

Awareness and Compliance on Waste Segregation: Implication to a Waste Management Program in a University

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Proper disposal is among the most important aspects of a waste management program in an educational institution. This study was conducted in a university situated in the northern province of the Philippines and presents students' level of awareness on waste classification and their compliance level on proper waste segregation. A questionnaire was used to measure the level of awareness, whereas compliance level was measured through the audit of disposed wastes collected on segregated waste bins within the vicinity of the university. An average level of awareness on biodegradable waste was recorded among students, except for third year students who showed low level of awareness on this type of waste. Moreover, regardless of the type of residence, students showed low level of awareness in classifying waste. Generally, students' compliance level on waste segregation was very low. Registered low levels of awareness among university students may be linked to inadequate awareness campaign of the university, while low compliance level on proper waste segregation somehow calls for augmented forces to ensure strict compliance. Increased information dissemination and education campaign measures are recommended.

Keywords: *Awareness, Compliance, Waste segregation, Waste audit, Year level, Waste location.*

Introduction

With the aim to address the growing problem on solid wastes in the country, the government of the Philippines has enacted the Ecological Solid Waste Management Act of 2000, known as Republic Act no. 9003, declaring the policy of the state to adopt a systematic, comprehensive and ecological solid waste management program which includes the creation of the necessary institutional mechanisms. The following are included: collection as an act of removing solid waste from the source or from a communal storage point; disposal refers to the discharge, deposit, dumping, spilling, leaking or placing of any solid waste into or in an land; materials recovery facility includes solid waste transfer station or

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sorting station, drop-off centre, a composting facility, and a recycling facility. In addition, segregation at source shall refer to a solid waste management practice of separating, at the point of origin, different materials found in solid waste in order to promote recycling and re-use of resources and to reduce the volume of waste for collection and disposal.

Non-compliance to Republic Act 9003 poses legal obligations. However, it is not only due to legal reasons why proper waste segregation is encouraged. In fact, waste segregation is the first step in a conformable waste management program; it supports the concept of helping keep a good environment for protection of human health; and leads to income generation resources and cost savings for institutions (Premier Waste 2017). Further, taking into consideration the correct waste bin where one puts the type of garbage really matters (EMS 2016).

Practicing proper waste segregation at source accounts for several essential consequences; effective segregation of wastes means less waste goes to landfill. Segregated wastes are cheaper to dispose since it does not call for manual and mechanical sorting of mixed wastes (EMS 2016). For unsegregated wastes, post-collection segregation demands additional time and costs; it can wind up harming the environment especially when recyclable wastes are being sent to landfill (Premier Waste 2017). In addition, financial gains motivated residents of certain community to make the habit of waste segregation (Bulay-og 2010).

Implementation of institutional waste management programme faces different threats and challenges; among the simplest way to deal with these before it starts is by imposing strict proper segregation of waste at source. In 2007, prior to the order of strict implementation of local ordinance on waste management of the local government of (LGU) of La Trinidad, Benguet State University (BSU) implemented the so called “Eco-Waste Management Program” (EWMP) in response to the mandate of Republic Act 9003. The focus and objective of the said programme is proper waste segregation at source. EWMP consisted of four major components namely information, education and communication (IEC); collection and transportation (C&T); materials recovery facility (MRF) and research, training and development (R,T&D). Information and Education Campaign component has been in charge on the orientation of the different stakeholders of the university on proper waste disposal. It endeavored to familiarize the University of the Three-Bin System (recyclable, biodegradable, residual) to pertain to the classification of waste generated by the university.

Implementation of waste segregation at source in the university evolved over time. To facilitate easy compliance, individual garbage bins are removed, non-segregated waste bins were replaced by color coordinated segregated bins which were installed around the campus and offices. However, confusion was observed on what waste goes into the right bin. Further improvements were then introduced. The segregated bins were labeled with pictures. Moreover, to encourage maximum resource recovery, paper bins have been installed among offices; ‘bussing’ areas have been placed in the canteens to facilitate food waste segregation. Educational signages were installed to reduce stream contamination as much as possible. While it is true that BSU laboratory rooms produce some toxic wastes, these wastes were among the university’s limitation when it comes to its proper disposal, thus, these

goes out of the university and taken care of by the LGU's general services. Purchase of university garbage truck and installation of material recovery facility (MRF) are proposed to encourage maximum segregation at source, however, due to limited budget, it was yet to happen.

In October 2009, the first BSU waste audit was carried out and results revealed a high degree of misunderstandings about the appropriate disposal of food scraps, wrappers/sachets, plastic bags, tissue/wet paper, plastic bottles and Styrofoam. Two months later, a follow up waste audit and environmental awareness survey was conducted. Results bared a high degree of misunderstanding about the appropriate disposal of non-bottle (hard plastics), drinking straws, electronic equipment, plastic bags and ink cartridges; while disposal of foil, tissue/wet paper, Styrofoam, wrappers/sachets, tetra packs and ink cartridges are misunderstood to a lesser extent. Nevertheless, the BSU community clearly manifested excellent understanding and do practice correct disposal of plastic bottles and food wastes at home; however, these knowledge and awareness is not evident when inside the campus.

Since then, the implementation and compliance on proper waste disposal and segregation in the university was not studied nor evaluated whether it is known to target or not. The researchers perceived that there is a need to heighten waste management measures to ensure full participation and support in the advocacy on proper waste disposal and segregation. It is certain that viable mechanisms to re-introduce the university's EWMP are imperative. To address this concern, the study was undertaken to assess the awareness and compliance levels of students in the university's waste segregation scheme and provide relevant information on ways to improve its waste management program for a wider participation of the university community.

Materials and Methods

The study was conducted in one of the state run universities in the Philippines, situated in the heart of the municipality of La Trinidad, province of Benguet (16.42° N, 120.62° E). It is part of a project spearheaded by several faculty members belonging to one of the departments in the College of Arts and Sciences. As the college was designated to take charge of the IEC component of the university's EWMP, this project was conceptualized in response with the need to assess the mentioned programme.

A total of 511 undergraduate students enrolled during the school year 2015-2016 were randomly selected to participate in the study. Demographic variables such as year level and the type of residence where participants are currently residing were considered. A questionnaire was utilized to determine the level of awareness of students in classifying wastes into the category set by the university's EWMP. The respondents were asked to classify a list of wastes into residual, biodegradable and recyclable by placing a check mark under each type of waste. Percentage of wastes correctly classified was determined and assigned in a 5-point Likert scale as follows: very low awareness (VLA), 1-60%; low awareness (LA),

61-70%; average awareness (AA), 71-80%; high awareness (HA), 81-90%; and very high awareness (VHA), 91-100%.

To measure the level of compliance of students in segregating wastes, a waste audit from randomly selected segregated bins situated outside and inside the building structures within the vicinity of the university was conducted. And to generate the needed data, the contents of the segregated waste bins were checked by recording both the number of pieces of wastes correctly and incorrectly disposed in each bin; red bin for residual, green bin for biodegradable and yellow bin for recyclable. Percentage of correctly disposed waste is then determined. A 5-point Likert scale with the same range as shown previously was assigned with the following descriptions: very low compliance (VLC), low compliance (LC), average compliance (AC), high compliance (HC) and very high compliance (VHC). Test for homogeneity of data based on the groupings were conducted and attained before further analyses were done.

Data was analysed using ANOVA test to compare the level of awareness of students when grouped according to year level and their type of residence. The one-sample t test was used to compare the compliance level of students to average compliance. All data was tested at 0.05 level of significance.

Results

Demographic Variables and Awareness

Results indicate that students in all year levels exhibited a very low level of awareness on residual type of waste while low level of awareness on recyclable type of waste (Table 1). Whereas students in all year levels have average level of awareness on biodegradable type of waste except for third year students with low awareness level. In addition, there are no significant differences on the level of awareness of students in the different year levels on residual and recyclable type of wastes. However, the differences in the level of awareness of third year students on biodegradable type of waste compared to the other year levels is found to be significant given by *F* value of 2.956 significant at 0.05 level of significance.

Table 1. *Level of Awareness of Students on Type of Waste Classification when they are Grouped according to Year Level*

Type of Waste Classification	First Year		Second Year		Third Year		Fourth Year		F value
	%	DE	%	DE	%	DE	%	DE	
1.Residual	50.13	VLA	53.35	VLA	50.53	VLA	54.76	VLA	1.080 ^{ns}
2.Biodegradable	72.00	AA	74.82	AA	65.11	LA	71.24	AA	2.956*
3.Recyclable	69.33	LA	67.56	LA	65.60	LA	69.05	LA	0.633 ^{ns}

DE-Descriptive Equivalent, VLA-Very Low Awareness Level, *-Significant at 5% level, LA-Low Awareness Level, ns-Not Significant, AA-Average Awareness Level

Students who are not residing within the university premises have a very low overall level of awareness on the type of waste classification while those who are staying within the University have low overall level of awareness (Table 2). This

is also true for residual type of waste. Furthermore, students living in the four different types of residence have low level of awareness on recyclable type of waste. As for the level of awareness on biodegradable type of waste, it is average for students residing in their own house and relative's house while low for the other students who are renting. However, the differences in the levels of awareness of students on each type of waste classification when they are grouped according to type of residence are found to be not significant.

Table 2. Level of Awareness of Students on Type of Waste Classification when they are Grouped according to Type of Residence

Type of Waste Classification	Apartment/ Boarding House		Family-Owned		Relative-Owned		Within university		t value
	%	Des	%	Des	%	Des	%	Des	
1.Residual	50.51	VLA	53.86	VLA	50.33	VLA	60.42	LA	1.415 ^{NS}
2.Biodegradable	69.87	LA	71.83	AA	73.33	AA	70.00	LA	.549 ^{NS}
3.Recyclable	67.90	LA	69.61	LA	67.32	LA	63.54	LA	.484 ^{NS}
Overall	50.51	VLA	51.86	VLA	59.33	VLA	68.20	LA	1.535 ^{NS}

Ns-Not Significant, VLA-Very Low Awareness Level, LA-Low Awareness Level, AA-Average Awareness Level

Compliance at Different Locations

The students have a very low overall compliance level on the segregation of the different type of waste as indicated by the overall mean of 48.14 (Table 3). Further, the residual compartment of the segregated waste bins installed within each building exhibited average to high level of compliance in almost all the buildings, except for the college of Arts and Sciences with a very low compliance level. With the audited biodegradable and recyclable waste bins, the highest level of compliance was recorded at the RSDC building for biodegradable wastes and Animal Science building for recyclable wastes; other colleges/buildings however, had very low compliance level. The RSDC building houses one of the canteens in the university so the bulk of the wastes are food scraps and leftover food which are biodegradable wastes.

The very low result as an overall level of compliance poses a disturbing fact. The university students' compliance on proper waste segregation is significantly lower from the hypothesized average level of compliance (computed t-value = - 5.434, highly significant at 0.05 level of significance). Moreover, considering the idea that among the type of wastes, biodegradable seems to be the easiest to comply with; on the contrary, it displayed a very low level of compliance conveying a vituperative implication. Similarly, compliance for recyclable type of wastes is significantly lower than the average level (computed t – value = - 5.737, highly significant at 0.05 level of significance). This communicates a need to examine what lead these young adults to comply poorly, at the lowest level on all type of wastes.

Table 3. Level of Compliance of Students on Waste Segregation according to Type of Waste Classification at Different Locations

Waste Bin Location (Building)	Residuals		Biodegradable		Recyclable		OVERALL	
	%	Des	%	Des	%	Des	%	Des
Engineering	76.08	AC	26.69	VLC	16.03	VLC	39.60	VLC
HK	72.62	AC	0.00	VLC	12.50	VLC	28.37	VLC
Open University	79.53	AC	0.00	VLC	53.85	VLC	44.46	VLC
Soil Science	88.08	HC	61.11	LC	40.00	VLC	63.06	LC
Library	77.19	AC	37.04	VLC	75.00	AC	63.08	LC
Arts and Sciences Annex	81.86	HC	31.82	VLC	23.18	VLC	45.62	VLC
Veterinary Medicine	81.97	HC	50.00	VLC	14.35	VLC	48.77	VLC
Teacher Education	86.35	HC	0.00	VLC	0.00	VLC	28.78	VLC
Animal Science	70.70	LC	36.01	VLC	89.58	HC	65.43	LC
RSDC	79.06	AC	86.90	HC	43.48	VLC	69.81	LC
Arts and Sciences	53.54	VLC	25.63	VLC	25.96	VLC	35.04	VLC
Nursing	89.14	HC	51.66	VLC	21.86	VLC	54.22	VLC
Overall	77.86	AC	33.35	VLC	33.22	VLC	48.14	VLC
<i>t</i> value	1.013 ^{ns}		-5.798**		-5.737**		-5.434**	

**-Highly significant at 5% level of significance, VLC-Very Low Compliance Level, ns-Not Significant, LC-Low Compliance Level, AC-Average Compliance Level, HC-High Compliance Level

Discussion and Conclusions

This study assessed students' awareness and compliance levels in a waste segregation scheme set forth by the university's waste management programme, from which implications were drawn to come up with ways to improve the current program.

With waste segregation at source as the aim of the university's EWMP, a wider understanding of what this entails among all concerned is crucial. However, there appears to be a gap between purpose and implementation. Contrary results emerged from this study where students have difficulty in categorizing wastes into residual, biodegradable and recyclable as indicated by their low levels of awareness. Previous studies share this result where students have limited knowledge on recyclable and residual wastes (Budin et al. 2007); on the range of materials that can be recycled (Kaplowitz et al. 2009); and on what waste is and identifying recyclables (Grodzinska-Jurczak et al. 2003). More importantly, knowing what to put in which bin is fundamental in the segregation process; unfortunately, students did not even reach a level where putting wastes into the proper bin is done correctly. Such implicates a crucial drawback in the manner of waste segregation.

Role of Demographic Variables to Level of Awareness

Whether a student is a senior or freshman does not necessarily translate to having more exposure in the school's waste management programme. All students, regardless of year level, have very little idea on what wastes to put in residual and recyclable bins. It is possible that students have the mistaken idea that everything can be recycled so long as it is in good condition. Wastes that are supposed to be under residual category could have been considered as recyclables. Similarly, Barloa et al. (2016) did not find year level a factor on students' waste management knowledge. However, year level becomes a factor in the case of biodegradable type of wastes. Third year students have lower awareness on this waste category compared with the rest of the students in other year levels.

Where students reside does not indicate how well they know to classify wastes. Findings in this study show that students residing from all types of residence have limited knowledge on the classification of wastes into residual, recyclable, and biodegradable. Surprisingly, students who are staying in the university dormitories did not differ from those staying outside of the university when they were supposed to be more familiar with the university's waste segregation scheme. In addition, most of the students who participated in the study even claim that they practice waste segregation in their current residences (Dolipas et al. 2018). While this might be the case, it appears that the segregation scheme being used is not in consonance with the scheme set forth by BSU-EWMP. In context, this inference corresponds to what McDonald and Oates (2003) identified as respondents "practicing alternative way to the scheme" or "demonstrating a behavior outside of the scheme".

Altogether, demographic variables used in the study were shown not to matter where waste segregation behavior of students is concerned. Thus, when addressing the need to improve the current programme, measures taken should consider all year levels as well as reiteration of the university's critical role in spreading awareness that should reach the students' households.

Compliance Level and Implications

Color-coded segregated waste bins were placed at different buildings within the premises of the university. Yet, students do not know the correct bin to dispose of their wastes as evidenced by the waste audit done during the conduct of the study. This dismal result could be indicative to failure of the current waste management programme to adequately provide waste segregation logistics. If this is the case, then a revisit to the present implementation process becomes a necessity. Logistics issues cited by previous studies that ought to be considered are procedural directions or scheme-specific information such as *what type of waste* and *where to put the waste* could be lacking or inadequate; the size, design, number or location of waste bins might be inconvenient for students to comply; and information campaign and dissemination efforts could be insufficient or non-existent (Barr et al. 2003, Kaplowitz et al. 2009, Kelly et al. 2006, Mason et al. 2004, McDonald and Oates 2003, Sin-Yee and Sheau-Ting 2016).

While the problem could lie in the implementation process of EWMP, other underlying factors might be present as well. This may stem from issues of what happens next after waste segregation at source is done; segregated wastes must go somewhere else. If proper execution of subsequent processes such as materials recovery and collection is not evident to students, then their participation would be perceived as useless (Kelly et al. 2006).

Challenges and Measures for Improvement

The university is faced with two intermingling challenges: firstly, address low awareness and compliance levels by fostering a positive attitude among students towards proper waste segregation as well as increasing their participation in this correct practice; also, address the problematic state of its waste management programme by improving logistics issues to intensify the involvement of students in segregating wastes within the university.

Through its IEC component, the university could address insufficient understanding about the programme, particularly on waste segregation. Focusing on measures that would increase students' awareness level might also lead into correct practice of segregating wastes. Previous studies support this claim where higher levels of knowledge or understanding about waste management correspond to proper behavioural practices (Barr et al. 2003, Kelly et al. 2006). One such measure is by providing clear instructions in segregating wastes; where, according to past studies play a vital role in fostering positive behaviour in waste management (Barr et al. 2003, Budin et al. 2007, Doctor 2015, Kaplowitz et al. 2009, Sin-Yee and Sheau-Ting 2016). Instructions could be in the form of the "what", "how" and "where" (Barr et al. 2003, Kaplowitz et al. 2009, McDonalds and Oates 2003). Hence, improvements should be done in the existing scheme used in the EWMP; instructions on what waste goes into the right color coordinated trash bins should be made very clear – red for residual wastes, green for biodegradables, and yellow for recyclables. This would be easier for the university community to remember and act upon. Moreover, these instructions should also be properly and widely disseminated employing all possible means of communication, whether in written or verbal form and should be done frequently (Iyer and Kashyap 2007, Sin-Yee and Sheau-Ting 2016). Existing signages should be modified and placed strategically; inclusion of these instructions should be revived during orientation programmes; conduct of regular information campaigns should be taken by each college as their responsibility since they know what is suitable for their students. Also, promotional campaigns spearheaded by student organizations and/or the university could be conducted that may involve monetary or non-monetary incentives as these measures were found to motivate students to participate in pro-environmental activities (Iyer and Kashyap 2007, Kaplowitz et al. 2009, Marcell 2004, Sin-Yee and Sheau-Ting 2016). Constant verbal reminders on proper waste segregation practices could likewise be provided by college teachers in their classes, as suggested in a study identifying the characteristics that would promote proper waste segregation behavior (Sin-Yee and Sheau-Ting 2016). Consequently, whatever information dissemination strategy to be used, the

design must be tailored to the target audiences (Kaplowitz et al. 2009, Meneses 2006). Further studies could be done in this regard.

In the scheme of the university's EWMP, what is important would be the corresponding action – properly segregated waste at source. Hence, additional measures should also be done to address low compliance levels. From previous studies, having sufficient or high levels of knowledge on waste management does not necessarily translate to correct practice (Barloa et al. 2016, Ehrampoush and Moghadam 2005, Grodzinska-Jurczak et al. 2003). Accordingly, attention should be placed on factors that may hinder people to put into good practice what they already know. Identified in several studies are external condition such as convenience along with internal factors such as attitude and perception (Barr et al. 2003, Kelly et al. 2006, Sin-Yee and Sheau-Ting 2016). The issue on convenience could be addressed through improvement of logistics in the waste segregation scheme such as provision of greater number of segregated waste bins located at accessible areas as well as prompt and proper collection of segregated wastes to prevent overflowing and mixing of separated wastes. Moreover, the university could adopt some actions similar to what past studies have shown that would foster positive attitude among students to proper waste management. An example of this is the implementation of a school-based environmental education programme in which specifically-designed waste management educational sets were utilized in classrooms and practical activities were integrated in the current curriculum (Grodzinska-Jurczak et al. 2003). To make such programme applicable in the university setting, a modification in its design would be done such as involving the students themselves in the actual experience of pro-environmental activities (Marcell et al. 2004, Mason et al. 2004). Another modification may use a project-based approach; suggested for future studies.

In retrospect, the analysis of the present level of awareness and compliance on waste segregation in the university lead to several implications about the state of the current EWMP. This is crucial since waste segregation is regarded as the primary step in a waste management program (Premier Waste 2017). Mechanisms for improvement were put forward with the expectation that the mandates of the university's waste management program would be fully realized, thus, responding to Republic Act no. 9003.

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