



Research Article

Influence of Education on the Solid Waste Management Practices of Communities in Kampala City

Mugweri Fredrick¹, *Joseph C. Oonyu², John Sentongo³

^{1,2,3}Department of Science, Technical and Vocational Education, Makerere University School of Education, Kampala, Uganda

This study investigated the influence of public education on solid waste management in Kampala city. Across sectional survey research design was used because of the heterogeneous nature of the study population. The study employed both quantitative and qualitative methods. The sample size comprised of 289 respondents selected per division using multistage sampling using guidelines provided by 1970 Krejcie and Morgan correlation tables. The study established the organizations involved in public education to include; Kampala Capital City Authority (KCCA), Village Health teams (VHTs), NGOs and the private sector companies. Public meetings, use of mass media, community demonstrations and instruction to individual heads of households are the key strategies being used to educate the communities in the city on waste management. It was concluded that public education is improving waste management in the city. There is however less education on waste separation and organic waste management which constitutes over 50% of the waste generated in the city. Waste separation would improve on the quality and quantity of plastic waste supplied to recycling industries and education on organic waste management would reduce on quantity and cost of waste disposed of at the landfill.

Key words: Community education, solid waste management, practices, private sector, Community Based Organizations (CBOs), Non-Governmental Organizations (NGOs)

INTRODUCTION

Education is used to instill knowledge, change attitude and develop skills to transform communities in management of resources including waste management. Salequzzaman *et al.* 2001 argued that education is critical for promoting sustainable development and improving the capacity of people to address environment and development issues. The education program builds on the knowledge, values, skills, experiences and determination of human capacity needed to work on solving waste management issues at an individual and community level.

The World Bank (1999) argued that education equips people with knowledge, skills and attitudes to tackle any crisis. Jatau (2013) stressed that sufficient knowledge of the impact of waste management on health may help people to protect themselves from diarrhea, typhoid fever, cholera, hepatitis, malaria and other infections. Adequate education of the negative impact of poor refuse disposal may encourage people to adopt positive waste

management practices which in turn may also promote personal hygiene and a healthy environment.

According to Hogan (2002), environmentally engaging education activities provide a platform on which a community begins to exercise the knowledge needed to improve its environment. Political and social changes across the continent, including the rise of NGOs, have fostered an increased awareness of environmental issues among the public. Urban populations have become more involved in the issues surrounding municipal Solid Waste Management (SWM) (UNEP, 2000).

***Corresponding author:** Prof. Joseph C. Oonyu, Department of Science, Technical and Vocational Education, Makerere University School of Education, Kampala, Uganda. **Email:** joseph.oonyu@gmail.com **Co-Author Email:** ¹fredrickmugweri@yahoo.com, ³jsentongo@cees.mak.ac.ug

Education and change of attitude are interwoven. People are always adopting, modifying and relinquishing attitudes to fit the ever-changing needs and interests. Attitude may not be changed by simple education. Research in sciences has shown that knowledge on a topic may increase; people may even change attitudes (values), but that the step to improved behaviors and practices depends on a complex set of social and psychological factors (Asmawati *et al.* 2012). Miller *et al.* (1999) also reported that it is far from truth that providing information to groups and individuals lead them to appropriate personal and organizational actions and performance. This was supported by Pfeffer *et al.* (2000, P.30.) who observed that while information and knowledge are crucial to performance, knowledge of an issue is often not sufficient to cause action: "*there is only a loose and imperfect relationship between knowing what to do and the ability to act on that knowledge.*"

Skinner (2004) reported that effective community education is crucial to optimal waste management and hygiene leading to prevention of diseases and their potential burdens. Nations are adopting cost-reducing programs and conservation which tend to reduce, reuse and recycle to reduce the level of waste and recycle through aggressive community education of consumers and producers (Goldman *et al.*, 2001). Examples of successful public education campaigns have been carried out in Bamako, Cairo, Cotonou, Dakar and Johannesburg. In Nigeria, a nationwide public education campaign was conducted under the banner of sanitation. Some of these programs began in the mid-1980s and continue in the present times. They were undertaken by the district governments in collaboration with community service organizations, health and education departments and the media. The results of these programs ranged from drastic reductions in indiscriminate dumping to community-based SWM pre-collection and street cleaning (UNEP, 2000). This implies that particular skills and knowledge gained from environmental education would help in changing human behavior towards the environment as people/individuals develop those attitudes which guide them to environmentally supportive behavior (Ahmed *et al.*, 2009).

Many other interventions have been tried in Kampala City by various organizations, for example, government organizations or agencies, private sector organizations, public - private sector partnerships (PPP), decentralization and liberalization with the intention of improving efficiency, effectiveness and quality of service delivery in waste management. In spite of their involvement the problem persists in Kampala City (Uganda) because according the available literature, only 30-40 per cent of the solid waste generated is disposed of at Mpererwe - Kitezi landfill (NEMA 2004/05, 2010; KCC, 2008). Yet good waste management practices resulting from waste education could reduce on environment pollution and waste related diseases. It could also improve on reuse, recovery and

recycle of waste materials. Therefore, this study sought to find out the influence of education on waste management in Kampala city with particular emphasis on the following:

1. Identifying organizations involved in educating the public on waste management in Kampala city.
2. Finding out the strategies being used by organizations on waste management education.
3. Establish how education has influenced waste management in Kampala city.

NULL HYPOTHESIS

Waste education does not influence waste management in Kampala city

METHODOLOGY

Research Design

A cross sectional survey was used because of the heterogeneous nature of the study population.

Target population

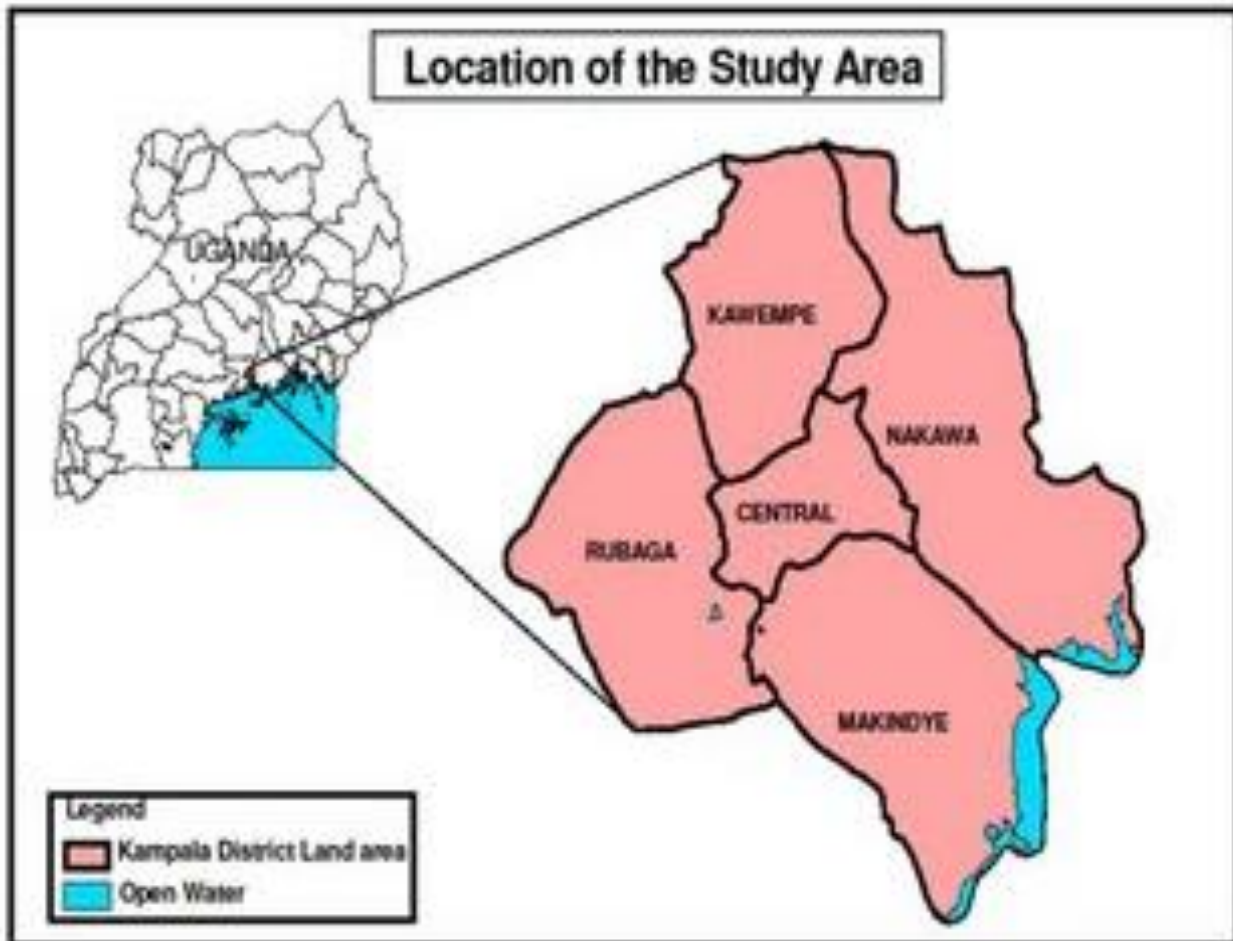
The study population comprised of several categories: local council leaders, leaders of community-based organization and Non-Government Organizations, opinion leaders and the resident communities. These respondents were selected from each of the five divisions of Kampala city, namely Central, Rubaga, Kawempe, Makindye and Nakawa, see Map below.

Sample size and sampling techniques

Participants in the study were selected using proportionate stratified sampling technique; the group with more individuals had more participants in the sample. The sample size comprised of 289 respondents: 20 leaders of CBOs, 10 leaders of NGOs, 5 leaders of KCCA and 250 resident community members. Of the 250 residents, 20 residents per division were selected using multistage sampling while 30 per division were selected using convenient sampling. Five KCCA leaders (one per division) were selected by purposeful sampling. Of the 20 leaders of CBOs, 5 per division were selected by random sampling. Of 10 NGOs leaders, 2 per division were selected by purposeful sampling and of the 5 leaders (town clerks) of KCCA, 1 per division was selected by purposeful sampling. Krejcie and Morgan (1970) correlation tables were used to determine the sample size of the population for each category.

Methods

The methods employed included survey, documentary review, interviews and observation.



Map of Uganda showing the location of the study area (Kampala city divisions).

Survey

Every town clerk in each division was given a questionnaire to provide information on waste education programs in their divisions. Questions were short, clear and simple as recommended by Barifaijo *et al.* (2010). Two NGO leaders, five CBO leaders and twenty local council leaders in each of the five divisions were given questionnaires on waste education programs, achievements and challenges faced. A hundred community residents, 20 per division were given questionnaires on waste education in their area. The value of the Cronbach's Alpha coefficient was .887 which was above 0.7 suggesting that the questionnaire was highly reliable (Nunnally, 1978). A waste management index was computed based on the 24 items which were scored on a five-point Likert scale (i.e. strongly disagree, Disagree, not sure/No opinion, Agree, Strongly agree). The index was computed by obtaining an average score for each respondent for the 24 statements which ranged from 1.0 to 5.0 with higher average scores signifying a higher level of waste management and vice versa. The higher the score, the more the respondents reported effective management of waste.

Direct field observations

This technique involved taking short field visits to different sites in the study area and field notes were taken using an observation guide. The field visits targeted SW collection points, courtyards, backyards, open spaces, streets, drainage channels, SW dumping sites, house-holds, business premises in the study area. This was done to verify the interview and questionnaire responses on solid waste management in the City.

Interviews

Direct interviews were administered to the resident populations, NGO leaders, CBO leaders, the private sector and KCCA leaders. A hundred-fifty residents, that is, 30 per division were interviewed on waste education in their area. The residents provided information on waste education meetings, and organizations and agencies involved in education programs in their areas. They also provided information on skills, knowledge acquired from waste education meetings and challenges they face in waste management. Leaders of organizations provided information on their contribution to waste management and the challenges they face in the dissemination of knowledge and skills to the communities.

Procedure

A pilot study was carried out in Jinja Municipality. Data was collected from 21 respondents, 7 from each division, namely town clerks, health inspectors, SW managers and local council leaders in each of the three divisions; Central, Masese-Walukuba and Mpumude-Kimaka. Changes made to the data collection instruments as a result of this pilot survey included minor alterations to some wording and layout of questions. The revised questionnaire was administered in the study area. The pilot run was conducted for two months (April and May 2012); thereafter, data collection was done in the study area for seven months, from June to December 2012 with the help of four research assistants.

Data Analysis

Data was coded entered into the computer system for analysis using a computer program, Statistical Package for

Social Sciences (SPSS) to get statistical values that were relied upon in the interpretation and discussion of findings. Quantitative data was presented using frequency tables. The Inferential statistics (mainly one way-ANOVA) generated values that were used to test the significance of the relationship between the variables after which the discussion of the findings was done according to the study objectives. Qualitative data of descriptive type was coded, transformed into sub-themes and then incorporated in the findings and discussion.

FINDINGS

Organizations involved in waste education in Kampala city

Organizations involved in public education on waste management are shown in Table 1.1

Table 1. 1: Organizations involved in waste education in Kampala city

	Divisions				
S/No	Makindye Division	Nakawa Division	Rubaga Division	Central Division	Kawempe Division
1.	Village Health Teams	Village Health Teams	Community Based Project (COBAP)	Mengo skills Association	Red Cross
2.	KCCA	Local Council leaders	Nakulabye Briquette Makers Technology	KTD, Kisenyi Development Team	Shelter Uganda
3.	Red Cross	KCCA	Living Earth	Slum Dwellers	Kamukamu-Makerere 111
4.	Slum dwellers Federation	Red Cross	Gods Care	Kisenyi11 Youth Development Initiative	Makerere University Nkoba Zambogo
5.	Community Integrated Development Initiative (CIDI)	Community Integrated Development Initiative (CIDI)	Red Cross	Agaliawamu group	KCCA, Fun Club
6.	African Medical Research Foundation (AMREF)	Slum dwellers Federation	Village Health Teams	Kisenyi111 Women group	Slum dwellers Federation
7.	Plan International	African Medical Research Foundation (AMREF)	Shelter and Settlements alternatives	Queens and Kings	Community Integrated Development Initiative (CIDI)
8.	Kansanga community group	Environment Alert	Environment Alert	Kisenyi111 Moslem Women group	African Medical Research Foundation (AMREF)
9.	Kazinga close urban village project	UPDF- Mbuya 1 Parish (Twice a year)	African Medical Research Foundation (AMREF)	Bulamu Health Community group	Plan International
10.	LukuliKirombe zone project	Village Youth Council	Community Integrated Development Initiative (CIDI)	Red Cross	Shelter and Settlements alternatives
11.	Shelter Uganda	Reach out Health Team	Red Cross	Buganda <i>Bulungibwansi.</i>	Environment Alert
12.	Buganda <i>Bulungibwansi.</i>	Parish Youth Council-Mbuya 1 Parish	Buganda <i>Bulungibwansi.</i>	Shelter and Settlements alternatives	Buganda <i>Bulungibwansi.</i>

Views of the public on organizations involved on waste education are summarized in Table1.2 below:

Table 1. 2: Views of the public on who is involved in waste management education in Kampala city

Agency		Proportion of people involved in the various divisions by agency				
		Nakawa Division	Makindye Division	Central Division	Rubaga Division	Kawempe Division
Officials from CBOs educate the community about waste management	Disagree	1(5.0%)	9(45.0%)	5(25.0%)	6(30.0%)	1(5.0%)
	Not sure	3(15.0%)	-	-	-	3(15.0%)
	Agree	16(80.0%)	11(55.0%)	15(75.0%)	14(70.0%)	16(80.0%)
Officials from private sector companies educate the community about waste management	Disagree	3(15.0%)	11(55.0%)	15(75.0%)	10(50.0%)	4(20.0%)
	Not sure	6(30.0%)	-	3(15.0%)	-	7(35.0%)
	Agree	11(55.0%)	9(45.0%)	2(10.0%)	10(50.0%)	9(45.0%)
Officials from KCCA educate the community about waste management	Disagree	1(5.0%)	-	1(5.3%)	6(30.0%)	1(5.0%)
	Not sure	1(5.0%)	-	-	-	1(5.0%)
	Agree	18(90.0%)	20(100.0%)	19(94.7%)	14(70.0%)	18(90.0%)
NGO officials often educate us about waste management in the city	Disagree	-	12(60.0%)	4(20.0%)	6(30.0%)	1(5.0%)
	Not sure	6(30.0%)	-	10(50.0%)	-	1(5.0%)
	Agree	14(70.0%)	8(40.0%)	6(30.0%)	14(70.0%)	18(90.0%)

Table 1.2 reveals that over 70% of the respondents in Rubaga, Nakawa, Kawempe and Central division and 55% in Makindye division reported that CBOs educate them on waste management. This implies that CBOs are probably more actively educating people in Rubaga, Nakawa, Kawempe and Central division than in Makindye division. CBOs were reported to be holding meetings weekly and sometimes monthly. Forty five percent of the respondents in Makindye and Kawempe divisions, 10% Central, 50% and 55% Rubaga and Kawempe divisions, respectively reported that the private sector was actively involved in educating them about waste management. The corresponding percentage for KCCA was slightly over 70% in the divisions of Makindye, Nakawa, Kawempe, Central and Rubaga. Overall, KCCA appears to be carrying out more public education on waste management in the city compared to the private sector. It was also established that Village Health Teams and local council leaders operate in all divisions and are mandated by KCCA to educate the public on waste management and other health issues but were not well facilitated.

Ninety percent, 70%, 40% and 30 % of the respondents in Kawempe, Nakawa, Rubaga, Makindye and Central divisions respectively reported that NGOs educate them. The CBOs appear to be more widespread and active than

NGOs. However NGOs appear to be more active in Kawempe division. They were reported to be educating communities on proper storage of waste; waste reduction e.g. molding of charcoal briquettes; stopping indiscriminate dumping of waste; dangers of waste to our health and environment; innovations in waste reduction, e.g. using straws to make bags, belts; or using tyres to make sandals and shoes; and emphasis by KCCA on the provisions of its Ordinance 2000 on waste management. This is done via meetings, seminars and workshops.

The respondents of Rubaga South reported that education sessions on waste management were rare with CBOs, KCCA, NGOs and private sector companies. As a consequence, the community indiscriminately scatters garbage all over because of lack of waste education in their area. There is therefore a need for KCCA to improve on waste education in the area and encourage NGOs, CBOs to participate in waste education in Rubaga South.

Strategies being used by organizations on waste education in Kampala city

The strategies being used by organizations on waste education in Kampala city are summarized in Figure 1.1 below.

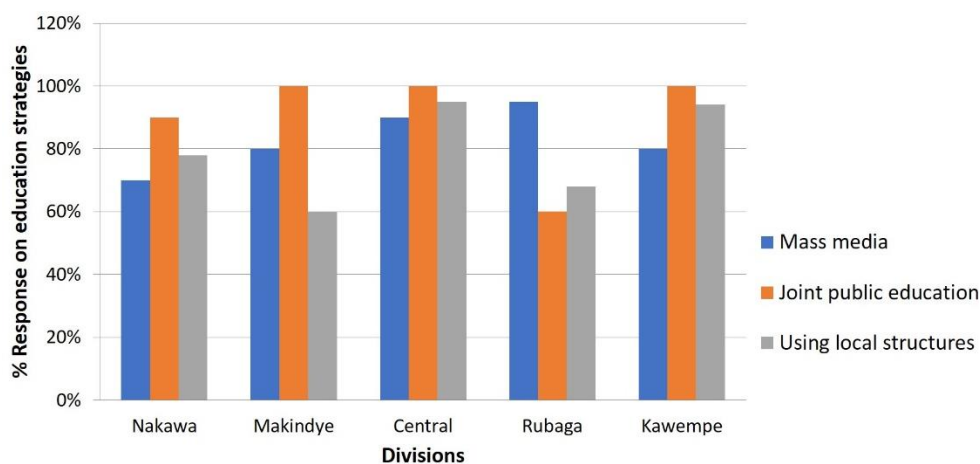
**Figure 1.1: Response to strategies being used by organizations on waste education in the divisions of Kampala city**

Table 1.3 reveals that 83% of the respondents reported that mass media, namely newspapers, TV and Radio were used to educate the communities on waste management in the city. Eighty-five percent of the respondents said that the education sessions were helping the communities to develop a positive attitude towards waste management. Due to this change of attitude, some of the respondents claimed that there is less indiscriminate dumping of waste in the city especially along main highways and drainage channels. However, backyard dumping is still a challenge in low income areas of the city. This implies that in spite of the effort of KCCA and other organizations on waste education, waste dumping is still a challenge in some areas of the city.

All the respondents in Makindye, Central as well as Kawempe, 90% in Nakawa and 60% in Rubaga reported that there were joint education sessions by NGOs, KCCA, and the private sector in Kampala city. These organizations also use the existing local government structures to pass information to the local communities. Less than 50% of the respondents reported that there are public education materials such as posters on waste management in the City (see Figure 1.2). Posters send a strong message to the community on waste management.

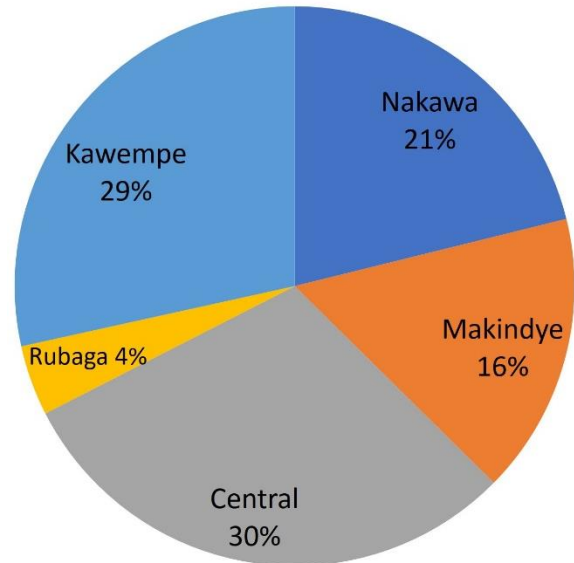


Figure 1.2: Response to availability of demonstration materials in the divisions Kampala city

The responses on the perceived public attitudes, awareness, and practices on waste management in Kampala are shown in Figure 1.3 below.

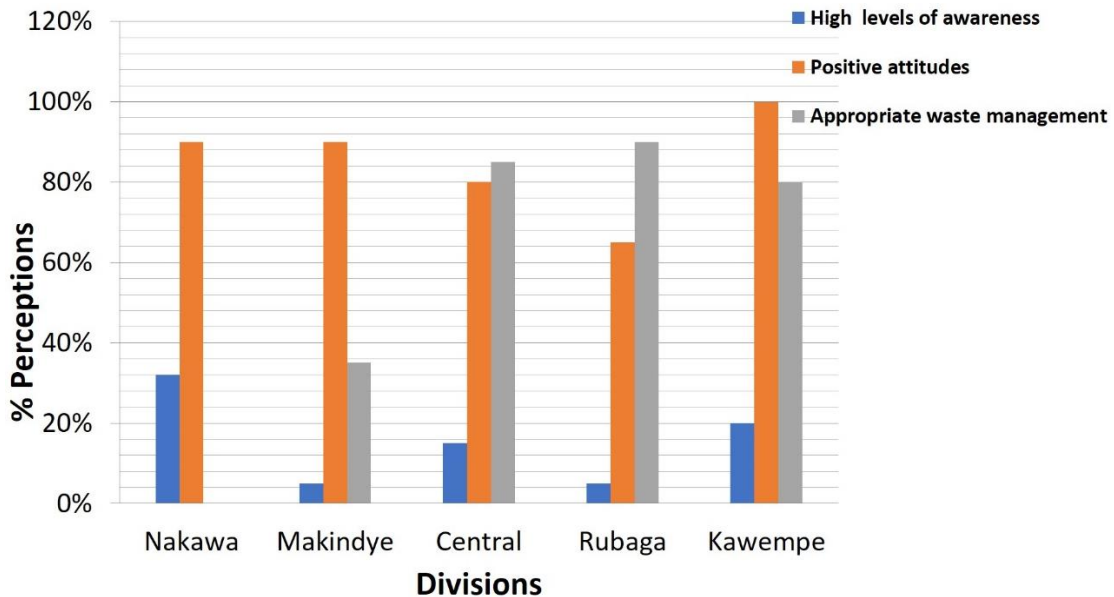


Figure 1.3: Community perceptions of their Attitudes, awareness and practices on waste management in the divisions of Kampala city

Less than 50% of the respondents in all the divisions reported that the level of awareness among the communities on waste management was high in Kampala city due to education efforts. This implies that the agencies involved in education require more efforts in all the divisions.

In Figure 1.4, over 70% of the respondents in Nakawa, Central, Kawempe and Rubaga divisions agreed that they are now using more appropriate waste management

practices due to the education they receive. In an interview with the respondents, they revealed that they store some of the waste in boxes, bags, drums before being transferred to zonal collection containers or to refuse trucks of KCCA that collect the waste. They have also been educated on how to turn waste materials such as old kettles, saucepans, charcoal stoves, iron sheets and Jerri cans into useful things such as new saucepans in the case of metals and shoes, mats, and decoration items in the case of plastics.

Influence of education on waste management in Kampala city

Table 1. 3: Influence of education on waste management in the Divisions of Kampala City

	N	Mean	Std. Deviation	F-value	P-value
Nakawa Division	20	3.5	0.3	2.537	.045
Makindye Division	20	3.3	0.2		
Central Division	20	3.5	0.6		
Rubaga Division	20	3.2	1.1		
Kawempe Division	20	3.7	0.4		
Total	100	3.5	0.6		

The findings in Table 1.3 Show that Kawempe division is having a high mean score (mean 3.7, SD=0.4) on the index of waste management which implies that the communities in this Division are implementing waste education better than in the other four divisions. This is followed by Nakawa and Central divisions whose average was 3.5 while Rubaga Division had the lowest score on the same index which suggests that there was less waste in some areas of Rubaga division, especially southern division. The computed value of the F-statistic for the ANOVA test was 2.537 with a p-value of 0.045 which was statistically significant at 0.05. The findings thus suggest that waste education has a significant bearing on the management of waste in the Divisions of Kampala City. According to the findings, we see that the Divisions with more waste education are performing better than those with less education in the management of waste. It was however established that although Rubaga Division had the lowest average score on the index of waste management, further analysis shows that some parts of the division such as Rubaga North is performing better (mean=3.8, SD=0.9) than Rubaga South (mean=2.0, SD=0.9). A look at the findings further show that Rubaga North is significantly ($p < .05$) performing better than other Divisions in the implementation of waste management practices as a

result of more waste education in the area (Table 1.4). A standard deviation greater than 1.00 was taken to indicate high variability among respondents.

Table 1.4: Influence of education on waste management in the Divisions of Kampala City

	N	Mean	Std. Deviation	F-value	P-value
Nakawa Division	20	3.5	0.3	18.349	.000
Makindye Division	20	3.3	0.2		
Central Division	20	3.5	0.6		
Kawempe Division	20	3.7	0.4		
Rubaga North	13	3.8	0.5		
Rubaga South	7	2.0	0.9		
Total	100	3.5	0.6		

The null hypothesis

The null hypothesis is therefore rejected and the alternative hypothesis taken i.e. Community education has positive bearing on the management of solid waste in Kampala city.

The findings thus suggest that waste education has a significant bearing on the management of waste in Kampala City. This was supported by qualitative findings. Some members of the communities in Rubaga South reported that there were no meetings on waste education by KCCA, CBOs and NGOs. The respondents in most divisions were aware or had been sensitized by NGOs on waste picking as income generating and a waste reduction strategy.

Waste management activities of waste pickers could be enhanced by supplying them with protective ware, providing storage facilities and the marketing of their products (Table 1.5).

Table 1. 5: The influence of education on waste management practices of communities in Kampala city

Perception or view		Views of community members by divisions (proportion of respondents)				
		Nakawa Division	Makindye Division	Central Division	Rubaga Division	Kawempe Division
The community practices proper waste storage by use of affordable waste bins e.g. bags, boxes etc.	Disagree	2(10.0%)	1(5.0%)	3(15.0%)	6(30.0%)	-
	Agree	18(90.0%)	19(95.0%)	17(85.0%)	14(70.0%)	20(100.0%)
The community puts in practice the knowledge they acquire about waste management	Disagree	2(10.0%)	-	1(5.0%)	5(25.0%)	-
	Not sure	1(5.0%)	2(10.0%)	-	1(5.0%)	1(5.3%)
	Agree	17(85.0%)	18(90.0%)	19(95.0%)	14(70.0%)	18(94.7%)
The community has been guided by officials on waste separation	Disagree	12(60.0%)	16(80.0%)	15(75.0%)	10(50.0%)	9(45.0%)
	Not sure	-	-	-	3(15.0%)	6(30.0%)
	Agree	8(40.0%)	4(20.0%)	5(25.0%)	7(35.0%)	5(25.0%)
NGO officials have educated us about the use of organic waste	Disagree	11(55.0%)	12(60.0%)	8(40.0%)	11(55.0%)	7(35.0%)
	Not sure	4(20.0%)	-	-	1(5.0%)	7(35.0%)
	Agree	5(25.0%)	8(40.0%)	12(60.0%)	8(40.0%)	6(30.0%)
The community has been guided by officials on compost formation	Disagree	16(80.0%)	20(100.0%)	15(75.0%)	14(70.0%)	10(50.0%)
	Not sure	1(5.0%)	-	3(15.0%)	6(30.0%)	6(30.0%)
	Agree	3(15.0%)	-	2(10.0%)	-	4(20.0%)
The community practices compost formation	Disagree	16(80.0%)	20(100.0%)	16(80.0%)	14(70.0%)	12(60.0%)
	Not sure	4(20.0%)	-	3(15.0%)	6(30.0%)	7(35.0%)
	Agree	-	-	1(5.0%)	-	1(5.0%)
The community is learning to sell recyclables to recycling industries in Kampala and Jinja (plastics and metals)	Disagree	3(15.8%)	-	-	-	-
	Not sure	1(5.3%)	-	-	-	2(10.0%)
	Agree	15(78.9%)	20(100.0%)	20(100.0%)	20(100.0%)	18(90.0%)
The community meetings have improved on waste management practices in the city (storage, separation and disposal)	Disagree	-	1(5.0%)	2(10.0%)	6(30.0%)	-
	Agree	20(100.0%)	19(95.0%)	18(90.0%)	14(70.0%)	20(100.0%)
Innovations of waste reduction introduced by NGOs are practiced in the city	Disagree	4(20.0%)	6(30.0%)	2(10.0%)	7(35.0%)	1(5.0%)
	Not sure	3(15.0%)	1(5.0%)	3(15.0%)	-	2(10.0%)
	Agree	13(65.0%)	13(65.0%)	15(75.0%)	13(65.0%)	17(85.0%)
Innovations of waste reduction introduced by CBOs are practiced in the city	Disagree	4(20.0%)	6(30.0%)	2(10.0%)	7(35.0%)	1(5.0%)
	Not sure	3(15.0%)	1(5.0%)	3(15.0%)	-	2(10.0%)
	Agree	13(65.0%)	13(65.0%)	15(75.0%)	13(65.0%)	17(85.0%)
KCCA encourages the community to do waste reduction i.e. turn waste materials into useful products	Disagree	-	-	-	6(30.0%)	2(10.0%)
	Not sure	2(10.0%)	-	-	1(5.0%)	-
	Agree	18(90.0%)	20(100.0%)	20(100.0%)	13(65.0%)	18(90.0%)
The community has been made aware of the dangers of poor waste management	Disagree	2(10.5%)	-	2(10.0%)	1(5.0%)	-
	Not sure	1(5.3%)	-	-	-	1(5.0%)
	Agree	18(84.2%)	20(100.0%)	18(90.0%)	19(95.0%)	19(95.0%)

Table 1.5 reveals that over 70% of the respondents in all divisions reported that public education on waste management by CBOs, the private sector, KCCA and NGOs helped them to understand the need to acquire affordable bins for waste storage. The majority of them now store their wastes well in bins. Despite this observation, overall there were low levels of awareness of the dangers of proper solid waste management in many parts of the City. This was attributed to apathy by majority of city dwellers. Over 70% of the respondents in Makindye, Central, Rubaga divisions and 60% in Nakawa and 45% in

Kawempe division reported that they had not attended any waste management education meetings. This indicates the need to strengthen education on waste education in all the divisions of the city. Organizations also need to educate the community on the importance of waste separation at the source and supply bins for waste separation. The Naguru Go-Down council leaders were of the view that they could not afford many bins for waste separation. They appealed to CBOs, NGOs and KCCA to supply them with bins to enable them separate waste.

Less than 20% of the respondents in Nakawa, Central and Kawempe reported that they have not been guided by organizations on how to carry out composting, while over 60% in Makindye, Nakawa, Central, Rubaga and 60% Kawempe disagreed. This implies that compost formation is done on a very small scale in the city. Consequently, more education is needed on compost formation since compostable waste materials constitute over 50% of the waste generated in the city. This would reduce on the volume of waste delivered at the landfill. The respondents who reported that they had been educated on the use of organic waste by NGOs and KCCA constituted only 37%. This implies that organic waste, which constitutes the highest percentage of waste generated, is poorly managed by the people in the city.

Over three quarters of the respondents in Makindye, Central, Rubaga, Kawempe and Nakawa divisions agreed that they were educated by organizations on recycling and marketing of plastics and metal. This activity could reduce the volume of waste that is disposed of at the landfill, thus reducing the cost of waste transportation to the landfill. In this case, most of the respondents stressed that they face challenges of storage and marketing of recyclables and wanted KCCA to invest in recycling industries to provide market for our recyclable waste.

Community education on organic waste would include solid waste reuse in agriculture, utilization of organic wastes such as composting to reduce, reuse and recycle of organic waste. It could also be utilized in animal, poultry nutrition and urban food composting and energy production for lighting and cooking. Application of these skills and knowledge would greatly reduce on the quantity of organic waste disposed of at the landfill. This would further reduce on the cost of its collection, investment in zonal storage facilities and transportation to the landfill.

Just over 70% of the respondents in Kawempe, Makindye, Nakawa, Central and Rubaga divisions agreed that waste education helped them to acquire affordable bins for waste storage. The respondents reiterated that despite the implementation of waste education practices, delay of waste collection results in waste over flow at generation and zonal communal containers. This was attributed to frequent breakdown of refuse trucks, traffic congestion, inadequate refuse truck fleet and workers among other challenges. KCCA could increase their waste vehicle fleet by repairing and maintaining refuse trucks, increase waste management staff and workers, use alternative routes to deliver waste to the landfill. However, councilors from Rubaga south observed that waste education without technological solutions [tools and equipment] is not sufficient in itself to improve waste management in the area.

Sixty five percent of the respondents in Nakawa, Makindye and Rubaga divisions; 75% in the Central division and 85%

in Kawempe division agreed to have attended meetings by NGOs and CBOs of how to turn waste materials into useful products. The study found out that there were blacksmiths in the city especially Kisenyi who smelt scrap metal and mold it into products such as saucepans, ladles and kettles. They also promote reuse of these products by repairing leaking containers as a result of wear and tear. Other respondents reported to be able to turn scrap metals into useful domestic materials into gutters, troughs, frying pans and stoves while others turn plastics, used straws, vehicle tyres and tubes into useful products such as bags, belts, sandals, shoes, ropes and furniture. The respondents reported that NGOs such as Nakulabye Briquette Makers are turning organic waste into charcoal briquettes. The communities complained that despite their skills, they face the challenge of marketing their products. Many respondents were of the view that government could raise tariffs on imported products as this could enable them to sell their products at competitive prices.

Over two thirds of the respondents in Nakawa, Makindye, Central, Rubaga and Kawempe division stated that they were aware of the dangers of poor waste management. The respondents highlighted the dangers including floods that block roads and drainage systems. Floods often lead to loss of life and property in the low-lying areas of Bwaise, Kisenyi and Kalerwe. In addition, bad odors from the garbage dumps pollute their environment; solid waste attracts flies that transmit diseases; and dust causes eye and respiratory diseases. Therefore, waste management education could be used to equip people with knowledge and skills for management of their environment including efficient waste management.

DISCUSSION

The findings indicate that organizations such as KCCA, NGOs, PS and CBOs are educating the people on waste management in Kampala city. The study revealed that education is improving waste management practices of the communities of Kampala city. According to Ballantyne *et al.* (2006), particular skills and knowledge gained from environmental education would help in changing human behavior towards the environment. Asmawati *et al.* (2012) asserted that knowledge on a topic may increase; people may even change attitudes, but the step to improved behaviors and practices depends on a complex set of social and psychological factors. Successful public education campaigns were reported by UNEP (2000) in Bamako, Cairo, Cotonou, Dakar and Johannesburg. UNEP (2000) reported that nationwide public education campaigns in Nigeria resulted in drastic reductions in indiscriminate dumping to community-based municipal solid waste pre-collection and street cleaning. According to Munro (1992), Mathare Youth Sports Association and the Clean-up Nairobi Campaign group improved the cleaning up of Nairobi city by educating the community on waste management.

The study showed that radio and television are used to educate the people on waste management in the city. Moseler *et al.* (2008) argued that the media can play an important role in increasing public participation and awareness and can serve as an instrument for socio-psychological incentive. They found that mass media involvement, through the use of advertisement and campaigns geared towards recycling and reusing products, was seen as a useful incentive to public participation in waste management in Peru. This was supported by Kafando *et al.* (2013) who argued that to information, education and communication (IEC) to the population on the impacts of poor waste management could be strengthened through broad casting/debates, door to door sensitization, forum, theater, movies projections followed by discussion on awareness that would result in a real change in individual behavior. Onu *et al.* (2014) emphasized that authorities should be encouraged to promote environmental information and education (EIE) among the general public because the extent to which people participate effectively in waste management can only be improved through education. Besides education, Kafando *et al.* (2013) and Onu *et al.* (2014) argued that there is need to improve on the infrastructure, increase staff, and supply technological materials (tools and equipment) to the communities for efficient management of solid waste.

The study demonstrated that there is collaboration among the organizations involved in waste education to the community in Kampala city. According to Nahapiet *et al.* (1998), collaboration enables sharing and combining of knowledge to create new approaches and solutions. Morhrman *et al.* (2003) also asserted that their research provided a strong confirmation of the inseparability of fundamental planned change and social networks. Networking and collaboration are vital as reported by Hashimoto (2016) and Arvind *et al.* (2011) who observed that management of waste can be improved through collaboration and information sharing. According to Mwaura *et al.* (2014) coordination is important for continuity and sustainability. Furthermore, Goventa *et al.* (2001) contended that coordination avoids duplication of activities and enables collection and sharing of information on gap and needs of the community.

The study showed that there were inadequate posters on waste management on streets in the city. It is known that such materials send a strong message about waste management to the community. However, Pawlowski (2001) argued that according to previous research, raising awareness and education via printed materials is not as effective as using modern promotional technologies. Therefore, this study argues that modern technologies such as use of billboards, mega phones, loudspeakers, etc. could be used to demonstrate effective waste management techniques to the communities.

The low levels of awareness of impact of proper waste management among the communities in the city are a major concern. According to Jessica (2015), Milea, (2009) and O'Connell (2011), improving waste management requires efforts to raise public awareness, increase funding, build expertise and invest in infrastructure. For example, Mrayyan *et al.* (2006) argued that the low level of awareness regarding the health and environment impacts of improper management of solid waste makes it difficult to implement recycling and disposal programs in many developing countries. Furthermore, the study established that attitudes towards waste management are improving. However, Adeyemo *et al.* (2013) posited that the attitude of the people towards waste management is affected by their level of awareness of waste management. This is also supported by Ogola *et al.* (2011) who said that people with positive attitude have good waste management practices because they are aware of the negative impacts of poor waste management such as ill health and environmental pollution.

The study further demonstrated that most people did not have adequate knowledge on proper waste management including its impacts on health. Al, Khatib *et al.* (2009) reported lack of knowledge of waste management causes littering of waste by the community. This suggests that education of the community improves waste storage and other functions of waste management. According to Henry *et al.* (2006) and Jessica (2015) convenience of garbage bins has been cited many times in research as a priority when disposing of trash and when they are not present or lacking in areas, this has been enough to litter. The study found out that the majority of the respondents claim to put into practice the knowledge they acquire on waste management. The results of the study Aini *et al.* (2002) in Malaysia indicated that in order to overcome the solid waste crisis, the conscience of the individual needs to be raised through environmental awareness and concern, inculcation of sustainable consumption practices and education on waste management. Therefore, education and awareness raise people's conscience on waste management issues and improves waste management.

The study has also demonstrated that the public has not been adequately guided by organizations on waste separation. Waste separation is important for composting and recycling industries. According to Sharholy *et al.* (2008) and Slate *et al.* (2001), segregation of waste is a prerequisite for composting and recycling industries. According to Tsiboe *et al.* (2004), Austria, the Netherlands and Denmark developed a waste management education system to efficiently separate their domestic waste into glass, paper, and plastic products, thereby enabling easy collection and consequently reuse. According to Suttibak *et al.* (2008), mitigation measure for waste separation would include supply of free bins for organic materials as it was done to the community by NGOs and government in Thailand.

The study showed that the community is also not well guided on compost formation; therefore, few practice backyard compost formation. In addition, Barreira *et al.* (2006) asserted that composting is an economically viable method compared with other processes and effective in contributing to the reduction in the amount of material that should be taken to the landfill. However, although successful experiences have been reported in its application (Mbuligwe *et al.* 2002; Zurbrügg *et al.* 2005; Bezama *et al.* 2007), other scholars acknowledged that there are important limitations (Zurbrügg *et al.*, 2005; Barreira *et al.* 2006; Körner *et al.* 2008) which include failure of waste segregation at the source. According to Zerbock (2003), a low-technological approach to waste reduction is composting because in developing countries, the average city's municipal waste stream is over 50 percent organic material. Therefore, education on waste segregation could be extended to the community with supply of bins for waste separation to promote waste reuse, composting and recycling. Most of the people said that they have not been educated on the uses of organic waste. According to IPCC (2006) and World Bank (1999), biodegradable fraction is high in MSW of low-income areas due to the life style of inhabitants.

According to David (2003), poor waste management causes diseases in humans and pollution of the environment. For example, metals such as cadmium, arsenic, chromium, nickel, dioxins and *PAH*₃ are carcinogenic while organochlorines are lipophilic and accumulate in fat tissues and are associated with reproductive or endocrine disruption. Onibokum *et al.* (1999) argued that improper waste management leads to malaria and diarrhea. However, Onibokum *et al.* (1999) further asserted that the community had some knowledge on the harmful effects of poor waste management but have very limited knowledge on the implication of waste in environmental contamination and transmission. Rhule (2008) argued that the high level knowledge on waste management sometimes does not correspond with the observed practices.

Some people have learnt to sell recyclables such as metals and plastics to recycling industries in Mukono, Kampala and Jinja. According to studies conducted by Bolaane (2006) in Botswana, Al-Khatib *et al.* (2015) in Palestine, Mrayyan *et al.* (2006) in Malaysia, educational programs affect the relationship between people's attitudes towards solid waste management and their recycling activities. They are also not well guided on compost formation and as a result, few practice backyard compost formation. According to Mckenzie (2012) and Metson *et al.* (2016), in a multi-family setting centralized composting program supported by community education can reach a maximum diversion rate of more than 30 per cent. Moreover, according to Odlare *et al.* (2015), recycling of organic waste within agriculture can reduce the need for mineral fertilizers and restore organic carbon deficiency in

the soil. This suggests that organic waste reuse in agriculture reduces the cost of disposal while improving crop productivity.

Some NGOs are training the community on waste reduction strategies; for example, Nakulabye Briquette Makers Technology (NBMT) trains the community on the processing of charcoal briquettes from organic waste. Charcoal briquettes produced by the community reduce the amount of charcoal used in cooking by around 60 per cent (UNCST 2011). This reduces on the organic solid wastes that would pollute the environment and reduce cutting down of trees that would result in environmental degradation. CBOs are also training the community on making a wide range of products from plastic materials, but their products are less competitive compared to imported products on the open market.

According to Smith *et al.* (1999), poor environment management leads to environmental pollution which contributes between 25 and 33 per cent of the total global burden of disease. Ezzati *et al.* (2002) argued that diarrheal diseases, malaria and acute respiratory illness were seen as outcomes for which the environment was especially influential. Over 80 per cent of the diseases in Uganda are ascribed to poor environmental conditions (NEMA, 2004/05, 2006/07, 2008).

CONCLUSION AND RECOMMENDATION

The study indicates that public education is improving waste management practices in the city. The organizations responsible for collection and disposal need to strengthen education on waste separation which is prerequisite to reuse, recovery, recycle and compost formation. The communities need more education from NGOs on the use of organic waste since it constitutes a large percentage of the waste generated in the city. The waste education programs could further be made more effective if funding of CBOs and NGOs by government and international agencies is increased to cater for the need for more public education.

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