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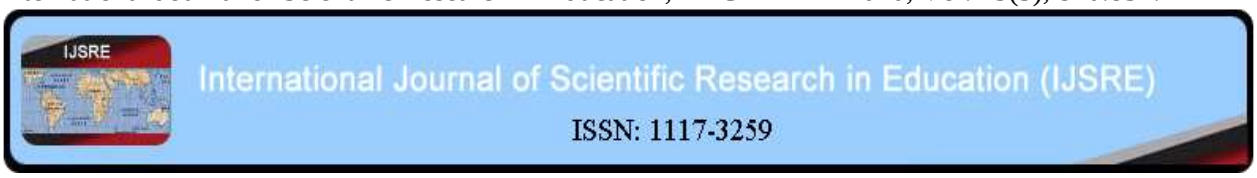

Knowledge and Involvement of Science and Non-science Students in Solid Waste Management: An imperative of Science and Environmental Science Education

Wisdom James Owo
Department of Integrated Science
Faculty of Natural and Applied Sciences
Ignatius Ajuru University of Education, Nigeria
owowisdom70@hotmail.com

Kpeno Amon Ephraim
Department of Curriculum Studies & Instructional Technology
Faculty of Education
Ignatius Ajuru University of Education, Nigeria
kpenoephraim@yahoo.com

Abstract

Management of solid waste is a global phenomenon, and so it is believed that people around the world are knowledgeable of the adverse effect of poor solid waste management yet large volume of solid waste is always seen in the environment. Improper management of solid waste has been associated with different human factors including inadequate knowledge and participation of people in activities involved in solid waste management. This comparative study employed survey design to investigate the knowledge and involvement in solid waste management among 100 participants (424 science and 576 non-science undergraduate students) in Rivers State. Data was collected using a questionnaire "Students' knowledge and involvement in solid waste management, SKISOWM" developed by the researchers. SKISOWM was subjected to content and face validity, pretested, and the reliability (r = 0.79) determined by the use of Cronbach Alpha method before it was administered to the participants to obtain data. Results of data analysis using mean, standard deviation and independent samples t-test indicated that science students are more knowledgeable and more involved in solid waste management than the non-science students. From the results of this study it is evident that non-science students need to acquire more knowledge and be committed to safe and environmentally friendly methods of managing solid waste including e-waste. Thus it was suggested that developing a sound solid waste control curriculum for schools, provision of short course(s) for science and non-science teachers on topics relating to waste management, and formation of environmental management and its related clubs in schools will go a long way to promote and implant proper solid waste management and safe environmental culture in the students.

Keywords: Environment, Waste, Solid Waste Management, Knowledge, Involvement, Science Non-science Students.

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INTRODUCTION

The environment in which we live is very important as it directly affects us in various facets of our lives. We dwell on it for everything including the basic necessity of life such as food, clothing and shelter. So, it becomes very important for man to maintain, protect and preserve the environment for his total sustenance. But in the cause of man's desire to better his standard of living man engages in several activities that directly or indirectly alters the environment and thereby causing environmental problems resulting to environmental degradation. Environmental problem or degradation is a global concern. It has no boundary between developed and developing nations. One of the main causes of environmental degradation is improper management of waste.

Waste

Waste is commonly defined as anything the owner no longer need but thrown away or intended to be thrown away. According to the organization for Economic Corporation and Development, OCED (1994), it can also be regarded as any substance or its product(s) that has no economic value to the original owner or any material that has been used for its intended purpose by the owner and required to be expelled or discarded. Most of the waste in the environment are generated by man as a result of their domestic, agricultural, biomedical (healthcare), industrial/commercial, construction/demolition, office, academic and research activities among others. One of the classes of waste with regards to the state of matter is solid waste. Solid waste may be defined as all the useless, unwanted or discarded materials resulting from human and animal activities that are commonly dry, solids, semi-solids, liquids in containers. Solid wastes are generally classified into garbage and rubbish. Garbage is the putrefying solid or semi-solid waste from food such as meat, fish, vegetables, fruits etc. This class of waste usually originates from the sale, handling, storage, preparation/cooking and consumption of food. It is biodegradable. Rubbish consists of non-perishable materials including metals, polyethene, paper, wood, glass, plastics, ashes, and broken or damaged tableware. Rubbish may be combustible or non-combustible depending upon whether or not it can be decomposed by burning.

Waste as unwanted materials, if not properly discarded posed dangerous consequences (Yadav & Mishra, 2004). It constitutes both physical nuisance, physical and health hazards. Poorly discarded waste is among the major causes of soil, water and air contamination (W.H.O, 2016) and disease outbreak (Pervez and Kafeel, 2013; W.H.O, 2010) in many parts of the world particularly in developing countries and therefore it is important for it to be carefully managed. Although there is no permanent solution for environmental waste problems, but man can play some crucial roles to control and reduce waste generation by proper awareness and involvement in managing waste.

Waste Management

Management of solid waste refers to the policies, strategies and series of activities directed toward the handling and monitoring of waste from its production and storage through collection, transportation to processing and final disposal to ensure that it does not cause damage or harm to human health, natural resources, cultural heritage, and the environment. Solid waste

management encompasses several activities including reduction, recycling, segregation, processing or modification, treatment and disposal each having different levels of complexity (Zagozewski, Judd-Henry, Nilson & Bharadwaj, 2011). In its entirety, solid waste management addresses all logistics (such as administrative, planning, financial cost, legal, and environmental and health impact) involved in the entire sequence of solutions to problems of solid wastes to avoid its negative impact on the inhabitants of a community or the society. Solid waste management's basic goal is to reduce the volume of solid waste discarded on land by processing and treating it to recover materials and energy as resources in a cost effective, safe and environmental friendly manner (MF, 2009).

There are different methods used in the treatment and reduction, and disposal of solid waste. However, the choice of the method depends upon the characteristics of the waste, available land space as well as the disposal cost. They include:

Reuse: This method of waste management involves reusing the valuable waste material in its original form or processed form (i.e. creative reuse or up-cycling respectively) instead of discarding it. For example coca cola glass bottles can often be collected, washed, refilled and delivered many times in their life. Empty ink cartridges can be refilled with ink. Creative Reuse or Up-cycling is the reuse of unwanted items by re-purposing them into new end use items. For example, empty plastic water bottle can be washed and used as container for kerosene.

Recycle: Waste recycling involves reprocessing the waste material and converting it into another product entirely, sometimes product with lower grade and value. It is the preferred option when reuse is not an option. However, most recycling processes is actually regarded as *down*cycling i.e. recycling of waste materials into a lower grade of material that will later be discarded. For example, recycling of paper into low quality disposable paper such as toilet paper:

Incineration: It is a controlled thermal decomposition or combustion process in which the solid waste is decomposed by heating or burning in an incinerator in the presence of excess air (oxygen) at very high temperature of about 1000 ^{oC} and above. In the process the combustible solid waste are decomposed into gases leaving behind ashes and non-combustible materials as residue. Incineration has an advantage of reducing the volume of combustible components of the solid waste by 80–90%.

Shredding and Compaction: Solid waste shredding is a physical or mechanical process of reducing the size of the waste. It involves cutting or breaking large solid waste into tiny pieces before they are compressed or compacted. Compacting waste also cause waste to break. Shredding and compaction are usually used to decrease the volume of solid waste.

Pyrolysis: This is the thermal disintegration of waste in the absence of air (oxygen) during which the organic matter (carbonaceous materials) in the waste is converted into inorganic and other organic substances that can be used as solid, liquid and gaseous fuel e.g char, pyrolysis oil and synthesis gas. Some organic substances are very unstable to heat and so when heated to a high temperature (200-900^{o}C) in an environment of no oxygen they decompose into gas together oils, tars and solid residue.

Gasification: Gasification is a process which involves the partial or incomplete incineration combustion of solid waste at high temperature (about $1000^{o}C$) in the presence of little oxygen to produce gaseous fuel such as syngas that is rich in carbon dioxide, CO_2; carbon monoxide, CO; methane, CH_4; water vapour, $H_2O_{(g)}$; nitrogen, N2, and hydrogen,H_2.

Sanitary Landfills: Sanitary Landfilling also known as engineered landfilling is a method in which a well-designed trench lined with impervious materials and well laid out leachate and gas collection devices is used as the solid waste disposal site. The waste is deposited and spread in the trench in layers, compacted and covered with earth materials at the end of the day tips to prevent any contact between the solid waste and the surrounding environment, especially the groundwater. Anaerobic decomposition of organic waste matters in the solid waste yields methane gas (Goorah, Esmyot & Boojhawoon, 2009) which can be collected. Sanitary landfills are environmental friendly.

Composting: Organic waste is biodegradable. Composting is a natural biological method for the conversion of organic matter into compost under regulated aerobic (requires oxygen) or anaerobic conditions (without oxygen). Anaerobic digestion is often used, however it produces odour and methane gas which is an important source of bio-energy. The compost is of great advantage to soil and plants when added to soil. It improves the soil characteristics and fertility.

In Nigeria, waste generation has increased significantly over the past decade. Wale (2016) estimated that Nigeria produces about 32 million tonnes of Solid waste each year and only 20-30% the waste is collected. Careless handling of Municipal or urban solid waste has contributed to sewer blockages, flooding and water bodies choke. Households and in some cases local factories, artisans and traders that are in the immediate surroundings produce much of the waste (Wale 2016). Inadequate collection and disposal of municipal wastes is an environmental tragedy in Nigeria as the country currently lacks sufficient arrangements for implementing integrated waste management systems. Port Harcourt, the capital of Rivers State is one of the major cities in the South-South region of Nigeria where heaps of waste is conspicuously seen on most streets and strategic points aside those in gutters and drains and undeveloped plots of lands. According to Binafeigha and Enwin (2017), about a total of 1,505,106 kg of solid waste is generated daily in Port Harcourt City and so the city is faced with an increased volume and diverse characteristics of waste due to economic growth and population explosion in the city.

The problems of solid waste management in our environment are numerous. They are on the increase especially with the rising proportion of e-waste in the solid waste stream and its attendant hazardous pollutants. E-waste is generally referred to as any unwanted or end-of-life electrical and electronic equipment (such as dishwasher, TV, camcorders, cameras, refrigerators, DVD, VCD players, MP3 players, radio, telephones, microwave oven, air conditioners, computers and accessories, mobile phones, fluorescent lamps etc.) as well as their respective components that are thrown away by their original or end users. Though such devices contain both toxic and valuable substances (Zhan & Xu, 2014), they are generally considered toxic when not properly disposed because of the presence of some hazardous substances including heavy metals like lead, hexavalent chromium, mercury, cadmium and nickel, and or their compounds (such as cadmium oxide, cadmium sulphide, lead oxide), and persistent organic pollutants (POPs) such as polyvinyl chloride (PVCs), polycholorobiphenyls (PCBs), and halogenated flame retardants (e.g. octabromodiphenyl ether OBDE, Decabromodiphenyl ether, DBDE and tetrabromo-bisphenol A, TEBPA).

The Research Problem

All over the world; efforts are being made at different levels to make people get the awareness about environmental protection and sustenance for a healthy living. Knowledge of waste generation and waste management starts from the home when in our houses we generate substances we do not want to use but to be dispose of or converted into something that we can use for other purpose(s). It is believed that the education a child receives contributes greatly in influencing the child's attitude towards a thing and as well bringing the child to a higher horizon. And so we assume that a student who is educated must be knowledgeable to his environment and its associated problems and thereby assist in providing solutions to the problems including that of solid waste. Yet our environment continue to experience heaps of solid waste. Does it mean that students who are educated are not concern about the littering of waste in the environment? Tartiu (2011) opined that students must have good knowledge about environmental problems so as to enable them contribute effectively in proper waste management. This study therefore sought to investigate the level of science and non-science students' knowledge and involvement in solid waste management in Rivers State.

The Research hypotheses

The study is guided by the following null hypotheses:

- There is no significant difference in the mean rating of science and non-science students' knowledge of solid waste management:
- There is no significant difference in the mean rating of involvement in solid waste management between science and non-science students

RESEARCH METHOD

This study is a comparative one. It utilizes a survey design to assess science and non-science students' knowledge and involvement in the management of solid waste in Rivers State. The design involves the collection and analysis of data from the respondents on variables under investigation.

The participants were 1000 undergraduate students (comprising 424 science and 576 non-science) who were selected randomly from four tertiary institutions in Rivers State. They signed a consent form after they were briefed on the purpose of the study which makes them eligible to participate in the study.

The instrument for the study was a questionnaire titled "Students' knowledge and involvement in solid waste management, SKISOWM". The questionnaire has two sections, A and B. Section A elicits demographic information of the respondents. Section B has two parts, 1 and 2. Part 1 contains 15 items that sought for information on students' knowledge on solid waste and solid waste management while part 2 contains 11 items that solicit for information on students' involvement in solid waste management. The instrument was designed on a 4-point rating scale. SKISOWM was face and content validated, and its reliability coefficient ($r = 0.79$) obtained by the use of Cronbach Alpha method.

Data generated was analysed by descriptive statistics (mean and standard deviation), and inferential statistics (independent sample t-test). Remarks on the level of science and non-

science students' knowledge and involvement in solid waste management were made based on a cut-off mean of 2.5 on a 4-point scale while the difference between the two groups with regards to the variables was considered significant at p value less than 0.05.

RESULTS

Table 1: T-test of significant difference between science and non-science students with regards to overall rating of their knowledge on solid waste management

Groups	N	Mean	Std. Dev	Df	t-value	P-value
Science	424	2.818	1.2744	998	2.590	0.007
Non-Science	576	2.609	1.1685			(S)

Df =998, S = Significant at P<.05

Table 1 showed that the overall mean rating of the science students (2.818, SD=1.2744) is higher that of non-science students (2.609, SD = 1.1685). It also indicated that there is a significant difference (t=2.590, p< 0.05) between science and non-science students' overall knowledge of solid waste management in favour of the science students. Therefore the null hypothesis (Ho_1) is rejected.

Table 2: Science and non-science students rating of their Knowledge about solid waste management with respect to individual items

S/N	Items	Science Students N = 424			Non-Science Students N = 576			t-test of sig. diff btw the groups	
		Mean	SD	Remark	Mean	SD	Remark	t-ratio	P-value / Decision
1	You are aware of the basic functional elements of waste management	2.54	0.89	Agree	2.22	0.77	Dis-agree	6.24	0.000 (S)
2	You are very much knowledgeable of the principle of waste minimization	2.88	0.85	Agree	2.66	1.10	Agree	3.46	0.001 (S)
3	In the management of solid waste, pyrolysis, combustion and incineration operate on the same principle.	2.47	1.09	Dis-agree	1.83	1.01	Dis-agree	9.63	0.000 (S)
4	You are very much knowledgeable of what segregation of waste entails	2.90	1.03	Agree	2.68	1.06	Agree	3.24	0.001 (S)
5	Landfilling and sanitary (or engineered) landfilling are the last option of waste management strategies	3.61	0.53	Agree	2.78	1.10	Agree	14.27	0.000 (S)

6	E-waste is also known as waste electrical electronic equipment	2.98	1.04	Agree	2.94	1.08	Agree	0.529	0.597 (NS)
7	You have a good knowledge of how e-waste can be disposed?	2.88	0.85	Agree	2.24	0.96	Dis-agree	11.02	0.000 (S)
8	Poor management of Solid waste is one of the environmental problems	3.14	1.02	Agree	3.05	1.05	Agree	1.251	0.211 (NS)
9	Recycling and reuse mean the same thing in waste management	1.62	0.10	Dis-agree	3.21	0.93	Agree	26.89	0.000 (S)
10	Solid waste can be biodegradable or non-biodegradable, combustible or non-combustible	3.17	0.95	Agree	2.92	1.06	Agree	3.80	0.000 (S)
11	Compost is a means of waste management	3.21	0.96	Agree	3.05	1.05	Agree	2.44	0.15 (NS)
12	Management of solid waste cannot only be carried out by Sanitation authorities	2.50	0.88	Agree	2.03	1.01	Dis-agree	7.01	0.000 (S)
13	Energy and material resources can be recovered from proper management of solid	2.62	0.97	Agree	2.34	0.82	Dis-agree	4.90	0.000 (S)
14	You have been taught waste management strategies in your school subjects/courses	3.07	1.00	Agree	2.54	1.18	Agree	7.52	0.000 (S)
15	You have attended waste management awareness programmes in school or elsewhere	2.28	0.91	Dis-agree	2.13	0.97	Dis-agree	2.51	0.012 (S)

Df =998, The remarks above are based on a cut-off point of 2.5 on a 4-point scale. $p< 0.05$ significant (S), $p> 0.05$ Not significant (NS).

Table 2 showed the mean and standard deviation of science and non-science students rating of their knowledge about solid waste and solid waste management with respect to analysis of variables or items on knowledge about in solid waste management. The table also showed the t-test of difference between the two groups of students with regards to knowledge about waste and waste management. From the table it is observed that the two groups of students agreed with statement of items 2, 4, 5, 6, 8, 10, 11 and 14, and disagreed with items 3 and 15. Again, while the science students agreed with statement of items 1, 7, 12 and 13, the non-science students did not agree. In each of these items the science students had higher mean rating. In addition, a t-test of significant difference between the two groups mean rating on individual item showed that there is a significant difference in favour of the science groups in all the items ($p< 0.05$) with the

exception of items 6 and 8 that the difference in mean rating was not significant (p>0.05) .

Table 3: T-test of significant difference between science and non-science students with respect to their overall involvement in solid waste management

Groups	N	Mean	Std. Dev	df	t-value	P-value
Science	424	2.795	1.2445	998	4.459	0.000
Non-Science	576	2.458	1.1291			(S)

Df =998, S = Significant at P<.05

Table 3 showed that the overall mean rating of the science students (2.795, SD=1.2445) is higher that of non-science students (2.458, SD = 1.1291). It also indicated that there is a significant difference (t=4.459, p< 0.05) between science and non-science students' overall involvement in solid waste management in favour of the science students. Therefore the null hypothesis (Ho_2) is rejected.

Table 4: Science and non-science student rating of their involvement in solid waste management based on items

S/N	Items	Science Students			Non-Science Students			t-test of sig. diff btw the groups	
		Mean	SD	Remark	Mean	SD	Remark	t-ratio	P-value / Decision
1.	I often try to minimize waste generation	3.39	0.84	Agree	2.82	1.11	Agree	8.97	0.006 (S)
2.	You often dispose your solid waste according to its type	3.25	0.94	Agree	2.10	1.14	Dis-agree	16.96	0.010 (S)
3.	You do burn all kinds of waste in the open or dispose them without segregation	1.62	0.92	Dis-agree	2.60	1.20	Agree	14.25	0.000 (S)
4.	You are not involved in waste management because it is the sole responsibility of waste management agencies	2.07	1.02	Dis-agree	1.81	0.86	Dis-agree	4.25	0.000 (S)
5.	Management of our household waste is the sole responsibility of our younger ones and / or housemaids	1.87	0.94	Dis-agree	1.95	0.85	Dis-agree	1.51	0.132 (NS)
6.	You do convert some of the waste in your home to compost	2.80	1.09	Agree	2.57	1.10	Agree	3.21	0.001 (S)
7.	You often segregate domestic solid wastes?	3.60	0.52	Agree	2.53	1.17	Agree	17.51	0.021 (S)
8.	There are different labelled waste storage	2.94	1.03	Agree	2.62	1.07	Agree	4.74	0.000 (S)

	container with cover in my house								
9.	E-waste is normally taken to experts to dismantle and dispose	3.33	0.70	Agree	2.24	0.96	Dis-agree	19.42	0.000 (S)
10.	I do engage in recycling of some waste	3.01	1.01	Agree	2.22	0.95	Dis-agree	12.55	0.011 (S)
11.	Sometimes I do throw waste on the roadsides or dump them in nearby river	2.75	1.17	Agree	3.01	1.08	Agree	3.62	0.000 (S)

Df =998, The remarks above are based on a cut-off point of 2.5 on a 4-point scale. $p< 0.05$ significant (S), $p> 0.05$ Not significant (NS).

Table 4 showed the mean, standard deviation and t-test of difference between the science and non-science students rating of their involvement in solid waste management with regards to individual items on involvement in solid waste management. It showed that the two groups agreed with statement of items 1, 6, 7, 8 and 11 but disagreed with items 4 and 5. The table also revealed that the science students agreed with statement of items 2, 9, and 10 while the non-science students did not agree. Again, the table indicated that the science students disagreed with item 3 whereas non-science students agreed. From the table it was also observed that the science students had higher mean rating than the non-science students for each of the items with the exception of items 3, 5 and 11 in which the non-science students had higher mean. A t-test of significant difference in mean rating between the two groups for each item showed that with the exception of items 5 that the difference in mean rating was not significant ($p>0.05$), there is a significant difference in favour of the non-science groups for items 3 and 11 ($p< 0.05$), and a significant difference in favour of the science students for items 1, 2, 4, 6, 7, 8, 9, 10 and 11.

DISCUSSION

Results of this study showed that a significant difference exist between science and non-science students overall rating of their knowledge in solid waste in favour of the science students. On individual item basis science and non-science students have knowledge about the principles of waste minimization, strategies of waste management, the role of environmental sanitation authorities in waste management, as well as their individual roles in waste management. They are also aware that waste can be bio-degradable, non-biodegradable, combustible and non-combustible. However, the science students are much knowledgeable in all these than the non-science students. This finding agrees with the finding of Mukherji, Sekiyama, Mino and Chaturvedi (2016) that 60% of the resident of Delhi, India cannot differentiate between bio-degradable and non-biodegradable waste. Contrary to the finding of Licy, Vivek, Saritha, Anies and Josphina (2013) that students are not much aware of e-waste and its disposal, this present study showed that students have the knowledge about e-waste, however, the science students have much knowledge than the non-science students.

Regarding the overall rating of involvement of students in proper waste management, the study showed a significant difference between science and non-science students in support of the science students. However, on individual item rating, both science and non-science students agreed to be involved in managing waste through waste minimization, waste

segregation, conversion of some waste into compost, and possession of labelled waste containers in their houses, but science students tend to engage more than the non-science students in these waste management activities. In addition, the science students engage in recycling of some solid waste, disposing their waste in accordance with the type of waste, avoiding burning of waste without segregation and taking e-waste to experts for dismantling and disposal.

The findings of the present study have made it clear that, in spite of the students' knowledge of importance of waste management, there is lack of proper involvement in the management of waste among the students, especially the non-science students. These findings are in congruence with the finding of Ifegbesan (2008).

The study also revealed that students do throw solid waste on the streets or dump them in nearby rivers and creeks without recourse to the effects of such action on the environment and the health of the people. Nonetheless, the non-science students were found to be the most culprit of this offence. They are also found to engage more in burning of all kinds of waste together or putting them together in the same storage container without segregation at the source of generation. This poor practice and involvement of students especially the non-science students in solid waste management could also be attributed to the prevailing poor attitude of the public towards collection and treatment or disposal of waste (Liyala, 2011) as well as lack of adequate knowledge. According to Liyala (2011), the generality of the people in urban communities do not participate responsibly in waste management because of their poor attitude and this is even worsened by the inability of the Municipal council authorities to enforce waste management laws.

Attitude impacts ones intention and behavior, and somehow depends on the knowledge and belief the persons have towards doing a thing. Students who believed in their cultural practices of improper dumping of waste, believing that this practice has no much impact on the environment tend to commit this crime against the environment compared to those with contrary belief. According to the theory of planned behavior (Ajzen, 1991) a person's behavior is the outcome or product of his intention to perform such behaviour, and that the behaviour intention of the person depends on the person attitude, subjective norms, volitional and perceived behavioural (or performance) control. And as such, a combination of one's favourable or positive attitude, willingness, perceived social pressure from people, and perceived level of ease or difficulty in performing a behavior, the stronger is the person's intention to perform the behavior (Ajzen, 2002). Again, there is always a difference between the attitude and the behavior of one who is knowledgeable about environmental problems and that of one who has little or no knowledge of the problems in the environment. Dhokhikah, Trihadiningrum and Sunanyo (2015) see knowledge as a key ingredient affecting environmental actions.

The significant difference in the level of involvement between science and non-science students in most of the activities constituting solid waste management in favour of the science students is an indication of a low level of involvement in waste management among non-science students as compared to science students. This could also be associated with inadequate knowledge of effective waste management strategies (Barr & Gilg, 2005) on the part of the non-science students probably because they were are not properly taught in schools. Knowledge of waste is very crucial in the management of waste. Adequate knowledge about a thing has influential role on one's perceived competence in doing that thing because knowledge has the ability to predict the individual's behaviour and lifestyle. This notwithstanding there is no significant difference between science and non-science students' involvement in waste

management with respect to management of household waste as the sole responsibility of younger ones and / or housemaids in the family. This finding indicates that students are committed to the management of their household waste and thereby supports the finding of Licy, Vivek, Saritha, Anies and Josphina (2013).

CONCLUSION AND RECOMMENDATIONS

It is the right of every citizen to live in and contribute meaningfully to his society when he or she is aware of the needs and problems of the society. This study has shown that most students are not actively involved in the management of solid waste because of inadequate knowledge of waste management and so it is the researchers opinion that students can acquire this knowledge through proper environmental education and guidance on waste prevention, separation of waste at source, recycling and other environmentally friendly methods of solid waste management if the following recommendations are well implemented.

- There is the need for the government through the curriculum planners/designers to develop a sound solid waste control curriculum either for a general or separate subjects/courses (science and non-science) suitable for the different levels of education
- Or a review of the existing ones to promote life-long environmental awareness and knowledge of solid waste and its management among the citizenry. Such curriculum should include various hands-on-activities and give equal opportunities to all to encourage participation or involvement of citizens in waste management.
- Teachers are the implementers of any school curriculum, and so provision of short course for science and non-science teachers on topics relating to waste management will enable the teachers (especially the non-science teachers) obtain much knowledge and skills on solid waste management for adequate and effective implementation of any waste management curriculum.
- Since every student is a member of a given community, Environmental management authorities should not be centralized at the Federal and State levels alone but should also be established at the Local Government Areas and community levels to promote community knowledge and involvement in waste management.
- It is necessary to establish environmental management clubs (e.g. green club, pollution control club among others) in schools to engage students in sharing ideas on issues relating to the environment will also go a long way to creating and enhancing students' knowledge and participation in the management of solid waste.

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