposal Awareness, Practice and the Attitude of Selected South African University Students: Implications for Environmental Education

Adejoke C. Olufemi^{1*}, Ugorji I. Ogbonnaya², Andile Mji³ and Murembiwa S. Mukhola⁴

^{1,3,4}*Department of Mathematics, Science and Business Education,*

Tshwane University of Technology, P/Bag X680, Pretoria, 0001, South Africa

²*Department of Mathematics, Science and Technology Education, University of Pretoria,*

P/Bag X680, Pretoria, 0001, South Africa

Telephone: ^{1}<+27788346772>, ²<+27737208026>, ³<+27 12 382 9932>, ⁴<+27123824690>*

E-mail: ^{1}<jokephemmy22@yahoo.com>, ²<ugorji.ogbonnaya@up.ac.za>,*

³mjia@tut.ac.za, ⁴<mukholams@tut.ac.za>

KEYWORDS Environmental Issues. Environmental Information. Greenhouse Gasses. Human Health. Industrialisation. Population

ABSTRACT In recent times, a high rate of industrialisation, population, urbanisation and civilisation has resulted in increased and indiscriminate generation of waste, which has a negative impact on the natural environment. Studies have revealed that waste contributes to about five percent of global greenhouse gas emission leading to climate change which has also given rise to serious human health problems all over the world. This study assessed waste disposal awareness, Practice and Attitude (APA) of students from a South African university. Three hundred and fourteen (314) respondents answered a 23-item APA questionnaire ($r = 0.80$). The quantitative data were analysed through computing descriptive statistics and inferential statistics (Chi-square). The results show that the majority of students displayed an adequate level of APA towards waste disposal. Male students demonstrated higher levels of APA than their female counterparts did. Students ranked newspapers as their most important source of environmental information on waste management and related matters which was followed by the television. Students should be educated as early as possible about the need for conservation of the environment if we expect a sustainable future.

INTRODUCTION

Over the past decades, our planet has been inundated with the hazardous phenomenon of waste management, which is caused primarily by human activities. Waste, according to literature refers to "...any garbage, refuse, sludge, and other discarded materials including solid, semi-solid, or contained gaseous materials, resulting from industrial, commercial, running and agricultural operations, and from community activities..." (Dung et al. 2017: 141). Due to rapid population growth, urbanisation and an improved standard of living, the amount of waste

being generated today has increased beyond expectation compared to the levels of waste found in the past. In fact, it is lamented that "...as the world's population has grown and become more urban and affluent, waste production has risen tenfold and by 2025 it will double again ..." (Hoornweg et al. 2013: 615). Similarly, a World Bank report indicates that with a total global population of 2.9 billion in 2002, approximately 0.64 kg of waste was generated per person daily, which increased to 1.2 kg per person daily with a population of 3 billion in 2012. It is projected that by 2025, the amount of waste that will be generated will increase to 1.42 kg per person on a daily basis with a total population of 4.3 billion people (Ziraba et al. 2016; Francisco et al. 2017).

Like many developed countries such as China, India and the United States, some African countries also face the challenge of dealing with accelerated production of waste. For instance, Nigeria, which is known to be the most populat-

*Address for correspondence:

A. C. Olufemi

Department of Mathematics, Science and Business Education,

Tshwane University of Technology,

P/Bag X680, Pretoria, 0001, South Africa

Telephone: +27788346772

E-mail: jokephemmy22@yahoo.com,

olufemiac@tut.ac.za

ed, urbanised and one of the largest producers of waste in Africa generates over 32 million tons of solid waste on a yearly basis (Bakare 2018). Similarly, in South Africa, it is estimated that more than 108 million tons of waste is generated annually (Greyling 2017) and in 2017 alone, approximately 42 million tons of general wastes were generated (Department of Environmental Affairs 2018). This quantity of waste produced in this nation has increased over the years due to the high rate of industrialisation, increased population, urbanisation, growth in economy and standard of living (Department of Environmental Affairs 2018).

Of this total amount of waste being generated, it is reported that only ten percent is recycled (Bothma 2014) while a larger percentage is dumped on landfills, which is the major means of waste disposal and treatment of waste in the country (Naidoo 2017). During this process, some dangerous gases such as Methane (CH_4) are released from the landfill sites, which affect climate changes and result in serious health problems among the people living around those affected areas (Naidoo 2017). A number of studies from different parts of the world have also reported that solid waste is contributing to about five percent of global greenhouse gas emission (Turner et al. 2015; Zhou et al. 2017). Several other studies have indicated that waste could have adverse effects not only on human health and the environment, but also on the economy if not properly disposed of or managed (Department of Environmental Affairs 2018; Kumar et al. 2017).

Despite all the attempts to address this problem, the quantity of waste produced all over the world continues to increase daily. In fact "...in Africa, it is estimated that currently the rate at which solid waste is growing in urban areas is much faster than the urbanization itself..." (Francisco et al. 2017: 82). This continuous increase in the volumes of waste and the damaging effects have been a cause of concern not only in South Africa, but also in every other nation of the world. One major concern is that in spite of the increase in waste generation many people around the world are not even aware of the impact of their negative actions on the environment and even their health (Bhutta et al. 2011; Department of Environmental Affairs 2011; McKay et al. 2015). Even those that already have this awareness continues to dispose their waste any-

how and anywhere not even minding the consequences (Licy et al. 2013). Smokers, for example, engage in dumping waste, because they lack the awareness of how their cigarette butts deposited at any convenient site, affect the environment and continue to do so. Similarly, in the case of commuters, pedestrians and people who carelessly dispose of wrappers, cans or waste items in public areas (Conserve Energy Future 2019) are guilty of contributing to the existing amount of waste. Studies have indicated that such neglect and irresponsible behaviour of humans can be attributed to a deficit in adequate environmental education (Yoada et al. 2014; McAllister 2015; Conserve Energy Future 2019).

Chapter 36-3. of Agenda 21 of the 1992 United Nations Conference on Environment and Development (UNCED), Rio de Janeiro states that "...Education is critical for promoting sustainable development and improving the capacity of the people to address environment and environmental issues" (Hens et al. 2010: 667). A similar proposition was made during the 2002 World Summit on Sustainable Development (WSSD) held in Johannesburg. Here, it was emphasised that the only solution to the various environmental issues threatening our environment is education. It is therefore very important that people should be given an opportunity where they can learn about the environment, its associated problems and environmental protection and conservation (Kanyimba et al. 2014). This is very important for young people because one way or the other, they also contribute to the pollution of the environment in their various territories (that is, on campuses and dormitories) through their littering and other habits that affect the environment negatively. The skills and knowledge they will acquire through this education would help to raise their level of awareness and change their negative lifestyles; it will also encourage them to respect the environment (Ifegbesan et al. 2017).

Waste Disposal and Waste Management in Schools

The prevalent tendency globally from primary to tertiary institutions is to view *littering* as a practice that is rampant among students. This can be confirmed by a study conducted in Bucharest from various educational institutions (pre-schools, primary and secondary schools,

high schools and special schools) on waste disposal. In this study, it was reported that in all of these institutions, students generated different forms of waste in high volumes (Ioja et al. 2012). Just like elementary and high schools, quite a number of studies have also reported large volumes of wastes being generated from higher education institutions campuses on a daily basis (Ifegbesan et al. 2017; Tangwanichagapong et al. 2017; Zhang et al. 2011). For example, a study conducted in a Bangladesh university reported that about 4,757 kg of solid wastes are generated per day from different locations within the campus (Saadat et al. 2012).

Other than the above studies, several other studies have also investigated on waste disposal or waste management among students in various institutions of learning from different countries, which are further highlighted.

The two terms waste disposal and waste management have been used differently in literature depending on various authors of existing publications. However, some have used the two terms interchangeably. Nevertheless, most environmental researchers agree on various aspects of these phenomena (waste disposal) (Daniel and Ibok 2013; Shahzadi et al. 2018) and waste management (Barloa et al. 2016; Dung et al. 2017; Licy et al. 2013). However, some of these studies focused on both elementary and secondary schools (Licy et al. 2013) while some on Higher Education Institutions (HEIs) (Barloa et al. 2016). These studies investigated different variables such as habits, practice, awareness, attitude knowledge and beliefs (Yakob et al. 2012; Daniel and Ibok 2013; Licy et al. 2013; Ahmad et al. 2015; Barloa et al. 2016).

For instance, a study conducted in Nigeria on waste disposal habits revealed that the environments of university students' residences were generally poor because of their indiscriminate waste disposal habits (Daniel and Ibok 2013). An Indian study conducted on awareness, attitude and practice of school students towards waste disposal revealed that students were well aware of waste disposal and management, but their waste disposal practices were inefficient (Licy et al. 2013). Ifegbesan (2010) investigated secondary school students' understanding and practice of waste management. This author reported, in his findings, that students were aware of waste problems in their school compounds, but displayed poor waste management practic-

es. Desa et al. (2012) assessed the attitudes and behaviour concerning solid waste management among first-year students in a certain university in Malaysia. The results revealed that sixty percent of the students had a positive attitude and high levels of practice and responsibility towards solid waste management. The authors went further to say that despite their positive attitude and good practice, there is still need for the university to encourage students by creating more awareness and educating them on managing solid waste on campus (Desa et al. 2012).

Saha (2013) conducted a study among some university students in selected hostels regarding awareness of waste disposal and perceived effects on their health. The study revealed that although students were aware of solid waste disposal, but they were not much concerned about the effects it could have on their health. However, some of these students were found to be suffering from various health problems such as diarrhoea, dengue, skin infections and eye infections, which were spread, by flies and rats from waste disposed by them.

Mdlozini (2015) evaluated the knowledge, practice and attitude of students towards waste management and recycling from a South African University. The study reported that students' level of knowledge was poor which also affected their attitudes and practice towards waste management and recycling. This author went further to suggest that students' attitudes and practice may be improved by education and policy enforcement (Mdlozini 2015).

Quite a number of studies as stated above have been published on waste disposal and management from other countries and different institutions of learning. However, in South Africa, there have been limited studies reported which have mostly been from elementary schools (that is, Hens et al. 2010; Kanyimba et al. 2014; van Niekerk 2014). For example, the study of Kayimba et al. (2014) focused on the effectiveness of an environmental management system in selected South African primary schools while that of Hens et al. (2010) focused on monitoring environmental management at primary schools in South Africa. To the best of the researchers' knowledge, only few studies have been found in South Africa, which addressed the aspects of students' awareness, knowledge, practice, and attitudes (that is, Mdlozini 2015; van Niekerk 2014). The study of van Niekerk (2014) focused

on both primary and high school students in the Mbeki Municipality, Mpumalanga province while that of Mdlozini (2015) focused on students from a university in Durban, Kwa-Zulu Natal Province.

Apart from investigating only these three main variables, the researchers of this study have also explored them from a demographic perspective focusing on demographic factors or variables. Quite a number of studies conducted on waste management/disposal have reported that demographic variables of individuals can actually influence their awareness, attitude, knowledge and practices (Ramos and Pecajas 2016; Ferrer 2015; Dung et al. 2014; Laor et al. 2018).

Some of these demographic factors or variables are gender, marital status, occupation, religion, race, age, grade or academic level. For example, a study conducted among medical students on understanding and practice about solid waste disposal and recycling revealed that, sixty-five percent of the students displayed higher levels of understanding, where males had significantly better knowledge compared to females (Ehrampoush and Moghadam 2005). Another study conducted in Nigeria among high schools students indicated that their level of knowledge, attitude and practice regarding waste management was relatively moderate and significant differences were reported between males and females. However, females were found to be more environmentally aware than males (Adeolu et al. 2014). A similar study conducted in Nigeria on students' knowledge and attitude towards solid waste management indicated that students' knowledge was low and there were no significant differences between males and females (Dung et al. 2017). Likewise, in Philippines a study on students' waste management practices showed no significant differences between males and females (Ferrer 2015).

Sources of Environmental Information

Environmental information is very crucial in helping young people acquire knowledge about their environment, its associated problems and necessary steps to bear in mind when addressing them. Information acquired through the different or various sources will go a long way in raising their awareness and helping them change their negative attitude or behaviour to be positive. These sources may range from people to media sources (such as television, newspapers

and internet) and schools. Television has long been the major source of environmental information but nowadays, especially since the 20th century, with the advent of advanced technology, dependence on internet seems to be taking over predominantly among young people (Keinonen et al. 2014; Kukkonen et al. 2012).

Several studies have been conducted on sources of environmental information across the world and they came out with various results. For instance, Keinonen et al. (2014) conducted a study on environmental information sources among students from three Nordic-Baltic Countries. The results indicated that in Finland, newspapers were found to be the most important source; in Sweden schools or educational context was the most important source. Lastly in Lithuania, environmental organisations were the most prevalent sources. In another study conducted in Finland among university students, it was reported that television was students' most favourite source for receiving environmental information, then secondly the newspaper and thirdly the internet (Kukkonen et al. 2012). A similar study conducted in Malaysia among Higher Education students reported the Internet as their most preferred choice for receiving environmental information. The authors went further to suggest that other media forms should be appreciated as they can also be effectively used in disseminating environmental information (Ahmad et al. 2015).

Adequate information or knowledge about the various environmental issues confronting our environment is very crucial for young people of today as early as possible. This is because they will grow up to be leaders and decision makers of tomorrow. Therefore, they are depended on as active agents of change towards a sustainable future. The reason is that they are "able to both identify issues that concern them and propose new ones of their own".... (Van Niekerk 2014: 14). For us then to be able to prepare them for this great task ahead of them, it is therefore, very crucial to understand their present status, views and ideas with regard to environmental issues.

The motivation for this particular study was prompted by student observation; students litter on campus despite the fact that there are waste bins at various designated points. This

they do may be unconsciously on a daily basis not even minding the effect waste may have on the environment and public health. Some of the materials deposited by students are items that could contain substances, which could be harmful to human health and the environment especially when waste pickers do not timeously collect them. Among these were items such as used papers, cigarette butts, wrappers, bottles and cans, fruit peels, food remains, food containers, plastics and a host of others. It may be generally assumed that when it comes to littering, university students should be more enlightened, educated and mature than learners at school. Unfortunately, this habit of littering is prevalent. This actually prompted the researchers to investigate the phenomenon of waste disposal awareness, practice and attitude of selected university students.

It is hoped that this study will contribute to the knowledge and insight gained from other studies on waste disposal/management in schools in South Africa and beyond.

Research Objectives

The objectives of this study were as follows. They were to determine:

- ♦ The level of awareness, practice and attitude (APA) of university students with regards to waste disposal;
- ♦ The influence of students' gender on the each of the three APA variables; and
- ♦ Students' most important sources of environmental information.

METHODOLOGY

Quantitative Approach

A quantitative approach (Albers 2017; Brown 2017) was employed to determine statistics concerning the university students' responses to the closed statements.

Participants

Participants for this study were 314 males and females from a South African University. The participants were randomly selected from the various departments in the seven faculties namely;

Arts Economics and Finance, Engineering, Humanities, ICT, Management and Sciences.

Instruments and Procedures

The data for this study was collected during the winter season in the year 2015. Data was collected by means of a questionnaire consisting of a combination of three parts. The first part requested participants to provide their gender. The second part comprised 23 items with 'Agree/Disagree' and 'Not sure' response scales on issues relating to waste disposal. This second part was further divided into three sections namely: awareness which consisted of 10 items, practice (6 items) and attitudes (7 items). The third part was a closed-ended question consisting 10 items requesting the students to indicate their information sources about waste issues. In this part, students were instructed to choose from a list of 10 items, the sources from which they received information regarding waste disposal and other environmental issues. In this section, '1' was the highest where '10' was the lowest, and '0' was for students with no sources of information.

The items of the questionnaire were adapted from other questionnaires (for example, Ifegbesan 2010; Licy et al. 2013; Olufemi 2012; Saha 2013; Olufemi et al. 2016). The reliability of the instrument was determined by computing Cronbach's Alpha. The alpha value was found to be 0.80.

The questionnaires were administered to students by the help of research assistants. They were completed and returned a week later. All analyses in this study were computed using IBM® SPSS® Statistics® version 23.

RESULTS

In all, a total number of 314 students, 175 (55.7%) who were males and 137 (43.6%) females participated in this study (Table 1).

Table 1: Biographical data of students (N =314)

<i>Gender</i>	<i>n</i>	<i>%</i>
Male	175	55.7
Female	137	43.6
Missing values	2	0.6

Of the 600 questionnaires distributed to participants, 314 (52%) questionnaires were returned. In analysing the data for this study, de-

scriptive statistics were employed. All analyses in this study were computed using IBM's SPSS[®] version 19. This questionnaire was divided into three sections namely: Awareness, Practice and Attitude. Descriptive statistics specifically frequency count and percentages were used for the analysis of each item of the three variables (Awareness, Practice and Attitude).

Awareness about Waste Disposal

The results of the respondents' awareness of waste disposal are fully explained in Table 2. Most of the students demonstrated a high level of awareness about waste disposal. Majority of the students (71.4% and 87.8%) agreed that they have heard about waste disposal and environmental pollution respectively while 28.3 percent and 11.9 percent did not agree. Most of the students (82.7% and 80.5%) also responded that improper waste disposal can result in the pollution of the environment and that there is a link between the environment in which we live and

human health respectively. A larger percentage of the students (80.8% and 84.7%) responded that improper waste disposal can be harmful to human health and that they are aware of the fact that waste bins are placed at designated points on campus respectively. Furthermore, 75.5 percent agreed to the fact that awareness about waste disposal is essential on the campus while majority (81.6%) declared that the municipality or school management have a role to play in the control of improper waste disposal. Barely half (57.2%) of the students considered improper disposal of waste as a problem at the campus area and unfortunately, more than half (60.2%) of them never heard of the world environment day.

Practice Regarding Waste Disposal

The result of students' practice regarding waste disposal are fully explained in Table 3. The majority of the students displayed a high level of practice regarding waste disposal. Most (67.9% and 80.1%) of the students reported that

Table 2: Awareness of waste disposal

<i>Items</i>	<i>Agree</i>	<i>%</i>	<i>Disagree</i>	<i>%</i>
1 Have you ever heard about Environmental pollution?	274	87.8	37	11.9
2 Have you ever heard about waste disposal?	217	71.4	86	28.3
3 Are you aware that improper waste disposal can result in the pollution of the environment?	254	82.7	52	16.9
4 Do you think there is a link between the environment in which we live and human health?	247	80.5	60	19.5
5 Do you think that improper waste disposal can be harmful to human health?	248	80.8	60	19.4
6 Are you aware of waste bins placed at designated points on campus?	260	84.7	47	15.3
7 Do you think awareness about waste disposal is essential on our campus?	229	75.3	75	24.7
8 Have you ever considered improper disposal of wastes as a problem at the campus area?	175	57.2	131	42.8
9 Do you think that the municipality or school management have a role to play in the control of improper waste disposal?	253	81.6	57	18.4
10 Are you aware that the World Environment day is celebrated yearly on the 5 th of June?	123	39.8	186	60.2

Table 3: Practice regarding waste disposal

<i>Items</i>	<i>Agree</i>	<i>%</i>	<i>Disagree</i>	<i>%</i>
1 I throw away my wastes just anywhere on campus	98	32.1	207	67.9
2 I am conscious of pieces of paper and other waste materials whenever I come across them	97	31.9	207	68.1
3 I make use of waste bins on campus in disposing my wastes	241	80.1	60	19.9
4 I support the practice of reduce, reuse and recycling of wastes	206	68.9	92	30.8
5 I am ready to change my throw away habits in order to keep our campus clean	246	80.7	58	19.0
6 I have attended training, seminar or workshop on environmental matters before	93	30.6	209	68.8

they do not just throw waste around the campus and that they support the practice of reducing, reusing and recycling waste. More than half (68.1%) of the students confessed that they are not conscious of pieces of paper and other waste materials whenever they come across them. Majority (80.1%) declared that they make use of waste bins on campus in disposing their wastes. Unfortunately, more than half (68.8%) of them responded that they have never attended training, seminar or workshop on environmental matters before. Almost all the students (80.7%) responded that they are ready to change their throw away habits in order to keep the campus clean.

Attitude towards Waste Disposal

The results of students' attitude towards waste disposal are fully explained in Table 4. Some of the students displayed positive attitudes, some negative attitudes, while some of were neither positive nor negative (not sure). Students (31%) reported that concern about littered waste is the sole responsibility of the campus cleaners and not their duty while 31.7 percent of them disagreed and the majority (37.3%) were not sure. A few of the students (27%) responded that they were comfortable seeing waste littered around the campus while a larger number (62%) responded that they were not comfortable, and the remaining were unsure. More than half (61.4%) of the students reported that they have a role to play in minimising irresponsible waste disposal or littering on cam-

pus, by setting an example of using bins and reprimanding those who littered. Many of the students (60.1%) declared that they are prepared to participate in the eradication of improper waste disposal within their campus community. Majority (71.9%) agreed that individual responsibility is very important in caring for and protecting the environment. Just about half (48.3%) agreed that people that pollute the environment should be fined while the rest were either not sure or they disagreed. Approximately half (51.5%) of the students disagreed with the statement "In my view, environmental problems in South Africa are temporary, so there is no need to worry about them" while 21.5 percent disagreed and 26.6 percent were not sure.

The Effect of Gender on Awareness, Practice and Attitudes

In this study, a cross-tabulation of the effect of gender on the three variables awareness, practice and attitudes were analysed by computing a Chi-square test. It was found that for all the variables, the p values ($p > 0.5$) revealed no significant differences with respect to students' gender even though the percentage scores for males were higher than females (Tables 5, 6 and 7).

Students' Sources of Environmental Information

Students were instructed to rank different sources where they acquire information about

Table 4: Attitude towards waste disposal

<i>Items</i>	<i>Agree</i>	<i>%</i>	<i>Disagree</i>	<i>%</i>	<i>Not sure</i>	<i>%</i>
1 Concern about littered waste is the sole responsibility of our campus cleaners and not my duty	94	31.0	96	31.7	113	37.3
2 I am comfortable seeing waste littered around the campus	81	27.0	186	62.0	32	10.7
3 I have a role to play in minimising irresponsible waste disposal or littering on campus	186	61.4	42	13.9	75	24.8
4 I am prepared to participate in the eradication of improper waste disposal within my campus community	181	60.1	40	13.3	80	26.6
5 Individual responsibility is very important in caring for and protecting the environment	217	71.9	33	10.9	52	17.2
6 People that pollute the environment should be fined	146	48.3	66	21.9	89	29.5
7 In my view, environmental problems in South Africa are temporary, so there is no need to worry about them	65	21.5	156	51.5	80	26.4

Table 5: Students' gender against awareness

Awareness	Gender		P value
	Male	Female	
<i>Have You Ever Heard about Environmental Pollution?</i>			
Yes	157 (57.5)	116 (42.5)	0.292
No	17 (45.9)	20 (54.1)	
<i>Have You Ever Heard about Waste Disposal?</i>			
Yes	126 (58.3)	90 (41.7)	0.294
No	45 (51.7)	42 (48.3)	
<i>Are You Aware that Improper Waste Disposal can Result in the Pollution of the Environment?</i>			
Yes	144 (56.9)	109 (43.1)	0.426
No	27 (50.9)	26 (49.1)	
<i>Do You Think There is Any Link between the Environment in Which We Live and Human Health?</i>			
Yes	140 (56.9)	106 (43.1)	0.789
No	33 (55.0)	27 (45.0)	
<i>Do You Think that Improper Waste Disposal Can Be Harmful to Human Health?</i>			
Yes	141 (57.1)	106 (42.9)	0.75
No	34 (54.8)	28 (45.2)	
<i>Are You Aware of Waste Bins Placed at Designated Points on Campus?</i>			
Yes	147 (56.8)	112 (43.2)	0.65
No	25 (53.2)	22 (46.8)	
<i>Do You Think Awareness Waste Disposal is Essential on Our Campus?</i>			
Yes	132 (57.9)	96 (42.1)	0.773
No	42 (56.0)	33 (44.0)	
<i>Have You Ever Considered Improper Disposal of Wastes as a Problem at the Campus Area?</i>			
Yes	94 (54.0)	80 (46.0)	0.176
No	79 (60.3)	52 (39.7)	
<i>Do You Think that the Municipality or School Management have a Role to Play in the Control of Improper Waste Disposal?</i>			
Yes	141 (56.0)	111 (44.0)	0.884
No	33 (57.9)	24 (42.1)	
<i>Are You Aware that the World Environment Day is Celebrated Yearly on the 5th of June?</i>			
Yes	68 (55.7)	54 (44.3)	0.823
No	106 (57.0)	80 (43.0)	

Table 6: Students' gender against practice

Practice	Gender		P value
	Male	Female	
<i>I Throw Away My Waste Just Anywhere on Campus</i>			
Yes	51 (52.6)	46 (47.4)	0.519
No	117 (56.5)	90 (43.5)	
<i>I Am Conscious of Pieces of Paper and Other Waste Materials Whenever I Come Across Them</i>			
Yes	56 (58.3)	40 (41.7)	0.044
No	111 (53.6)	96 (46.4)	
<i>I Make Use of Waste Bins on Campus in Disposing My Waste</i>			
Yes	134 (55.8)	106 (44.2)	0.728
No	32 (53.3)	28 (46.7)	
<i>I Support the Practice of Reduce, Reuse and Recycling of Waste</i>			
Yes	121 (59.0)	84 (41.0)	0.067
No	42 (45.7)	50 (54.3)	
<i>I Am Ready to Change my Littering Habits in Order to Keep Our Campus Clean</i>			
Yes	135 (55.1)	110 (44.9)	0.646
No	31 (53.4)	27 (46.6)	
<i>I Have Attended Training, Seminar or Workshop on Environmental Education/Waste Management Before</i>			
Yes	50 (53.8)	43 (46.2)	0.958
No	114 (54.8)	94 (45.1)	

Table 7: Students' gender against attitudes

Attitude	Gender		P value
	Male	Female	
<i>Removal of Littered Waste is the Sole Responsibility of Our Campus Cleaners and Not My Duty</i>			
Agree	51 (54.8)	42 (45.2)	0.569
Disagree	50 (52.1)	46 (47.9)	
Not sure	67 (59.3)	46 (40.7)	
<i>I am Comfortable Seeing Waste Littered Around the Campus</i>			
Agree	45 (56.3)	35 (43.7)	0.969
Disagree	103 (55.4)	83 (44.6)	
Not sure	19 (57.6)	14 (42.4)	
<i>I Have a Role to Play in Minimising Irresponsible Waste Disposal or Littering on Campus</i>			
Agree	101 (54.6)	84 (45.4)	0.553
Disagree	21 (50.0)	21 (50.0)	
Not sure	45 (60.0)	30 (40.0)	
<i>I Am Prepared to Participate in the Eradication of Improper Waste Disposal Within my Campus Community</i>			
Agree	105 (58.3)	75 (41.7)	0.952
Disagree	17 (42.5)	23 (57.5)	
Not sure	44 (55.0)	36 (45.0)	
<i>Individual Responsibility is Very Important in Caring For, and Protecting the Environment</i>			
Agree	122 (56.5)	94 (43.6)	0.03
Disagree	16 (48.5)	17 (51.5)	
Not sure	28 (53.9)	24 (46.2)	
<i>People that Pollute the Environment Should Be Fined</i>			
Agree	78 (53.8)	67 (46.2)	0.032
Disagree	36 (54.5)	30 (45.5)	
Not sure	53 (59.6)	36 (40.4)	
<i>In My View, Environmental Problems Such as Waste Disposal in South Africa are Temporary, So There is No Need to Worry About Them</i>			
Agree	35 (54.7)	29 (45.3)	0.589
Disagree	82 (52.6)	74 (47.4)	
Not sure	50 (60.0)	32 (40.0)	

waste and other environmental matters in order of preference. It can be seen from Table 8 that students rated newspapers the highest as the most informative source. This was followed by television and at the other end; extra-curricular activities and school lectures were ranked as the least informative sources. Nonetheless, 60

Table 8: Ranking of students' sources of information

Sources of information	Ranking
Newspaper	1
Television	2
Internet	3
Radio	4
Parents	5
Friends	5
Magazine	7
Books	7
Extra-curricular activities	9
School lecture	10

students reported that they did not have any sources where they received information.

DISCUSSION

This study sought to examine waste disposal awareness, practice and attitudes of students from a South African university. The results of the study are discussed and further compared with those reported in literature next. Firstly, with regard to awareness, the results indicated that most of the students were aware about waste disposal issues. For instance, they responded that they know about waste disposal and that improper waste disposal can result in the pollution of the environment, which cause serious health problems for humans. These findings concur with other studies where it was reported that students were aware and familiar with waste disposal issues (that is, Desa et al. 2011; Desa et

al. 2012; Saha 2013; Shahzadi et al. 2018). On the contrary, a study conducted in Bucharest from different educational institutions reported that most students from these various institutions demonstrated insufficient awareness regarding waste issues (Ioja et al. 2012).

However, for the item posing the question: "Are you aware that the world environment day is celebrated annually on the 5th of June?" more than half of the students responded that they were not aware. This is surprising, because environment day is an event that was established by the United Nations Environment programme in 1972. Since then, it has always been celebrated every year on 5 June in order to raise global awareness about taking positive action to protect nature and planet Earth. It could be assumed that the reason most of the students were not aware of this event could be that this event might not be celebrated in schools.

With regard to waste disposal practice, students generally had good practice regarding waste disposal. For instance, in the item that read, "I throw away my waste just anywhere on campus," more than half of the students responded that they do not. Furthermore, the majority of the students reported that they make use of waste bins on campus in disposing their waste. The results of this study correspond with a study conducted in Malaysia among first-year university students where it was reported that all the students showed high levels of practice and responsibility regarding solid waste management (Desa et al. 2012). The researchers further elaborated on the fact that the university still needs to enhance students' awareness through education on managing solid waste on campus (Desa et al. 2012).

However, in most studies, the trend has been that students had poor practice towards waste disposal or management (Arora and Agarwal 2011; Daniel and Ibok 2013; Ifegbesan 2010; Shahzadi et al. 2018). For example, in a study conducted in Rajasthan on knowledge, attitude and practice regarding waste management among university students in selected students' hostels reported low and less favourable waste management practice (Arora and Agarwal 2011). Poor waste practice or habit towards waste disposal was similarly reported among university students in Nigeria (Daniel and Ibok 2013).

Findings pertaining to the aspect of attitudes reveal that students also demonstrated a good attitude towards waste disposal, which also agrees with other studies (Desa et al. 2012; Ahmad et al. 2015). Contrary to this findings, are other investigations among university students in India (Saha 2013), Malaysia (Desa et al. 2011) and Rajasthan (Arora and Agarwal 2011) reporting that the majority had poor or low levels of caring about solid waste management. In summary, this study reports a good level of awareness, attitude and practice among students with regard to waste disposal, which almost tallies with a study conducted in Ethiopia (Yemaneh et al. 2017). These authors reported that the majority of the participants had good knowledge (81.8%), positive attitudes (77.5%) and good practice (76.9%) towards waste management (Yemaneh et al. 2017). This present study also examined the influence of gender on the other three main variables (awareness, practice and attitudes). The results reveal that for all the three variables tested, there were no significant differences with respect to gender. However, other studies conducted revealed significant gender differences with to males demonstrating higher levels than females (Ehrampoush and Moghadam 2005; Ekpoh and Ekpoh 2011) and females demonstrating higher levels than males (Yakob et al. 2012; Adeolu et al. 2014). Nonetheless, in agreement with the present study some studies also found no significant differences between the tendency to litter between males and females (Aminrad et al. 2010; Saha 2013; Ferrer 2015; Dung et al. 2017).

In summary, students rated newspapers as their most useful source of information followed by the television and internet. These findings correspond with a study conducted in Finland where newspapers were students' most important source of environmental information (Keinonen et al. 2014). The second and third most important sources of environmental information for students were television and the internet. This is also consistent with findings from another study conducted in Finland where the majority of the participating students also identified the television as their most important sources of environmental information followed by the newspaper and the Internet (Kukkonen et al. 2012). On the other hand, books, extra-curricular activities and lastly, school lectures were not found to be very useful sources of information,

because students ranked them as least informative sources. Whereas, a particular study conducted in Sweden revealed that students mostly received their environmental information from school or educational context (Keinonen et al. 2014). Also in the same study, environmental organisations were reported to be the most predominant source of environmental information for students in Lithuania.

Extra-curriculum activities not being an important source of information to students in this study could be that this unit does not include in their programmes, activities, which are able to create awareness and educate students about waste and other environmental issues. Finally, it is to be noted that 60 students reported that they did not even have any sources to obtain information about environmental matters. It is certain that this may be the case of many other students that were not part of this study. The implication is that, many of the students may not even reveal any awareness in connection with disposal of waste occurring around them. They are absorbed by their own daily routines and do not focus on how to get rid of waste.

CONCLUSION

This study investigated waste disposal awareness, practice and the attitude of students at a South African University. The purpose of the study was threefold. Firstly, waste disposal awareness, practice and attitude (APA) of students were determined. Secondly, the study determined the effect of students' gender in relation to the each of the three APA variables. Thirdly, the most important of students' environmental information sources were determined.

The findings reveal that majority of the students displayed high levels of awareness, practice and positive attitudes towards waste disposal issues. The analysis of gender according to all three variables shows no significant differences between male and females. With regard to sources of environmental information, students ranked the media (newspapers) as the highest then followed by television and internet. Although, the participants of this study may have had appropriate levels of awareness, practice and attitudes, it is very important that educational institutions, government as well as non-governmental organisations should still make

serious efforts to invest in sustainable awareness-raising projects involving students at all levels of education as early as possible. These values will help in equipping and preparing them to take action in addressing present and future environmental challenges. Furthermore, these values will not remain or end with them, but will also be passed on to the next generation. Based on these results, it was concluded that, in order to reach both genders of students in different countries and to benefit more from all sources of information, a variety of media should be used in educating students and the rest of the population for the purpose of sustainability.

RECOMMENDATIONS

The results of this study, which have transpired from the data analysis, gave rise to the following recommendations that are advanced here. All over the world, environmental issues are gaining increasing impetus on a daily basis. It is therefore, very important that necessary actions are taken in order not to pass on to the future generations environments that are destroyed.

Generally, in this study students had a moderate level of the awareness of responsible waste disposal. However, despite being aware to some extent they still engaged in littering, showing little awareness of the devastating effects litter can have on humans and the environment. As it was earlier mentioned by the researchers of this study that from time to time students were found throwing their waste carelessly and sometimes unconsciously just anywhere on campus. In order to improve on the awareness they seem to have already, there is still a need for serious education and raising an awareness on campus about waste disposal and its impact on human beings, the environment and the general ecosystem.

The university management could try to establish a specialised unit on campus, which could function under the Directorate or Department of extra-curricular studies that will focus on educating students about environmental matters in general. It was reported in this study that majority of the students responded that they do not attend training sessions, seminars or workshops on environmental matters. Therefore, programmes such as workshops, seminars, cam-

paings, environmental clubs and excursions or field trips could be organised from time to time.

Through these, students are occasionally provided with information relating to waste disposal management (that is, reducing, reusing and recycling of waste) and being informed on the other environmental issues. This is very essential in the sense that it will go a long way in helping students taking action to protect and preserve the environment further for the benefits of the future generations. Whatever information they receive through this unit may serve as a means of supplementing what they learn within the classroom.

It could be clearly seen from the findings that the majority of students responded that they are not aware of the long established Environment day, which is celebrated annually on 5 June. Through the specialised unit, students may be sensitised to the danger of litter and can be encouraged to participate in celebrating the Environment day and other environmental events in the future.

In addition, quite unexpectedly, this study's results indicated that students' highest sources of environmental information were the media (newspaper) which were followed by the role of television and then the internet and radio. Furthermore, other informative sources were reported to be magazines, books, extra-curricular activities and lastly university lectures. It could be clearly seen in Table 8 that students rated media as a powerful, informative source even to the extent that they are deemed as more effective than sources such as lectures. It is very important that students are made aware that a variety of sources is needed where students can benefit considerably from education instead of depending only on the media. In addition to this, a website could be created where lectures about waste issues are published on a weekly basis to inform students about detailed and adequate environment issues.

The government and universities' management could consider incorporating waste management issues into the various academic programmes at various institutions. For example, the principles of waste hierarchy (reduce, reuse and recycle) which are already incorporated into the school curriculum in other countries could also be implemented in South African schools. This will give all students an opportunity to learn and it will provide them with a detailed under-

standing and knowledge of all areas when it comes to the environment and its associated problems. It will also teach citizens to take responsibility for their own safety and nature conservation. Not only this, this principle if introduced into South African schools will help in reducing the amount of waste being generated thereby focusing on cost effective projects to deal with waste management and removal thereof. They will become aware of the value of recycling and using waste to create new products.

The problem of waste should not only be left to the government alone to solve, it is the responsibility of every individual to make a concerted effort to solve this problem. That is why it is very crucial that everyone is equipped with proper education that will facilitate taking the best decisions with regard to the perseverance of the environment. Pollution is a reality and waste management should be dealt with, since it remains a crucial aspect to consider as it affects the human's survival on planet earth. Finally, research studies on waste issues should be strengthened in the various institutions of learning in South Africa, in order to be proactive and to address the problem of this life-threatening phenomenon.

LIMITATIONS

One major limitation of this paper is that the study was only conducted at a single university. The intention of the researchers earlier was to conduct the study in at least five universities but due to reason beyond their control, this was not possible. The researchers plan to look into more universities in the near future.

ACKNOWLEDGEMENTS

The researchers of this study are grateful to the Deans office, Faculty of Humanities, Tshwane University of Technology, South Africa for financial support.

REFERENCES

- Adeolu AT, Enesi DO, Adeolu MO 2014. Assessment of secondary school students' knowledge, attitude and practice towards waste management in Ibadan, Oyo State, Nigeria. *Journal of Research in Environmental Science and Toxicology*, 3(5): 66-73.
- Ahmad J, Noor SMD, Ismail N 2015. Investigating students' environmental knowledge, attitude, prac-

- tice and communication. *Asian Social Science*, 11(16): 284-293.
- Albers MJ 2017. Quantitative data analysis - in the graduate curriculum. *Journal of Technical Writing and Communication*, 47(2): 215-233.
- Aminrad Z, Azizi M, Wahab M, Huron R, Nawawi M 2010. Environmental awareness and attitude among Iranian students in Malaysian universities. *Environment Asia*, 3: 1-10.
- Arora L, Agarwal S 2011. Knowledge, attitude and practice regarding waste management in selected hostel students of university of Rajasthan, Jaipur. *International Journal of Chemical, Environmental and Pharmaceutical Research*, 2(1): 40-43.
- Bakare W 2018. Solid Waste Management in Nigeria. BioEnergy Consult, July 25. From <<https://www.bioenergyconsult.com/solid-waste-nigeria>> (Retrieved on 15 February 2019).
- Barloa EP, Lapie LP, De la Cruz CPP 2016. Knowledge, attitudes, and practices on solid waste management among undergraduate students in a Philippine State University. *Journal of Environment and Earth Science*, 6(6): 146-153.
- Bhutta MKS, Omar A, Yang X 2011. Electronic waste: A growing concern in today's environment. *Economics Research International*, Article ID #474230, 8 pages.
- Bothma B 2014. South Africa Drowning in Dirt. eNews Channel Africa (eNCA), June 5. From <<https://www.enca.com/south-africa/south-africa-running-out-space-waste>> (Retrieved on 11 May 2017).
- Brown GTL 2017. Doctoral education in quantitative research methods: Some thoughts about preparing future scholars. *Frontiers in Applied Mathematics and Statistics*, 3(25): 1-4.
- Conserve Energy Future 2019. What is Littering? From <<https://www.conserve-energy-future.com/causes-problems-solutions-littering.php>> (Retrieved on 23 February 2019).
- Daniel EE, Ibok E 2013. Solid waste disposal habits of students in Nigerian universities: A case of university of Uyo, Nigeria. *Journal of Environmental Science, Toxicology and Food Technology*, 5(6): 46-50.
- Desa A, Abd Kadir N, Yusoff F 2011. A study on the knowledge, attitudes, awareness status and behaviour concerning solid waste management. *Procedia Social and Behavioural Sciences*, 18: 643-648.
- Desa A, Abd Kadir N, Yusoff F 2012. Waste education and awareness strategy: Towards solid waste management (SWM) program at UKM. *Procedia - Social and Behavioural Science*, 59: 47-50.
- Department of Environmental Affairs 2011. *National Waste Management Strategy*. Pretoria, South Africa: Department of Environmental Affairs.
- Department of Environmental Affairs 2018. South Africa State of Waste. *A Report on the State of Environment*. First Draft Report. Pretoria, South Africa: Department of Environmental Affairs.
- Dung MD, Mankilik M, Ozoji BE 2017. Assessment of college students' knowledge and attitudes toward solid waste management in north central zone of Nigeria. *Science Education International*, 28(2): 141-146.
- Ehrampoush MH, Moghadam MHB 2005. Survey of knowledge, attitude and practice of Yazd University of medical sciences students about solid wastes disposal and recycling. *Iranian Journal of Environmental Health Science and Engineering*, 2(2): 26-30.
- Ekpoh UI, Ekpoh IJ 2011. Assessing the level of climate change awareness among secondary school teachers in Calabar municipality, Nigeria: Implication for management effectiveness. *International Journal of Humanities and Social Science*, 1(3): 106-110.
- Ferrer PF 2015. Students' waste management practices: Association to demographic profile. *International Journal of Science, Environment and Technology*, 4(1): 125-134.
- Francisco OH, Yacob M, Adamu A, Zaninudin N 2017. Willingness to pay for improved solid waste management in commercial area of Sango, Ogun State Nigeria. *Journal of Environmental Science, Toxicology and Food Technology*, 11(11): 82-88.
- George D, Mallery P 2003. *SPSS for Windows Step By Step: A Simple Guide and Reference*. 4th Edition. Boston: Allyn and Bacon.
- Greyling M 2017. South Africa Produces 108 Million Tons of Waste Per Year. Fourways Review, May 26. From <<https://fourwaysreview.co.za/260625/sa-produces-108-million-tons-of-waste-per-year>> (Retrieved on 10 February 2019).
- Hens L, Wiedemann T, Raath S, Stone R, Renders P, Craenhals E, Richter B 2010. Monitoring environmental management at primary schools in South Africa. *Journal of Cleaner Production*, 18: 666-677.
- Hoorweg D, Bhada-Tata P, Kennedy C 2013. Waste production must peak this century. *Nature (International Weekly Journal of Science)*, 502(7473): 615-617.
- Ifegbesan A 2010. Exploring secondary school students' understanding and practice of waste management in Ogun State, Nigeria. *International Journal of Environmental and Science Education*, 5(2): 201-215.
- Ifegbesan AP, Ogunyemi B, Rampedi IT 2017. Students' attitudes to solid waste management in a Nigerian university: Implications for campus-based sustainability education. *International Journal of Sustainability in Higher Education*, 18(7): 1244-1262.
- Ioja CI, Onose DA, Gradinaru SR, Serban C 2012. Waste management in public educational institutions of Bucharest city. *Romania Procedia Environmental Sciences*, 14: 71-78.
- Kanyimba AT, Richter BW, Raath SP 2014. The effectiveness of an environmental management system in selected South African primary schools. *Journal of Cleaner Production*, 66: 479-488.
- Keinonen T, Yli-Panula E, Svens M, Vilkonis R, Persson C, Palmberg I 2014. Environmental issues in the media - students perceptions in the three Nordic-Baltic countries. *Journal of Teacher Education for Sustainability*, 16(1): 32-53.
- Kukkonen J, Kärkkäinen S, Keinonen T 2012. University students' information sources of education for sustainable development issues and their perceptions of environmental problems. *Problems of Education in the 21st Century*, 39: 93-104.
- Kumar A, Smith SR, Fowler G, Velis C, Kumar SJ, Arya S, Rena, Kumar R, Cheeseman C 2017. Challenges

- and opportunities associated with waste management in India. *Royal Society Open Science*, 4: 1-11.
- Laor P, Suma Y, Keawdounlek V, Hongtong A, Apidechkul T, Pasukphun N 2018. Knowledge, attitude and practice of municipal solid waste management among highland residents in Northern Thailand. *Journal of Health Research*, 32(2): 123-131.
- Licy CD, Vivek R, Saritha K, Anies TK, Josphina CT 2013. Awareness, attitude and practice of school students towards household waste management. *Journal of Environment*, 2(6): 147-150.
- McAllister J 2015. *Factors Influencing Solid-Waste Management in the Developing World*. Master's Thesis, Unpublished. Utah, United States: Utah State University.
- McKay TJM, Mbanda JT, Lawton M 2015. Exploring the challenges facing the solid waste sector in Douala, Cameroon. *Environmental Economics*, 6(3): 93-102.
- Mdlozini G 2015. *A Situational Analysis and Knowledge, Attitude and Practices (KAP) Study of Waste Management and Recycling at the Durban University of Technology (DUT)*. Master's Thesis, Unpublished. Durban, South Africa: Durban University of Technology.
- Naidoo R 2017. Improving Landfilling: Correct Practices and Useful Technologies. Landfill Infrastructure News, February 22. From <<http://www.infrastructurenews.com/2017/02/22/improving-landfilling-correct-practices-and-useful-technologies>> (Retrieved on 21 March 2017).
- Olufemi AC 2012. *Assessing the Levels of Awareness, Knowledge and Attitude about Environmental Pollution as well as the Presence of Pollutants in the Vicinity of Schools in a Coal Mining Area*. PhD Thesis, Unpublished. Pretoria, South Africa: Tshwane University of Technology.
- Olufemi AC, Mji A, Mukhola MS 2016. Assessment of secondary school students' awareness, knowledge and attitudes to environmental pollution issues in the mining regions of South Africa: Implications for instruction and learning. *Environmental Education Research*, 22(1): 43-61.
- Ramos JNA, Pecajas ES 2016. Attitudes and practices in solid waste management among the secondary schools in the division of Leyte. *International Journal of Engineering Sciences and Research Technology*, 5(7): 1452-1463.
- Saadat A, Parvin F, Alam A, Kamal A 2012. Status of solid waste generation at Jahangirnagar University campus and development of a suitable management plan. *Journal of Environmental Science and Natural Resources*, 5(1): 187-191.
- Saha K 2013. Solid waste disposal and its perceived effects on health among the students of Gauhati University of Assam. *Indian Journal of Research*, 21(8): 59-61.
- Shahzadi A, Hussain M, Afzal M, Gilani SA 2018. Determination the level of knowledge, attitude, and practices regarding household waste disposal among people in rural community of Lahore. *International Journal of Social Science and Management*, 5(3): 219-224.
- Tangwanichagapong S, Nitivattananon, V, Mohanty B, Visvanathan C 2017. Greening of a campus through waste management initiatives: Experience from a higher education institution in Thailand. *International Journal of Sustainability in Higher Education*, 18(2): 203-217.
- Turner DA, Williams ID, Kemp S 2015. Greenhouse gas emission factors for recycling of source-segregated waste materials. *Resources, Conservation and Recycling*, 105(A): 186-197.
- van Niekerk IM 2014. *Waste Management Behaviour: A Case Study of School Children in Mpumalanga, South Africa*. Masters' Dissertation, Unpublished. Potchefstroom, South Africa: Northwest University.
- Yakob N, Esa N, Yunus HM 2012. Exploring secondary school students' belief and attitude about waste management in Northern Peninsular, Malaysia. *International Journal of Global Education*, 1(1): 35-46.
- Yemaneh Y, Abera T, Hailu D, Niguse W, Chewaka L, Daniel, T, Abebe H, Tsegaye N 2017. Knowledge, attitude and practice towards solid and liquid waste management among Addis ketema and Kometa kebele community Mizan-Aman town, Bench Maji zone, South Nations nationalities and peoples regional state, South West Ethiopia. *Journal of Environmental Geology*, 1(1): 17-21.
- Yoda RM, Chirawurah D, Adongo PB 2014. Domestic waste disposal practice and perceptions of private sector waste management in urban Accra. *BMC Public Health*, 14(697): 1-10.
- Zhang N, Williams ID, Kemp S, Smith NF 2011. Greening academia: Developing sustainable waste management at higher education institutions. *Waste Management*, 31: 1606-1616.
- Zhou C, Jiang D, Zhao Z 2017. Quantification of greenhouse gas emissions from the predisposal stage of municipal solid waste management. *Environmental Science and Technology*, 51(1): 320-327.
- Ziraba AK, Haregu TN, Mberu B 2016. A review and framework for understanding the potential impact of poor solid waste management on health in developing countries. *Archives of Public Health*, 74(55): 1-11.