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Awareness, perception and practices (APP) of undergraduate students towards solid waste management (SWM)

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Abstract

Solid waste management (SWM) issues have drawn attention elsewhere primarily as a consequence of rapid urbanization and weak environmental policies. This at the latter calls for policy framework linking all sectors particularly the university-government networks. The chance of this concerted collaboration to function efficiently relies on the university's populace understanding on SWM. This study aimed to assess the undergraduate students of the former Mindanao University of Science and Technology (MUST), Philippines in their level of Awareness, Perception, and Practices (APP) towards SWM. A total of 349 students were randomly surveyed to identify APP. Data collected by self-administered questionnaire were analyzed using frequency count, percentage, correlation, and t-test. For all year levels, it was found that the level of awareness, perception, and practices of students in MUST varied. Overall, no significant difference was determined among factors of age, year level, and college of the students. Present findings can be a basis for policy development on SWM implementation in the university scale.

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Introduction

The mandate of Republic Act 9003-Ecological Solid Waste Management Act provides the legal framework on solid waste management (SWM) in the Philippines. The extent of the implementation of this policy showed institutional gaps owing to use of unregulated or unmonitored open landfills and dumpsites (Galarpe and Parilla, 2012; Galarpe and Parilla, 2014a; Galarpe, 2015). Aggravating the concern were associated environmental ill effects determined from socio-economic and physicochemical studies of waste disposal sites in the Philippines (Sia Su, 2007a; Sia Su, 2007b; Galarpe and Parilla 2014b; Galarpe, 2015; Nazareno *et al.*, 2011; Ejares *et al.*, 2014; Buagas *et al.*, 2015). Consequently, a need for appropriate institutional arrangements among all sectors is needed to address SWM issues.

One of the sectors which may provide SWM awareness is the university. This institution is capable of disseminating SWM strategies to students, improving practices towards solid waste disposal and recycling options. Studies elsewhere on SWM perception analysis showed improved behaviors and practices among students by providing recycling options and awareness (Malakahmad *et al.*, 2010; de Vega *et al.*, 2008; de Vega *et al.*, 2003; Mason *et al.*, 2003; Smyth *et al.*, 2010; Kaplowitz *et al.*, 2009) depending on a complex set of social and psychological factors (Desa *et al.*, 2011).

Extrapolating from literature it is essential to build good SWM awareness in academic institutions. Present literature on SWM in academic institutions were mainly; (i) focusing on first year students concerns towards SWM (Desa *et al.*, 2011); (ii) recycling and disposal practices of medical sciences students (Ehrampoush and Moghadam, 2005); and secondary students understanding and practices towards SWM (Ifegbesan, 2011). In the Philippines there is no study in particular dealing on evaluating students' level of awareness, perception, and practices (APP) towards SWM in a university, making the present study beneficial.

Locally, the former Mindanao University of Science and Technology (MUST), Philippines facilitated environmental activities. These were reflected in the: (i) introductory course in environmental science (e.g. ENVI 10) offered in the undergraduate programs; (ii) specialized course in BS-MSc Environmental Science and Technology; (iii) topics taught in the course National Service Training Program (NSTP); and (iv) facilities for SWM (e.g recycle and trash bins). The extents of these proactive environmental initiatives were not determined quantitatively among university students. It is with this purpose this study was conducted to extrapolate an environmental estimate on students' awareness, perception, and practices (APP) towards SWM.

Materials and methods

Framework

Solid waste management is a challenge for the cities' authorities in developing countries mainly due to the increasing generation of waste, the burden posed on the municipal budget as a result of the high costs associated to its management, the lack of understanding over a diversity of factors that affect the different stages of waste management and linkages necessary to enable the entire handling system functioning (Guerrero *et al.*, 2013). Consequently, a need for other social networks to create institutional arrangements for SWM (Ancog *et al.*, 2012) is seen timely to mitigate the concern. The academic entity for example is a vital source of environmental information pertinent to address SWM issues. It is with this purpose the study was initialized from the concepts of other studies elsewhere (Ifegbesan *et al.* 2010; Ifegbesan *et al.*, 2011; Adeolu *et al.*, 2014; Ehrampoush and Moghadam, 2015), assessing students APP towards SWM. To extrapolate the comparative measure in the university scale, factors for gender, college, and year level with set as variables to compare. Further questions on practices were similarly highlighted to quantitatively determine SW generate at a university scale (de Vega *et al.*, 2008; de Vega *et al.*, 2003; Smyth *et al.*, 2010; Zhang *et al.*, 2011). Types of disposal method were also determined.

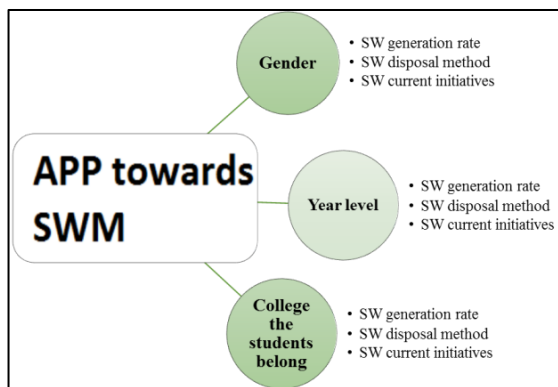


Fig. 1. Framework of the study.

Participants

Randomly selected undergraduate students of the former MUST from the four Colleges namely; College of Arts and Sciences (CAS), College of Engineering and Architecture (CEA), College of Industrial and Information Technology (CIIT), and College of Policy Studies, Education and Management (CPSEM) were the respondents for evaluating APP towards SWM. The conduct of study was on 2014-2015.

Respondents Profile

Out of the expected number of respondents (n=383), only 91.12% (n=349) of the questionnaire was successfully returned for analysis. The sample size (n=349) consists of male 177 (53.7%) and 172 female (46.3%) in which 106 from the 1st year level (30.29%), 73 from the 2nd year level (20.86%), 90 from the 3rd year level (26.0%), 66 from the 4th year (18.85%), and 14 from the 5th year level (4.0%). This number of respondents was the subject of the study for the evaluation and assessment towards SWM APP.

Sampling

The survey on students APP was conducted on October 2014. To determine statistically acceptable sample size to be extracted, Slovin's formula was used having 5% marginal error.

Out of the 8,782 students enrolled in the 1st semester of school year 2014-2015, the sample size (n) generated was rounded up to 383 respondents. This number of respondents was divided accordingly to the four (4) colleges. 80 respondents was taken from the CAS with the least population from the other colleges,

116 respondents from the CEA with the largest population, 103 respondents taken from the CIIT, and 84 respondents from the CPSEM. The survey in each college was handled by year level in a course-wise manner (each course in each college).

Survey Instrument

The survey questionnaire on evaluating students APP towards SWM was adopted from Ifegbesan, (2010) with modification on the nominal scales used to measure their respective response. About 38 key questions were administered to randomly selected students. The questions addressed the following highlights: (i) environmental policies; and (ii) APP towards SWM. The first part included 15 questions about knowledge on SWM and environmental concerns and policies.

The second part included 10 questions about opinions on situations regarding on environmental impacts and involvement to issues asked. The latter includes 10 questions with additional 3 questions on behavior towards SWM. Minor questions included an estimation of the waste generated per day (grams) and preferred waste disposal methods.

Evaluating Students APP towards SWM

The first part of the questionnaire measured the awareness of the students scored as 1, 2, and 3 for "yes", "no", and "somewhat". The second part measured perception was scored as 1, 2, 3, and 4 for "strongly agree", "agree", "disagree", "strongly disagree". The last part measured practices was scored as 1, 2, 3, and 4 for "Very often", "Often", "Seldom", "Never".

Minor questions measured the estimates of the waste they generated per day in grams and scored as 1, 2, 3, 4, and 5 for "waste < 100 g", "100g < waste < 300 g", "300 g < waste < 500g", "500 g < waste < 1000 g" and "more than 1kg" respectively. Lastly, the current and preferred method for waste disposal was scored as 1, 2, 3, 4, and 5, for "burning", "landfill-dumpsite", "composting", "recycling", and "trash bin".

Data analyses

The statistical methods used in this study included descriptive statistics expressed in frequency and percentage. Other statistical methods employed consisted of t-test and Pearson's product moment correlation coefficient to determine the relationship between students background variables (gender, year level, and college) and their awareness, perception, and practices (APP) towards SWM. Further, t-test and correlation was used to examine the hypotheses tested.

Results and discussion

Awareness of Students towards SWM

Table 1 presents the summary of students' response on SWM awareness. Notably, a high percentage of positive ("yes") response among CIIT students (61.70%) was observed perhaps due to convenient access to technology and information. This was followed by CEA, CAS, and CPSEM students. Overall, the responses for negative ("no") and "somewhat" (in doubt) recorded low in all colleges.

Table 1. Students' Awareness Responses towards SWM.

College	Awareness		
	Yes	No	Somewhat
CAS	48(60%)	17(21.25%)	15(18.75%)
CEA	55(55.56%)	25(25.25%)	19(19.19%)
CIIT	58(61.70%)	24(25.53%)	12(12.77%)
CPSEM	40(59.70%)	16(23.88%)	11(16.42%)
Year Level	YES	NO	SOMEWHAT
1ST	67(63.46%)	25(23.08%)	14(13.46%)
2ND	42(57.75%)	19(25.35%)	12(16.9%)
3RD	51(56.63%)	22(24.09%)	17(19.28%)
4TH	39(58.82%)	14(22.06%)	13(19.12%)
5TH	8(57.14%)	4(28.57%)	2(14.29%)
Gender	YES	NO	SOMEWHAT
MALE	103(58.18%)	43(24.58%)	31(17.32%)
FEMALE	111(64.51%)	34(20.04%)	27(15.85%)

On the year level factor, the first year students' responded being positively aware towards SWM (63.46%). Present finding is in agreement with Desa *et al* (2011) as reflective of the integration of SWM concepts to the NSTP and Environmental Science (ENVI 10) courses among first year students. The NSTP course in particular initiated SWM strategies by donating waste bins as receptacles for recyclable waste PET bottles. These were placed visibly along major pathways and densely populated area in the university (canteen) (Galarpe and Heyasa, 2017). This practice may promote positive attitude towards recycling Omran *et al.*, 2009) and as a convenient activity by familiarizing the public with recycling sites (Sidique *et al.*, 2009). Ideally, a pro-active educational system (e.g. integration of SWM to the courses) will eventually encourage adoption of sustainable practice (de Vega *et al.* 2003). Likewise, despite the female respondents (64.51%) being positively aware towards SWM than male respondents (58.18%) no significant difference in both genders was determined (t-obtained: -0.1318).

Perception of Students towards SWM

Perception evaluation revealed that students from CIIT perceived positively towards SWM (N = 44) whereas students from CEA perceived less likely positively towards SWM (Table 2). However, within the college the CAS students rate highest (53.3%) on "strongly agree" response as perception towards SWM. The perception response in each year level was highest at "strongly agree" response (average of 46.32%) except for the 5th year level (highest at "agree" response with 52.54%). On the gender factor, both female and male respondents have high percentage of "strongly agree" response, although female respondents had the higher response with 50.78%. Overall, a moderate perception towards SWM was observed among students. The findings of students' perception towards SWM corroborated with the findings on awareness (see Table 1) where CIIT and first year students showed highest positive response. On a larger scale, poor perception can be associated to irregularity and inefficient collection system, poor monitoring of the private waste service providers/authorities (Longe *et al.*, 2009).

Table 2. Students' Perception Responses towards SWM.

College	Perception			
	Strongly Agree	Agree	Disagree	Strongly Disagree
CAS	39(53.3%)	24(32.83%)	7(9.89%)	3(3.98%)
CEA	42(45.62%)	36(39.62%)	10(11.1%)	3(3.66%)
CIIT	44(47.82%)	35(38.1%)	11(11.46%)	2(2.62%)
CPSEM	36(49.73%)	25(34.38%)	9(11.78%)	3(4.11%)
Year Level	<i>Strongly Agree</i>	<i>Agree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
1 ST	50(48.54%)	37(35.92%)	12(11.65%)	4(3.89%)
2 ND	33(50.00%)	24(36.37%)	7(10.61%)	2(3.03%)
3 RD	42(48.28%)	31(35.63%)	11(12.62%)	3(3.45%)
4 TH	30(49.18%)	21(34.42%)	7(11.48%)	3(4.92%)
5 TH	4(35.59%)	6(52.54%)	1(10.17%)	1(1.7%)
Gender	<i>Strongly Agree</i>	<i>Agree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
Male	81(45.83%)	71(40.11%)	20(11.43%)	5(2.86%)
Female	87(50.78%)	58(33.55%)	20(11.63%)	7(3.98%)

Practices of Students towards SWM

Summary of results for students' practices towards SWM is shown on Table 3. Overall, the responses of the four colleges favored on "often" with CEA students having the highest response (39.79%) followed by CAS students (39.27%). Similarly, at the year level factor the "often" response had the highest percentage obtained. The 4th year level students had the highest "often" response (41.17%). While awareness and perception were observed better among CIIT and first year students these however do not reconcile with SWM practices.

It was noticeable that senior students from CAS and CEA practiced better SWM. Students at this level had undergone sufficient training in the sciences reinforcing their consciousness to ideally practice SWM. Likewise, on the gender factor both male and female favored on "often" response with male having the higher response (38.33%). Extrapolating from this, results revealed that regardless of factors considered (college, year level, and gender) students rated "often" and "seldom" for SWM practices. Students were aware with SWM problems but possessed poor SWM practices (Ifegbesan, 2010).

Table 3. Students' Practices Frequency Responses.

College	Practices			
	Very Often	Often	Seldom	Never
CAS	20(24.37%)	31(39.27%)	21(25.38%)	9(10.98%)
CEA	14(15.05%)	37(39.79%)	26(27.96%)	16(17.20%)
CIIT	23(25.28%)	34(37.36%)	25(27.47%)	9(9.89%)
CPSEM	21(29.17%)	24(33.33%)	20(27.78%)	7(9.72%)
Year Level	<i>Very Often</i>	<i>Often</i>	<i>Seldom</i>	<i>Never</i>
1 ST	29(27.68%)	40(37.65%)	25(23.56%)	12(11.11%)
2 ND	16(21.75%)	26(35.88%)	20(26.98%)	11(15.39%)
3 RD	17(19.03%)	36(39.46%)	26(29.40%)	11(12.11%)
4 TH	14(20.73%)	27(41.17%)	19(28.42%)	6(9.68%)
5 TH	2(15.44%)	5(38.97%)	4(26.47%)	3(19.12%)
Gender	<i>Very Often</i>	<i>Often</i>	<i>Seldom</i>	<i>Never</i>
Male	37(21.11%)	68(38.33%)	48(27.22%)	24(13.34%)
Female	41(23.69%)	65(37.68%)	47(27.32%)	19(11.31%)

Association of students background/factors to APP

Using Pearson's Product Moment correlation coefficient, relationship between student's background variables and APP were measured. Table 4 showed that there was a very low correlation in all the variables compared. Overall, the APP results had a negative correlation with respect to gender, indicating that both male and female students had the

same level APP towards SWM. A positive correlation was found between APP and the colleges the students belong. This can be explained by high level of APP among CIIT students (refer to Table 1-3) as compared to other colleges. Likewise, awareness ($r = -0.02743$) and practices ($r = -0.13031$) had a negative correlation with respect to year level except for perception ($r = 0.038337$).

It was observed that first year students perceived better towards SWM (Table 2). This can be attributed to NSTP courses tackling environmental awareness which was mainly enrolled by students at this year

level. Although a very low correlation was measured, still a correlation between variables involved was discerned to exist.

Table 4. Correlation between student's background and APP.

Parameters	Gender	Year level	Colleges	Awareness	Perception	Practices
Gender	1					
Year Level	0.06004	1				
Colleges	-0.01671	0.025129	1			
Awareness	-0.19135	-0.02743	0.120747	1		
Perception	-0.17804	0.038337	0.118819	0.2011377	1	
Practices	-0.05861	-0.13031	0.123343	0.3384829	0.310785104	1

Solid waste generation per student capita

Further questions to evaluate the students SWM practices were administered in the conduct of the survey. It was determined that students waste generation per day was <100 grams (0.100 kg/capita/day) in all colleges (Fig. 2).

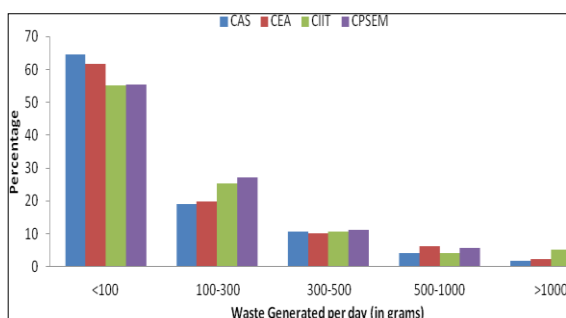


Fig. 2. Students waste generation (grams) daily in every colleges.

The findings were in agreement with the results of waste generation rate on each year level (Fig. 3).

The results however do not reconcile with the National Solid Waste Management Status Report (2015) on average waste generation of 0.500 kg/capita/day. The study primarily covered SWM generation of students within the university and other waste stream at their respective households was not included.

SWM disposal method

The solid waste disposal method practiced by the students was through the use of solid waste bins/trash bins. The convenient access to solid waste bins may encourage the practice of reducing, reusing, and recycling (Ivy *et al.*, 2013; Malakahmad *et al.*, 2010). This was found comparable regardless of the college and the year level the students belong (see Fig. 4-5). However, due to the limited number of recycling waste bins the students consequently less favored for recycling although it was a preferred means of disposal (Fig. 6-7).

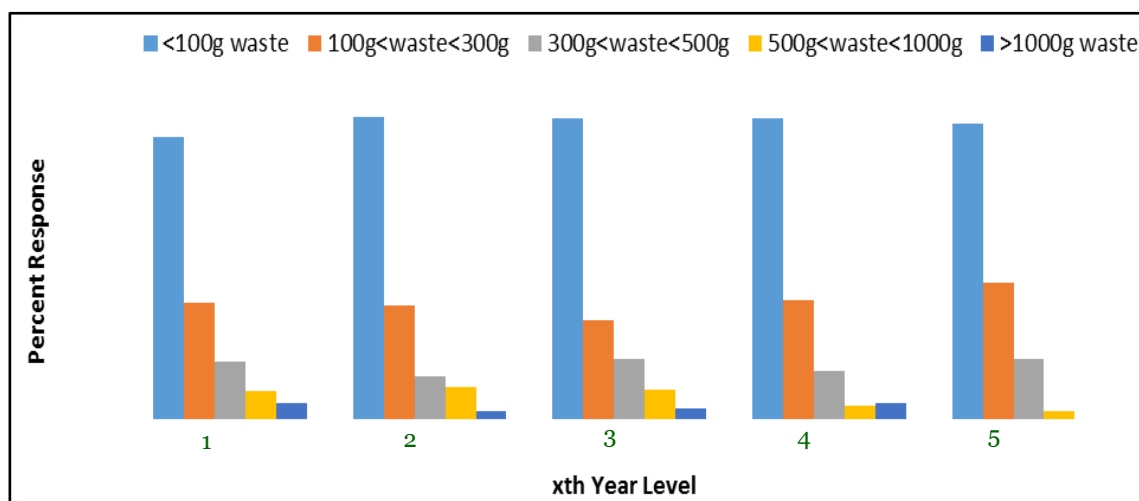


Fig. 3. Students waste generation (grams) daily on each year level.

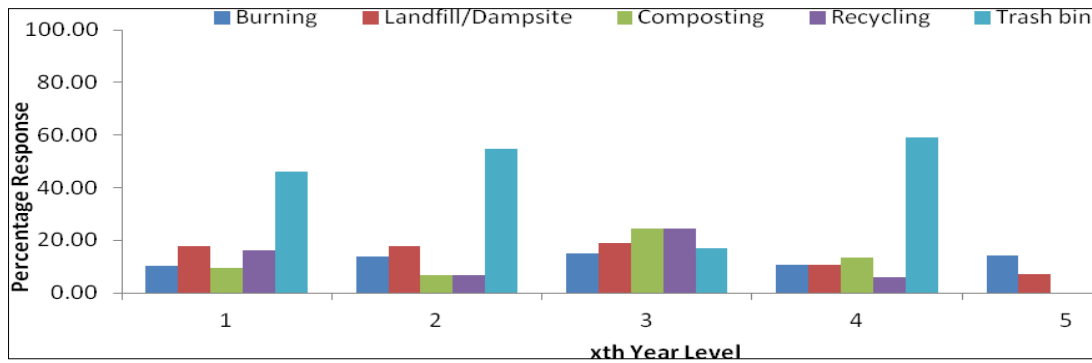


Fig. 4. Students practiced solid waste disposal method by year level.

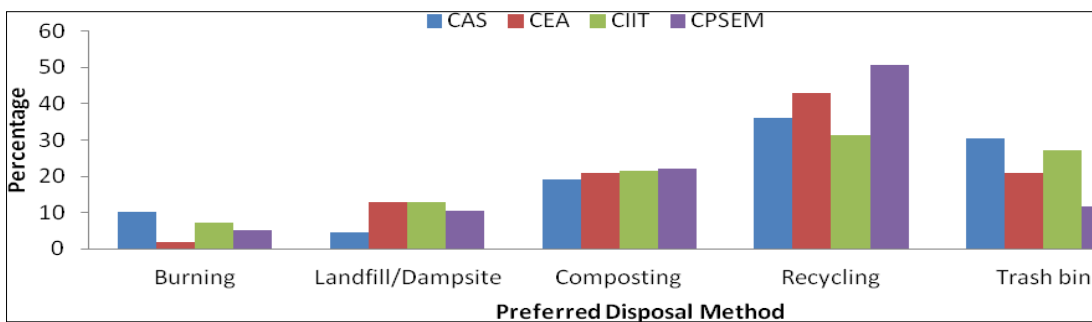


Fig. 5. Students practiced solid waste disposal method on college.

Present result was in agreement with the findings of Ehrampoush and Moghadam (2005) of lesser students (66%) with positive action on segregation and recycling of solid wastes. Similarly, a concern on indiscriminate SW disposal through open dumping

and burning was determined regardless of gender, college, and year level (Adeolu *et al.*, 2014). This necessitates the need for appropriate SWM awareness to develop student's fit environmental culture (Licy *et al.* 2013).

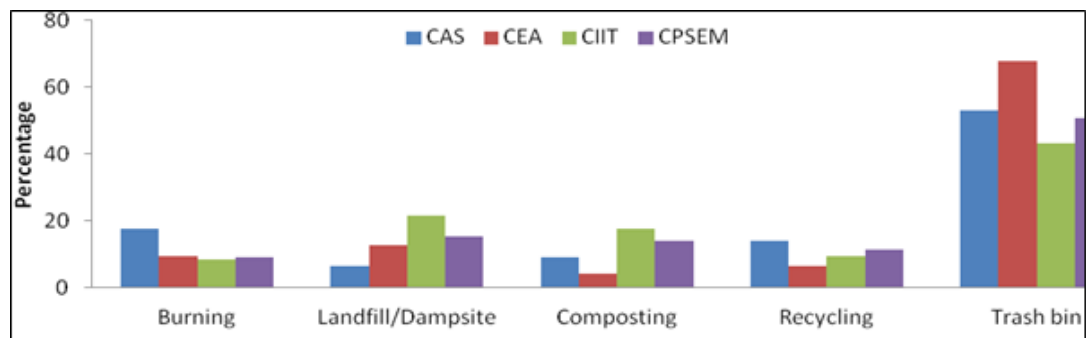


Fig. 6. Students' preferred solid waste disposal method by college.

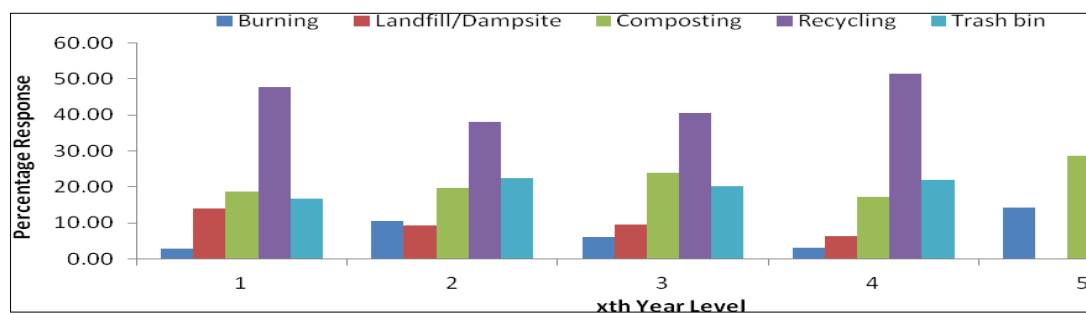


Fig. 7. Students' preferred solid waste disposal method by year level.

Current initiatives and practices

Although there is no existing course or program intended to address SWM in the university, several measures were observed to positively encourage SWM. These may include providing recycling and segregation options to dispose SW (see Fig. 8). Present practices allows students to develop familiarity to SWM, and create positive recycling related behaviors (Ivy *et al.*, 2013; Malakahmad *et al.*, 2010; Omran *et al.*, 2009; Sidique *et al.*, 2009; Kim *et al.*, 2005).



Fig. 8. a) NSTP donated waste bins for PET bottles; b) new solid waste bins.

Conclusion

Overall, it can be extrapolated that the level of awareness among CIIT students ranked highest indicating favorable knowledge towards SWM, environmental concerns, and policies. Perception analysis however revealed that CAS students had favorable response towards SWM. In terms of best fit SWM practices, CEA students ranked highest and the most practiced form of solid waste disposal was through waste bins in the university. Although all colleges preferred recycling as a better option the absence of sufficient facilities discounts the practice. Overall, regardless of the students' factors and backgrounds evaluated no significant difference was measured on APP. While the present results revealed that motivation to encourage best practices for SWM is limited, recommendations (e.g. courses, recycling options and awareness) however for SWM can be applied.

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