

INFLUENCE OF AWARENESS PROGRAMS ON SOLID WASTE MANAGEMENT ATTITUDES: A STUDY OF SCHOOL CHILDREN IN YAKKALAMULLA DIVISIONAL SECRETARIAT OF SRI LANKA

¹Udeni Navoda Samarahewa, ²Rangika Palliyaarachchi

¹Assistant Director of Education, Zonal Education Office, Udugama – Galle, Sri Lanka, ²Monash University, Dandenong Road, Caulfield East, Vic 3145

¹navoddasam@yahoo.com, ²rangika.palliyaarachchi@monash.edu

ABSTRACT

Waste Education (WE) has been given less priority in the Sri Lankan general education curriculum. Sustainable waste management program of a country should encourage public participation as well. Awareness is a way through which proper waste management practices can be inculcated. Once educated, children can be used as disseminating agents. Waste is becoming a significant issue in Sri Lanka. The purpose of this study was to measure the influence of Solid Waste Management Awareness Programs (SWMAP) on school children's attitude. Three attitude related indexes, namely attitudes, concern and willingness to participate were measured using a close ended questionnaire. The sample consisted of grade 08 and 09 students of Yakkalamulla Divisional Secretariat, in Galle district. Survey and experimental methods were used for a random sample of 346 students. The sample was divided into an experimental group and a control group. The preliminary survey revealed that majority of the students were positive regarding the three indexes. Mann Whitney U test results revealed that considered indexes did not differ with gender, prior knowledge and waste separation behavior, although, attitude and concern increased with age. The awareness program was conducted with the experimental group, covering the environmental impact of solid waste, best practices conducted in other countries, role of students and organic fertilizer preparation. The experimental results revealed that the awareness program had a significant positive impact upon all three indexes considered. The Pearson correlation coefficients between the three indexes were positive, where the experimental group post test recorded the strongest relationships. Key words: Awareness programs, Solid Waste Management, Attitudes, Concern, Willingness to participate

INTRODUCTION

Deterioration of the environment was started after the humans settled down in small communities. At the beginning of the human settlements, the quantity of wastes produced were small. After the communities expanded, generation of waste increased. During and after the industrial revolution, waste increased in leaps and bounds. Waste was recognized as a problem during 1960s (Basnayake, 2006). The problem of waste was well controlled in some developed countries. This problem is inevitable, but through proper methods it can be controlled.

The problem of solid waste has become a critical issue in South Asian developing countries. Sound waste management technologies were being developed in developed countries like Japan. Those technologies are difficult to be adopted in a developing country like Sri Lanka due to various reasons.

Solid Waste Management (SWM) was challenging to developing countries due to the conventional political, legal and policy environments. In Sri Lanka, solid waste is a major issue. A huge disaster occurred recently due to a sliding of a waste dump at Meethotamulla, Sri Lanka.

Developing an effective Solid Waste Management System (SWMS) involves active participation of many parties. A number of direct and indirect benefits can be expected from an effective SWM system. For example, it could contribute to the generation of job opportunities, a source of income generation for

participants, improve the quality of the service.

Contracting or privatization of SWM is practiced by countries like Singapore, Malaysia, Thailand, Philippines and Indonesia. However before carrying out programs of Public Private Partnership, it is important to get the consent of many parties including the public. It was reported that there was a public protest against Kaduwela-Korathota Waste to Energy Project after it has been contracted and the developer being identified (Mannapperuma, 2017).

Le et al (2017) found that attitude towards waste sorting or recycling is the crucial predictor of public waste management behavior. Municipalities encourage waste separation. Under Sri Lankan context bio degradable and non-bio degradable wastes are collected separately for the municipal collection purposes.

Informal waste pickers, itinerant waste buyers and small scale recyclers also practice waste management indirectly (Ahmed & Ali, 2004). Environmental education is a way through which the opinions, attitudes and knowledge regarding SWM can be improved. However, in the Sri Lankan school curricular a less priority was given for environmental education. Some topics related to SWM are taught through subjects like Practical Technical Skills (PTS), Agriculture and Bio Systems Technology (BST). Apart from that Environmental Pioneers Program conducted through the Central Environmental Authority is another mode through which environmental education is transferred.

Prior researchers have studied the attitudes of adults towards SWM. Attitudes of

children can be easily affected, as they are sensitive subjects. Schoolchildren are a more vulnerable group and their behavior can be easily changed through awareness programs. On the other hand when proper attitudes and knowledge are inculcated, they are more likely to practice them as lifetime habits. Experimentation of the knowledge and attitudes of school children, is also important to make curriculum reforms.

The questionnaire was designed based on the work of Earn(2011) and Vitharana(2017) and the copies, were administered among 346 students of Grade 8 and 9. This sample was selected out of a population of 1113 students. The selected sample was sub-divided into two equal groups. Four sets of observations were made, namely control group pre-test, control group post-test, experimental group pre test and experimental group post –test.

There is a dearth of research evidence to understand attitudes of school children towards SWM and how they can be influenced via awareness programs. This research is an effort to shed some light on it.

The remainder of this paper is organized as follows. In Section 2, the literature review and the theoretical perspectives of SWM are presented. Section 3 outlines the research context and method. Section 4 provides an analysis of the influence of SWM program. Finally, discussion and the concluding remarks are presented in Section 5.

LITERATURE REVIEW

Solid Waste Management Definition

Asian Productivity Organization (2007) defined Solid Waste Management as the

discipline associated with controlling the generation, storage, collection, transfer and transport, processing and disposal of Solid Waste in a manner that is in accordance with the best principals of health, economics, engineering, conservation, aesthetics and other environmental considerations and that is also responsive to public attitudes (as cited by Seeman et al; 2016)

Waste generation in Sri Lanka

According to Mannapperuma(2017) present Municipal Solid Waste(MSW) generation in Sri Lanka is around 6500 to 7000 Mt/Day. The calculated per capita waste generation varies from 1-4kg/day. Mannapperuma(2017) also has shown that present MSW collection is around 3500/Mt/Day. Therefore the collection efficiency is around 50%. Which means nearly half of the generated waste is not collected.

Abeywardhana et al (2012) had shown that nearly 37% of the people in Galle-Sri Lanka, separate waste into two categories as bio degradable waste and non biodegradable waste.

Mannapperuma(2017) also pointed out that annual growth rate of garbage generation in Sri Lanka is around 1.2% – 2%. Daily generated amount of waste in Southern Province is around 490 MT Mannapperuma(2017). As the municipal garbage collection efficiency is 50% half of the generated waste is disposed in other ways. This is why awareness programs are needed in Sri Lanka.

After establishing the National Solid Waste Management Support Centre (NSWMSC, 2013), it was tried to promote waste segregation in Sri Lanka, via providing plastic buckets to separate waste at

household level. Under this program most of the households/Institutions, Island wide were provided with 1-3 plastic buckets.

Guerrero et al (2013) described the importance of awareness campaigns to influence the behavior of individuals to segregate waste and to participate in waste management programs.

According to Abhayawardana et al (2012) the public included in their survey were aware of the SWM practice in Galle Municipal Council Area. The surveyed 100 households appreciated the daily collection (Abhayawardana et al; 2012). Nearly 100% of the public give their cooperation by placing the garbage bins outside at the correct time for collection by the Galle Municipal Council (GMC) workers.

Factors affecting Solid Waste Management Behavior

Le et al (2017) have found that most recent Municipal Organic Waste Separation at Source (MOW – SAS) programs that have been introduced in developing countries remain pilot programs. The work of Abhayawardana et al (2012) in Sri Lanka proves that is true. There are many factors affecting the waste separation and household participation in SWM programs, some of which are internal and others are external.

Attitudes, Subjective norms, perceived behavioral control, intension, and situational factors significantly predicted household waste behaviors in Guangzhou, China (Zhang et al, 2015). Except the situational factors, others are intrinsic and can be positively influenced through awareness programs.

Zhang et al (2015) proposed that future policies and campaigns should focus on

encouraging residents' active participation in waste separation, strengthening the propaganda of environmental knowledge, educating residents about the moral obligations and establishing a sense of responsibility for protecting the environment.

Zhang et al (2015) also pointed out that situational factors negatively impact on waste separation behavior. However in this study the affect of situational factors are not considered.

Afroz et al (2011) had identified that concern about the environment and Willingness to separate waste affected the respondents' behavior to Waste Management.

Pakpour (2014) identified that attitude, Perceived behavioral control; Intention and moral obligation were some significant predictors of household waste behavior at time 2.

Hornik et al (1995) discovered that the strongest predictors of recycling behavior are internal facilitators: specifically consumer knowledge and commitment. Hornik et al (1995) also pointed out that not only the internal facilitators but also some external incentives and facilitators predict recycling behavior.

Tonglet et al(2004) suggested that pro-recycling attitudes are the major contributor to recycling behavior and that these attitudes are influenced by opportunities, facilities and knowledge to recycle.

Some of the previous researchers have studied the attitudes of the schoolchildren towards SWM and how the attitudes were changed through awareness programs.

Details of those are included in the discussion section of this paper.

RESEARCH METHODOLOGY

Area where this research was carried out

There are 9 major provinces in Sri Lanka and Southern Province is one of them. Southern Province is sub divided into three districts namely Galle, Matara and Hambanthota. Yakkalamulla Divisional Secretariat belongs to Galle district.

Yakkalamulla is one of the 18 divisional secretariats in Galle District.

There are 10 public schools in the Yakkalamulla Divisional Secretariat which contain secondary grades. Out of those 10 schools, 9 are Sinhala Medium Schools which were included in this study. Geographical location of the study area is given in figure 01.

The research population were grade 08 and grade 09 students of the Sinhala medium public schools in the study area.

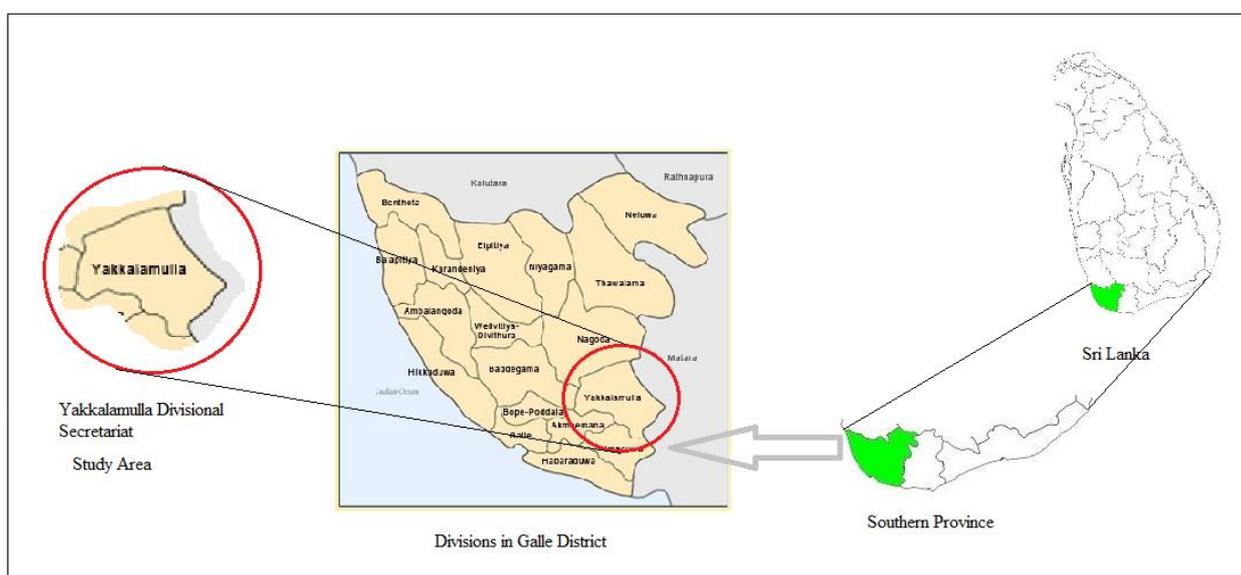


Figure 1: Study Area

The target population consisted of 1113 students. A sample of 346, was drawn according to the simple random sampling method. Yakkalamulla Divisional Secretariat was selected because it was more convenient for the researcher. The sample size was significant according to Yamane(1967) (as cited by Abeywickrama, 2008). The sample was sub divided into two equal groups as the experimental group and the control group.

Prior to data collection the questionnaire was pre-tested for the content validity. A group of students and teachers were administered the questionnaire for the pilot test. The respondents were also requested to give feedback about the questionnaire. Based on the feedback received, the instrument was reformed.

The prepared questionnaire was translated from English to vernacular language Sinhala. Afterwards it was back-translated

into English and the discrepancies were checked and corrected.

The copies of the prepared survey questionnaire were distributed among the experimental group and the control group in different venues. Preliminary information were gathered and the Initial survey was conducted.

Details of the awareness program

The awareness and attitude development program conducted for the experimental group ran for about eight hours. The program constituted of five power point presentations, an audio - visual of practical

compost making, two short films and an inspirational Sinhala song which presented the bad waste management behavior. Lecturing, Interactive learning through questioning and answering were used by the demonstrators. Meanwhile the pre test and the post test were also conducted before and after the program contents.

Two short films that were in English language were translated in to Sinhala language by two trained students. The following references and materials were used for preparing slides and events of the awareness program.

Table 01:Details of the awareness program

Events	References used
Environmental impact of waste	(Basnayake,2006)
General information regarding waste management in Sri Lanka	(Mannapperuma,2017)
Best practices adopted in other countries	(Ministry of environment and Forests – Bangladesh,2009)
How this town produce no trash (short film)	Zero Waste Town (Kamikatsu,Japan) (2016)
Waste management and recycling technology of Japan (short film)	Waste Management and Recycling technology of Japan (2017)
Preparation of organic fertilizer (DVD)	Department of Agriculture , Gannoruwa , Sri Lanka (2016)
Inspirational Song (yanna rata wate)	DeSilva D(2011)

The control group were taught normal lessons according to the school time tables. Pretest and Posttest were also conducted for the control group.

Structure of the preliminary survey

Students' background information; age, grade, gender, prior knowledge about SWM, waste separation behavior, presence of domestic bio gas units / domestic

composting units and awareness about the Municipal Solid Waste collection and separation program were collected and percentages were calculated.

Structure of the experimental data collection

Three indexes were tested. The details of the tested indexes are listed below.

Table 02: Details of the tested indexes

Index	Number of Items
Concern to Solid Waste Management	10
Willingness to Participate	11
Solid Waste Management Attitudes	12

Items in the concern to Solid Waste Management index were confronted with 11 point Likert scale options. Which is shown below.

Table 03: Likert scale used to test the concern about SWM

Extreme negative concern	←				Indifference/No Idea	→				Extreme positive Concern	
	-5	-4	-3	-2		-1	0	1	2		3

Each item in the Willingness to participate index was given 11 point Likert scale to be answered. Which is shown below.

Table 04: Likert scale used to test the willingness to participate

Extremely not willing to participate	←				Indifference/No idea	→				Extremely Willing to participate	
	-5	-4	-3	-2		-1	0	1	2		3

Each item in the Solid Waste Management Attitude index was confronted with 11 point Likert scale to be answered. Which is shown below.

Table 05: Likert scale used to test the attitude towards SWM

Strongly Disagree	←				No Opinion	→				Strongly agree	
	-5	-4	-3	-2		-1	0	1	2		3

Research Questions

Question 1 :Do attitudes, concern and willingness to participate significantly differ across gender groups ? (Male and Female)

Question 2 :Do attitudes, concern and willingness to participate significantly differ between the groups who have heard about SWM and the group who haven't?

Question 3 :Do attitudes, concern and willingness to participate significantly differ across different age groups ?

Question 4 :Do attitudes, concern and willingness to participate significantly differ between the groups who are currently practicing waste separation and the group who are not.

Question 5 : Does the awareness program positively impact upon the attitudes, concern and willingness to participate?

Question 6 : Are the three indexes positively correlated with each other?

Data Analysis

Table 06: Methods of Data Analysis

Data category	Method
Preliminary information	calculation of percentages
Question 1	Mann Whitney U test
Question 2	Mann Whitney U test
Question 3	Mann Whitney U test
Question 4	Mann Whitney U test
Question 5	Mann Whitney U test
Question 6	Pearson correlation coefficient

Results and Discussion

Personal Characteristics and Preliminary information of the respondents

The study consisted of 346 respondents which were divided in to two groups. The details and personal characteristics of the sample, control group and the experimental group are shown in table 7.

Table 07: Personal Characteristics of the Respondents

Variables & Categories	Control Group (N=173)		Experimental Group (N=173)		Whole Sample (N=346)	
	No. Respondents	%	No. Respondents	%	No. Respondents	%
1 Gender						
Male	65	38	65	38	130	38
Female	108	62	108	62	216	62
2 Age						
12 yrs	3	2	2	1	5	1
13 yrs	50	29	41	24	91	26
14 yrs	106	61	126	73	232	67
15 yrs	12	7	4	2	16	5
16 yrs	2	1	0	0	2	1
3 Education						
Grade 8	43	25	43	25	86	25
Grade 9	130	75	130	75	260	75
4 Heard About SWM before						
Yes	111	64	111	64	222	64
No	62	36	62	36	124	36
5 Separate Waste at Domestic Level						
Yes	65	38	56	32	121	35
No	108	62	117	68	225	65
6 Awareness About the Municipal Waste Management Program						
Yes	137	79	135	78	272	79
No	36	21	38	22	74	21
7 Domestic Bio-gas Units						
Yes	5	3	9	5	14	4

No	168	97	164	95	332	96
8 Domestic Compost Units						
Yes	106	61	96	55	202	58
No	67	39	77	45	144	42

According to the table, 38% of the respondents were male and 62% were female and they were evenly distributed across the control group and the experimental group. The sample consisted of students from 12yrs to 16yrs and all of them were either grade 8 or 9 students. 64% of the respondents have heard about Solid Waste Management before while 36% of them never had heard about Solid Waste Management before. 35% of the respondents separate waste at Domestic level while 65% of them do not separate waste at Domestic level. 79% of the respondents knew about the Municipal Solid Waste Management Program and 21% of them did not know about the Municipal Solid Waste Management program. In contrast Abhayawardana et al (2012) has shown that all of the adult respondents in their study were aware of the SWM practice in Galle Municipal Council area.

4% of the sample maintain bio-gas units at their houses while 96% of them do not have bio-gas units at their homes. 58% of the respondents have Domestic composting units while 42% of the respondents do not have domestic composting units.

Differences between dependent variables between selected independent groups

Between Boys and Girls

Table 8 shows the differences/indifferences between boys and girls of the whole sample. Only pre test results were analyzed for this matter.

*Table 08: Mann Whitney U test results for differences between boys and girls (N for boys =130 * number of items in the index, N for girls=216*number of items in the index)*

Index	Median		Mean		Test statistic (W)	p
	Boys	Girls	Boys	Girls		
1 Concern to Solid Waste Management	4	4	3.09	3.23	2254061.5	0.8768

2	Willingness to participate	4	4	3.3	3.5	2688841	0.3124
3	Attitudes (Positive Statements)	4	4	3.2	3.4	798935	0.4016
4	Attitudes (Negative Statements)	0	0	-0.452	-0.248	552684.5	0.3257

Mann Whitney U test results show that there is no particular difference between boys and girls regarding Concern, willingness and Attitudes. The Mann Whitney U test results were not significant at $p \leq 0.05$.

Between those who have heard about SWM before and those who hadn't

*Table 09: Mann Whitney U test results for differences between the Children who had heard about SWM before(Yes group) and Children who hadn't(No group) (N for yes group =222 * number of items in the index, N for no group = 124*number of items in the index)*

No	Index	Median		Mean		Test statistic (W)	p
		Yes group	No group	Yes group	No group		
1	Concern to Solid Waste Management	4	4	3.2072	3.1355	2121242.5	0.3831
2	Willingness to participate	4	4	3.4717	3.3878	2588261	0.8029
3	Attitudes (Positive Statements)	4	4	3.3536	3.4261	776105.5	0.7916
4	Attitudes (Negative Statements)	0	0	-0.341	-0.295	537979	0.8908

Table 9 shows that there is no significant difference regarding any Index between those who had heard about SWM before and those who hadn't.

Between Students of 13yrs or below and 14yrs or above

*Table 10: Mann Whitney U test results for differences between the Children of 13yrs or below and 14yrs or above (N for ≤ 13 group =96 * number of items in the index, N for $14 \leq$ = 250*number of items in the index)*

No	Index	Median		Mean		Test statistic (W)	p
		≤13yrs	14yrs≤	≤13yrs	14yrs≤		
1	Concern to Solid Waste Management	4	4	3.0073	3.2484	1603053	0.0269
2	Willingness to participate	4	4	3.3049	3.4942	1981917.5	0.3532
3	Attitude (inverse statement values recoded)	3	3	1.697	2.104	1927611	0.0066

Age of the respondents varied from 12 – 16 while majority were 13 or 14. The respondents were grade 8 and 9 students therefore majority of grade 8 were 13yrs and grade 9 were 14yrs. However there were few age out-liers. Table 10 shows the differences between those two groups.

Results show that there are significant differences in concern and Attitude. The older students are more concerned and have stronger attitude than younger students.

Between Students who already separate waste and those who do not separate waste

*Table 11: Mann Whitney U test results for differences between the Children who separate waste and children who do not separate waste at their houses (N for those who separate waste = * number of items in the index, N for those who do not separate waste = 250*number of items in the index)*

No	Index	Median		Mean		Test statistic (W)	p
		sep	don't	sep	don't		
1	Concern to Solid Waste Management	4	4	3.1298	3.2093	3905217.5	0.6791
2	Willingness to participate	4	4	3.4582	3.411	4697305	0.6682
3	Attitude (inverse statement values recoded)	3	3	1.8798	2.0509	4742129.5	0.3381

According to the table number 11, again there are no differences between the students who separate waste and those who do not separate waste.

Experimental Results

Figures below show the responses of the students for the three Indexes considered. Those responses were categorized to four groups as Experimental group pre-test, Experimental group post test, Control group pre test and Control group post test.

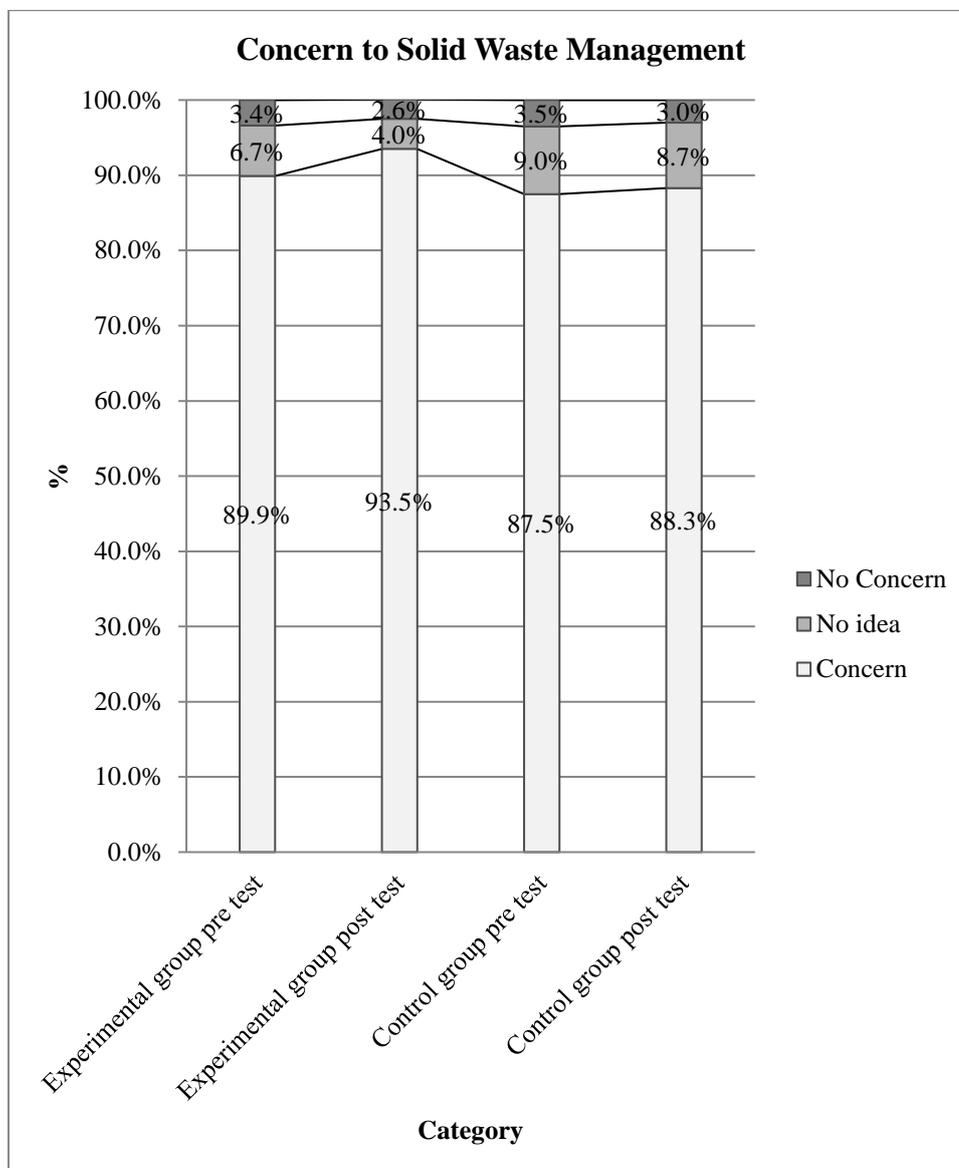


Figure 02: Percentage of students who are concerned about SWM

93.5% of the post experimental group were concerned about SW issues. followed by the pre experimental group (89.9%), post control group (88.3%) and pre control group (87.5%).The percentage value for “concern” is an aggregate value of mild concern to extreme concern.

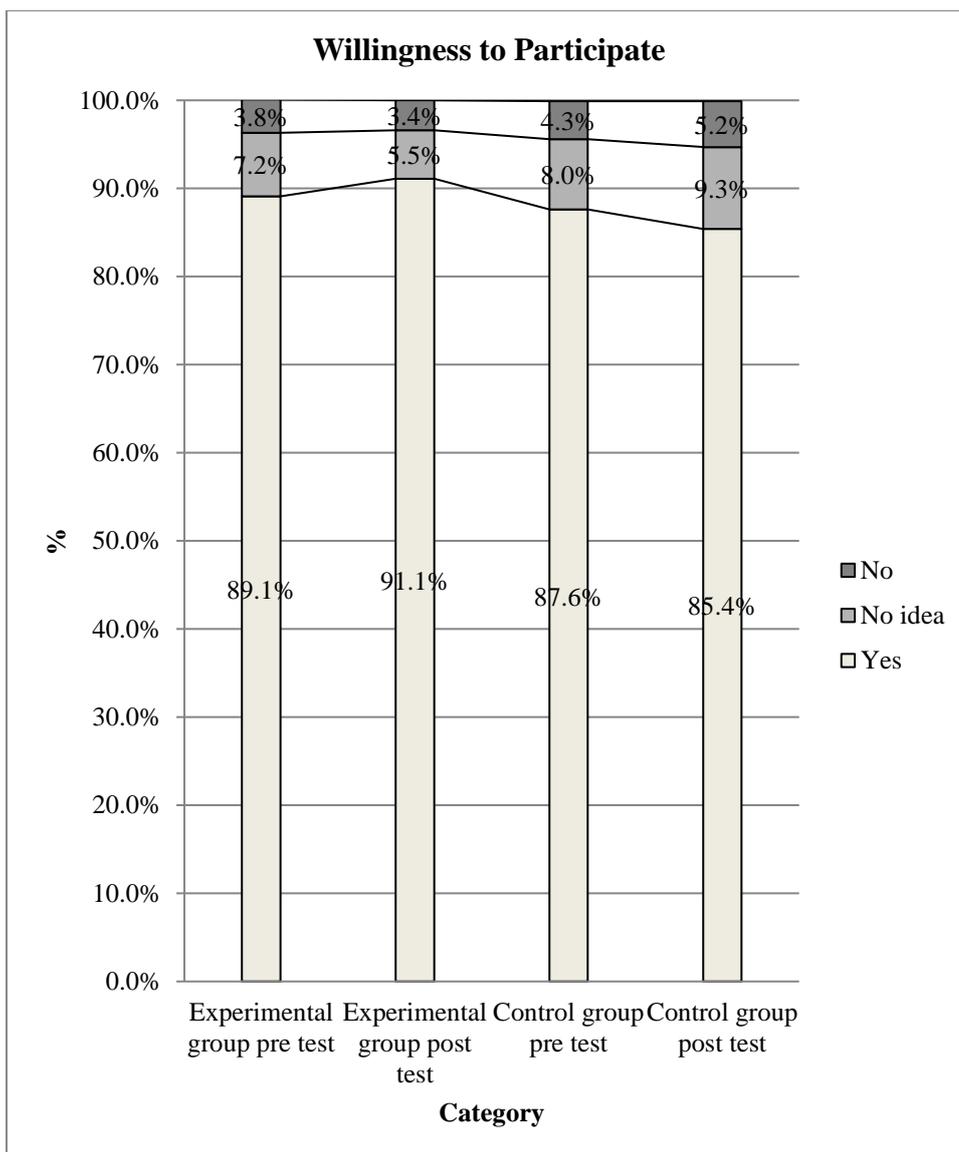


Figure 03: Percentages of students' willingness to participate in SWM

Willingness to participate was highest with the post Experimental group(91.1%), followed by the pre experimental group (89.1%), pre control group(87.6%) and the post control group(85.4%). Willingness to participate was an aggregate value of mild willingness to strong willingness. SWM attitude scale consisted of some positive, negative and neutral statements. Later in this paper positive statements, negative statements and recoded values for the Attitudes were analyzed, according to that analysis only the positive statements were significantly different between the experimental group and the control group. Therefore only the accumulated results for the positive statements are indicated in the following figure.

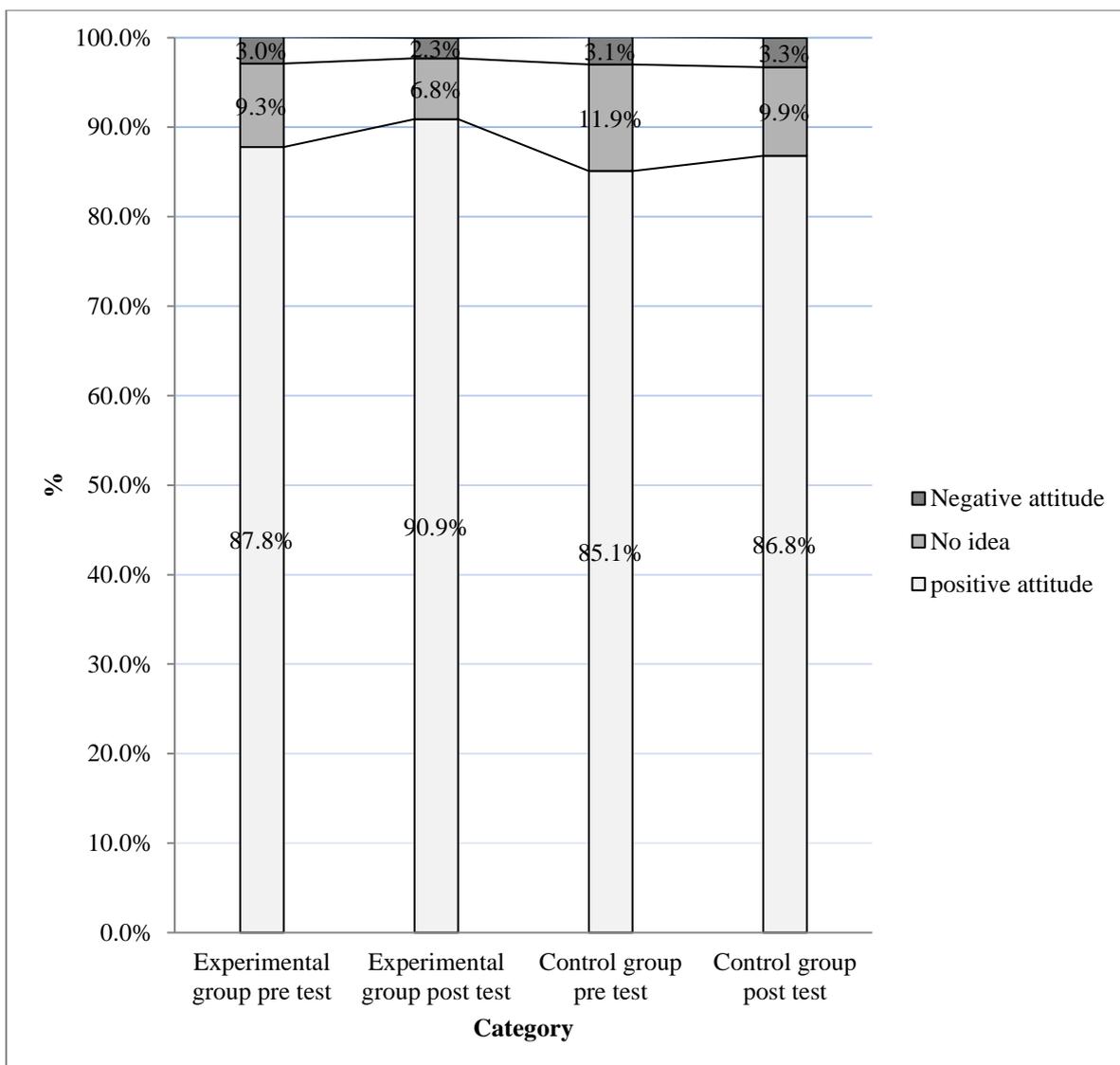


Figure 04: Percentages of SWM attitudes of the respondents

Post experimental group showed the highest positive attitude of 90.9%, followed by pre experimental group(87.8%),post control group(86.8%) and pre control group(85.1%). Regarding the negative statements disagreement for the statements were moderate in both experimental and control groups. 39th item of the questionnaire was merely checking and opinion thus it was rejected as an attitude. 53.8% of the post experimental group agreed that local government is not doing enough to fix the garbage problem and 46.8% of the post control group agreed with that. It is hard to conclude whether the local government is doing well or not. The question was only usable to check the opinion of the respondents.

Given below in table no12 are the mean and median values obtained for the four tests, for different Indexes.

Table 12: Pre test and post test means and medians (Experimental group N = Control Group N =173)

Index	Experimental group pre test		Experimental group post test		Control group pre test		Control group post test	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Concern about Solid Waste Management	3.22	4.00	3.54	4.00	3.14	4.00	3.26	4.00
Willingness to participate	3.51	4.00	3.57	4.00	3.37	4.00	3.12	4.00
Attitudes (Positive Statements)	3.38	4.00	3.55	4.00	3.38	4.00	3.34	4.00
Attitudes (Negative Statements)	-0.42	0.00	-0.06	0.00	-0.23	0.00	-0.03	0.00
Overall Attitude Index(Negative statements recoded)	2.03	3.00	1.96	3.00	1.95	3.00	1.83	3.00

Post Experimental group shows the highest mean value for concern about solid waste Management(3.54), followed by post control group(3.26), pre experimental group(3.22) and pre control group(3.14).

Post experimental group also shows the highest mean value for willingness to participate(3.57), followed by pre experimental group(3.51), pre control group(3.37) and post control group(3.12) Post experimental group shows the highest mean values for Attitudes-Positive statements(3.55) followed by pre control and pre experimental groups(3.38) and post control group(3.34). As this comparison is not enough to get the experimental affect, Mann Whitney U test was conducted to compare the experimental affect and the control affect. For that the following steps were followed

Calculated the post test minus pre test value for each observation in each index for the experimental group and the control group. Mann Whitney U test was conducted for the

experimental group changes and the control group changes obtained values for each single item

Mann Whitney U test was conducted for the experimental group changes and the control group changes for each index to get the overall affect.

Results of the above are given in Table nos.13 – 15

Table 13: Mann Whitney U test results for Experimental affect vs Control affect on Concern to Solid Waste Management (Experimental group N = Control group N = 173)

Item No	Statement	Median (Post test-Pre test)		Mean (Post test-Pre test)		Test statistic (W)	p
		Experiment al group	Control group	Experiment al group	Control group		
13	How concerned are you about health risks related to burning garbage?	0	0	0.509	0.416	30349	0.7204
14	How concerned are you about illegal dumps polluting rivers, streams and wells?	0	0	-0.13	-0.29	30886.5	0.3494
15	How concerned are you about diseases that are related to improper storage and disposal methods, like leptospirosis and malaria?	0	0	0.231	0.254	29818	0.8323
16	How concerned are you about flooding due to garbage blocking drains and gullies?	0	0	0.093	0.162	30126.5	0.9054
17	How concerned are you about the reduction of natural resources that are used to make the products we buy and use (such as, oil for plastic bottles and trees for paper)?	0	0	0.676	0.358	31470.5	0.1179
18	How concerned are you about the service provided by the garbage truck in this area	0	0	0.439	0	31247.5	0.1856

19	How concerned are you about litter in this area?	0	0	0.439	0.168	31113.5	0.2381
20	How concerned are you about illegal dumping in this area?	0	0	0.214	0.11	30918.5	0.332
21	How concerned are you about the presence of rats in this area?	0	0	0.59	-0.01	32011.5	0.032*
22	How concerned are you about garbage around your area?	0	0	0.093	0.035	31040.5	0.2708
	Overall Concern to SWM (N for Experimental group = Control group=1730)	0	0	0.316	0.12	3081147	0.0029*

Table 13 describes the experimental affect Vs Control affect for the first Index i.e Concern to SWM. Although most of the item-wise differences were not significant, The overall affect was significant. As the experimental group change was higher, the treatment(SWMAP) had a positive affect for changing the respondents concern to SWM.

Table 14: Mann Whitney U test results for Experimental effect vs Control effect on Willingness to participate (Experimental group N = Control group N = 173)

Item No	Statement	Median (Post test-Pre test)		Mean (Post test-Pre test)		Test statistic (W)	p
		Experimental group	Control group	Experimental group	Control group		
23	Have you ever heard about composting?	0	0	0.162	-0.08	30781	0.4109
24	Have you ever heard about recycling?	0	0	0.549	0.197	31674.5	0.0746*

25	If a recycling program was set up, that collect materials like plastic, paper, metals etc would you be willing to separate these in to separate bags for collection purposes?	0	0	-0.2	-0.31	30288	0.77
26	Would you be willing to pay for pickup of these recycling materials from your home?	0	0	0.89	0.173	32646.5	0.0047*
27	Would you be willing to participate in a program to compost food and yard waste?	0	0	-0.24	-0.23	29944	0.9392
28	If you were paid for every plastic bottle that you returned to the grocery store, would you participate in a program to return the plastic bottles?	0	0	0.052	-0.41	31241	0.1879
29	Would you be willing to purchase less throwaway products (such as, plastic bottles) to help reduce the amount of garbage you get rid of, if an alternative product of the same cost was provided?	0	0	-0.32	-0.52	31277	0.1753
30	Would you like more information about how and what types of garbage you can compost, reuse, and recycle in order to reduce the amount of garbage that you need to get rid of ?	0	0	-0.35	-0.64	31040.5	0.2708
31	If a skiff was located in your community, would you be willing to carry your garbage to it?	0	0	0.081	-0.2	30582.5	0.5426
32	Would you be willing to participate in building the skiff for your community?	0	0	-0.29	-0.55	30686.5	0.4711
33	Would you be willing to participate in the maintenance of this skiff?	0	0	0.335	-0.14	31376.5	0.1436

Overall effect for Willingness to participate (N for Experimental group = Control group=1903) 0 0 0.061 -0.25 3749100.5 0.0002*

Table 14 describes the experimental affect vs control affect for the second index i.e Willingness to Participate. Although most of the item wise differences were not significant, the overall affect was significant. The mean change in the experimental group is higher than that of the control group. Therefore the treatment(SWMAP) had a positive affect for changing the respondents Willingness to participate in SWM programs.

Table 15: Mann Whitney U test results for Experimental affect vs Control affect on Attitudes about Solid Waste Management (Experimental group N = Control group N = 173)

Item No	Statement	Median (Post test-Pre test)		Mean (Post test-Pre test)		Test statistic (W)	p
		Experimental group	Control group	Experimental group	Control group		
Positive Statements							
34	I play an important role in the management of garbage in my community	1	0	0.965	0.457	31535	0.1025
35	Environmental education should be taught in schools.	0	0	0.11	-0.11	31499	0.1109
36	The purchase decision that I make can increase or decrease the amount of garbage my household must get rid of (dispose of)	0	0	0.104	-0.2	31395.5	0.1381
43	Picking up garbage around my community is my responsibility as a resident.	0	0	0.052	0.075	30070	0.9537
44	Public education about proper garbage management	0	0	-0.08	-0.03	29665	0.7067

	is one way to fix the garbage crisis						
45	It is very important that the Local Government put recycling laws and programs in place	0	0	-0.14	-0.43	31204	0.2016
	Overall effect for Attitudes to SWM(positive statements)-(N for Ex perimental group = Control group=1038))	0	0	0.168	-0.04	1108155	0.027*
Negative Statements							
37	I don't care that burning garbage can be bad for my health and the health of others.	0	0	0.295	-0.25	31132	0.2303
38	People throw garbage on the streets and in the drains and gullies because they have no other means of getting rid of (disposing of) their garbage.	0	0	0.173	-0.09	30644	0.4996
40	Correct garbage management <u>should not be</u> taught in schools	0	0	0.792	0.873	29598.5	0.6544
41	Other personal issues (like crime, unemployment and cost of living are more important to me than a garbage free community.)	0	0	0.41	0.295	30599.5	0.5305
42	Regular collection of garbage is the only solution to the garbage problem.	0	0	0.104	0.179	29572.5	0.6343

	Overall effect for Attitudes to SWM(negative statements)-(N for Ex perimental group = Control group=865)	0	0	0.355	0.201	756982	0.423
	Overall effect for Attitudes to SWM (Both positive and minus affect removed values of negative statements(N for Ex perimental group = Control group=1903)	0	0	-0.07	-0.11	3654173	0.348
	Neutral Statements						
39	The local government <u>is not doing</u> enough to fix the garbage problem	0	0	-0.58	-0.4	29040	0.2946

Table 15 describes the experimental affect Vs Control affect for the third Index i.e SWM Attitudes. Although most of the item wise differences were not significant, the overall affect for the positive statements were significant. Therefore the treatment(SWMAP) had a positive affect for changing the respondents attitudes to SWM, regarding the six positive statements. But there is no significant difference for negative statements and neutral statement.

The awareness program had a significant positive influence. The experimental group change and the control group change is graphically shown below.

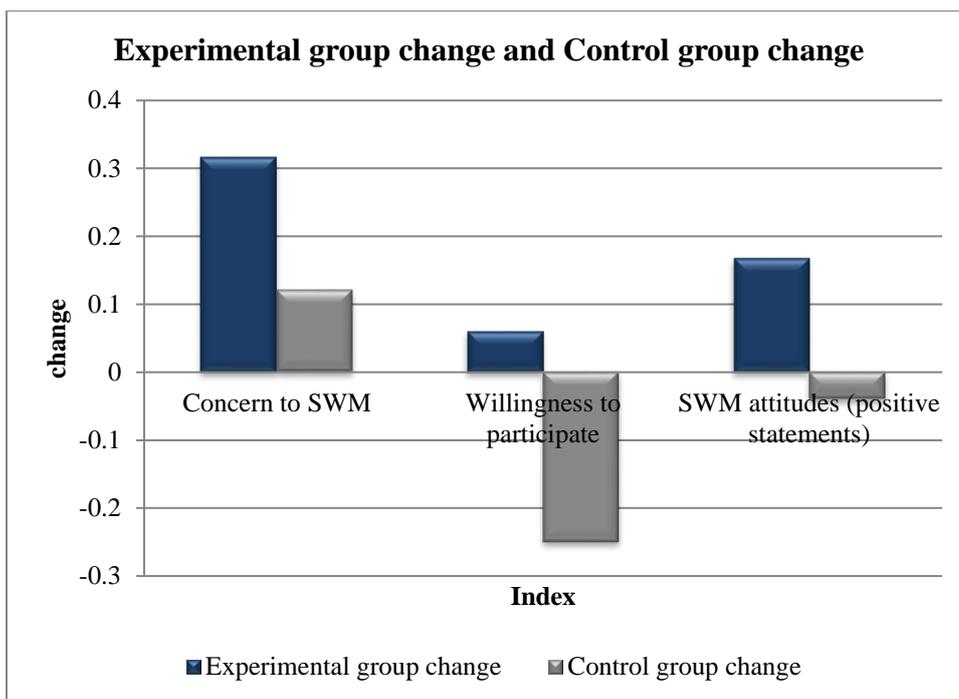


Figure 05: Affect of the awareness program: comparison of the experimental group change and the control group change

Concern about SWM, attitude towards SWM and willingness to participate had positive linear relationships with each other. The relationships were significant and the experimental group post test results showed the highest Pearson correlation coefficient values. Tables below summarizes the Pearson correlation coefficient values.

Table 16: Pearson Correlation Coefficient between dependant variables (whole group Pre test)

	Concern	Willingness
Willingness	0.455*	
	p = 0.000	
Attitude	0.461*	0.541*
	p = 0.000	p = 0.000

Table 17: Pearson Correlation Coefficient between dependant variables (Control group post test)

	Concern	Willingness
Willingness	0.586*	
	p = 0.000	
Attitude	0.547*	0.685*
	p = 0.000	p = 0.000

Table 18: Pearson Correlation Coefficient between dependant variables (Experimental group post test)

	Concern	Willingness
Willingness	0.648*	
	p = 0.000	
Attitude	0.653*	0.704*
	p = 0.000	p = 0.000

Figures below show the best fitted lines for the above mentioned relationships, which were based on experimental group post test results.

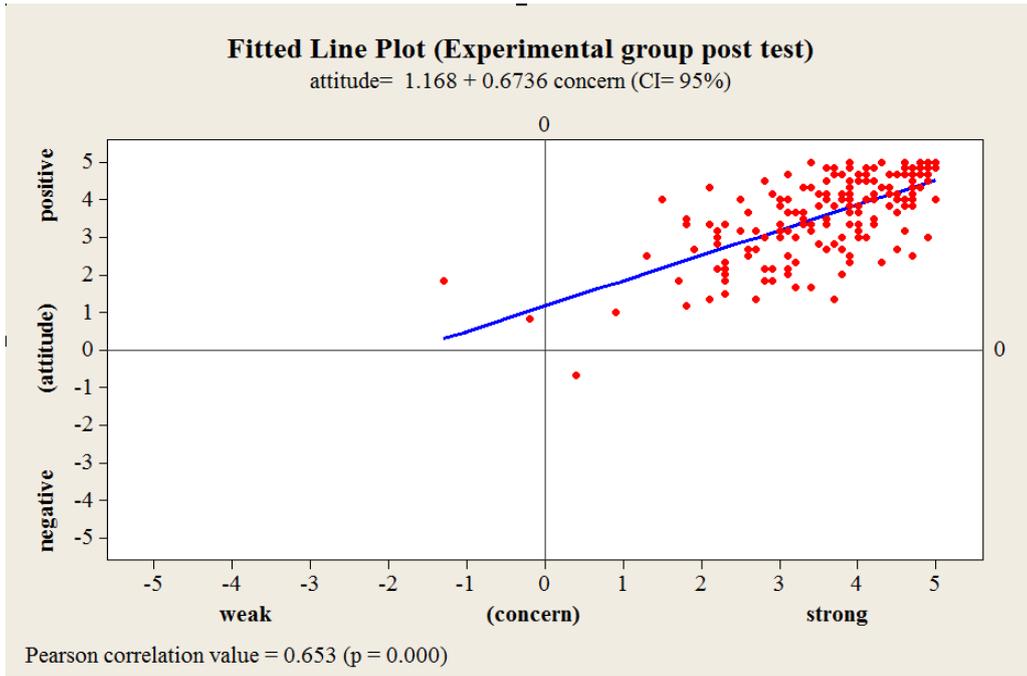


Figure 06: Positive linear relationship between Concern and Attitude to Solid Waste Management.

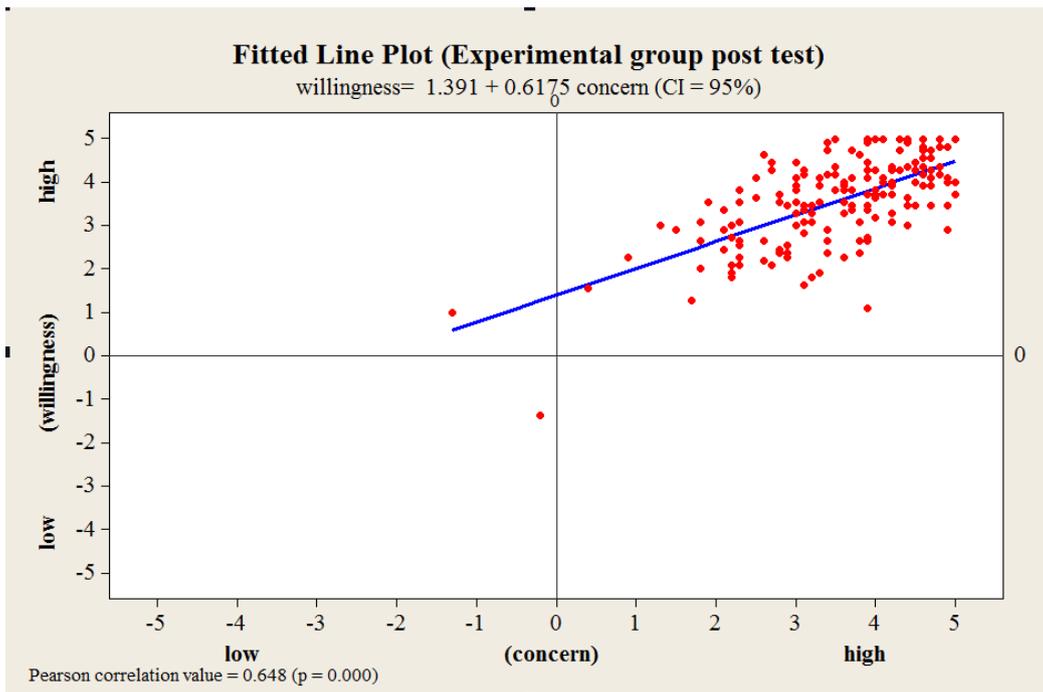


Figure 07: Positive linear relationship between Concern and Willingness to participate

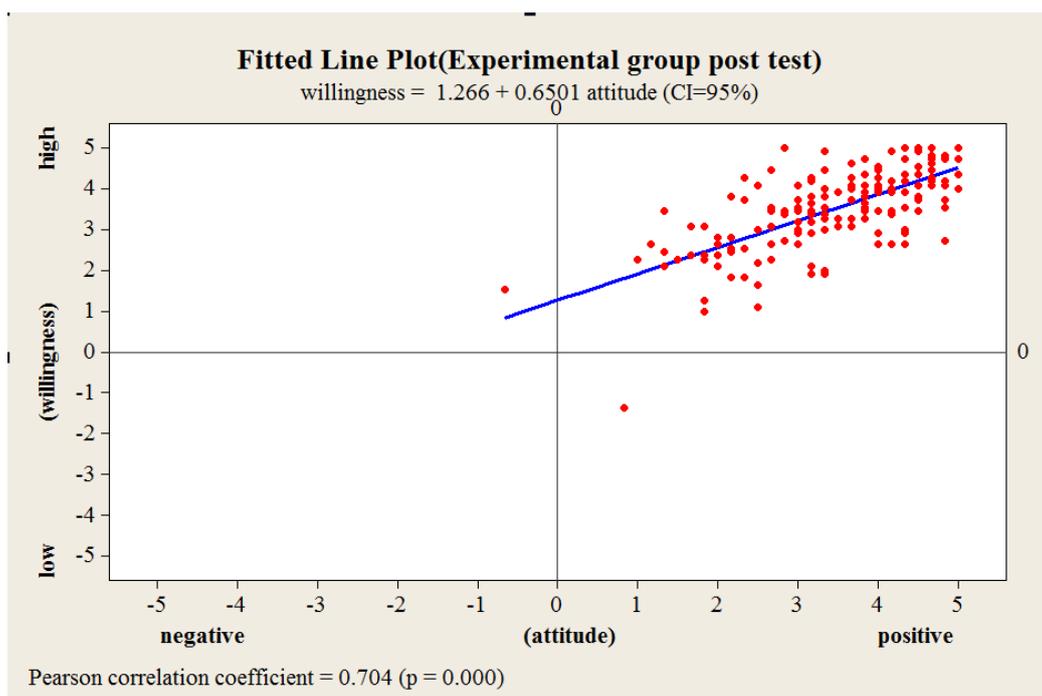


Figure 08: Positive linear relationship between Attitude and Willingness to participate (Experimental post test).

DISCUSSION

As mentioned in the Literature review section, according to Le et al (2017) most recent MOW – SAS programs in developing countries remain pilot programs. The work Abhayawardana et al (2012) revealed that only 37% of the Galle district separate waste. Similarly, only 35% of the respondents separate waste in the present study.

Grodzinska – Jurczak et al (2010) have evaluated the impact of a School Waste Education program upon students' environmental knowledge, attitudes and behavior. In their research it was observed that environmental knowledge does not necessarily lead to

improved practice as many researches previously suggested. Their program had a positive influence on students knowledge although the improvement was not significant. In contrast the experimental results of the present study reveals that the program had a significant impact on students concern, attitude and willingness to participate.

Ifegbesan (2010) revealed that the propensity for waste management differed by age of the students. According to Ifegbesan (2010) with respect to age, students in the age group of 10 – 15 years had significantly higher knowledge of waste management than the students in the age group of 16-20 years. Although the waste management

practices were higher with the older student group. Grodzinska – Jurczak et al (2010) also found that students' knowledge correlated with their age. The older students had higher degree of knowledge. In the present study also the concern and attitude were higher in the older student group.

Another finding of Grodzinska – Jurczak et al (2010) was that the knowledge on Waste Management did not differ based on students' gender. Ercan & Bilen (2014) also pointed out that there was no difference in environmental attitudes between boys and girls of 6th, 7th and 8th grades in primary schools in Kahramanmaras province in Turkey. But the findings of Ifegbesan (2010) revealed that the propensity for waste management differed by gender. According to Ifegbesan (2010) male students had a higher environmental awareness than female students. Therefore gender based differences in environmental and waste management attitudes is controversial. In the present study no differences were observed in the dependant variables between two gender types.

Grodzinska – Jurczak et al (2010) also found that after the program the % of students having pro-environmental behavior increased from 9.9% to 13.6%. In the present study also it was observed that there were significant positive changes in the all considered indexes after the program.

The selected student sample in Ifegbesan's (2010) study were aware

about the waste problems in their schools but their waste management practices were poor. However in this study the waste management practices of the students was not considered.

Yakob et al (2012) has stated the importance of increasing the public awareness, especially young generation towards proper waste management through education. The same authors convinced that proper education regarding the subject is a key to promote sustainable development.

CONCLUSIONS

Students' overall concern, attitude and willingness to participate regarding SWM were positive.

The SWMAP had a significant positive influence on School children's attitude, concern and willingness to participate about Solid Waste Management. Concern about SWM issues, SWM attitudes and Willingness to participate in SWM programs, were positively correlated with each other. The older students had a higher concern and stronger attitude to Solid Waste Management. Willingness to participate did not differ with students' age. There were no differences in attitudes about SWM based on gender, waste separation behavior, and previous knowledge.

RECOMMENDATIONS

To enhance 3R practices, as already practiced in Kamikatsu-Japan (How this town produce no trash, 2016) ,municipalities could conduct

awareness programs to the public. Lack of awareness is one reason for the waste problem in Sri Lanka.

School is a prominent place where this mission can be started. If practical waste management is supported by the school curriculum, students will be more willing to participate in such programs. Even if it is not supported by the school curriculum, it is better to have awareness programs and campaigns for students. Also it is recommended to observe the behavioral change after a campaign or a program.

This study only evaluated the effect of an awareness program. For future research it is recommended to study whether the awareness programs affect differently upon different groups in the sample.

One limitation of this study is that, it did not measure the long term impact of the awareness program. Therefore for future research it is recommended to measure the long term impact of extended awareness programs.

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