# Solid Waste: Awareness, Characterization and Management among Mindanao State University - Buug Campus Constituents

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## ABSTRACT

Mindanao State University-Buug Campus is a rising and developing state university in Zamboanga Peninsula. As a developing university, it faced challenges institutionally, financially, academically and environmentally. Environmentally, MSU-Buug faced issue on solid waste mismanagement. There were already measures undertaken to improve solid waste management in the campus but solid wastes were still seen scattered around the university vicinities. Thus, this study was conducted to determine the level of awareness on solid waste among the students, waste characterization, waste issue, and management. A descriptive research design was used in the study with 310 respondents. It employed a questionnaire concerning the awareness of solid waste management of the students. Key informant interview was done to determine the present solid waste management practices, issues, problems, and solutions. Weighing scale was used in determining the weight of solid waste. Data were gathered, analyzed, and interpreted using frequency and percentage distribution and chi-square test. Findings showed that the level of awareness on solid waste management among the students was high, there was no significant relationship on the level of awareness on solid waste management in terms of the student's age, course, year level and tract, however, there was a significant relationship on the level of awareness on solid waste management in terms of the student's sex. There were 5 types of waste generated in the university which are: biodegradable, non-biodegradable, recyclable, special and hazardous waste. The total volume of waste generated in one month was 613.8 kg. No garbage policy, segregation, proper waste disposal and composting were the present practices on solid waste management. Undisciplined students and lack of funding on solid waste management projects were the issues that need to be addressed.

Keywords: Awareness, solid waste management, segregation.

## I. INTRODUCTION

Solid waste refers to all discarded household, commercial waste, nonhazardous institutional and industrial waste, street sweepings, construction debris, agriculture waste, and other non-hazardous/non-toxic solid waste (RA 9003). Solid waste, in any form, is a problem that must be properly managed. Every one of us knows that garbage is harmful, so we need to dispose our garbage properly (Smythe et.al, 2010).

Most countries in the world experience challenges in managing waste. The Philippines, for instance, experienced floods that took the lives of many Filipinos. One of the causes of this flooding is the improper waste disposal (Lohri et al., 2013). Nowadays more and more people are taking interest in environmental issues, as they have started to experience the ill-effects of ecological issues if it is not properly disposed of, the consequences are dangerous (Yadav & Mishra, 2004). So, there is an urgent need to streamline and sensitize young minds to the environmental problem and concerns. It is the education which makes human beings knowledgeable to the environment and problems related to it. Young minds must have awareness about environmental problems so that they can play their role very effectively in proper waste management (Gakungu, 2012).

Mindanao State University-Buug is one of the campuses of the Mindanao State University System located at Datu Panas, Buug, Zamboanga Sibugay. MSU-Buug is composed of four colleges, the College of Agriculture and Fisheries, College of Arts and Sciences, College of Education and College of Forestry and Environmental Studies; a Graduate School (School of Graduate Studies), a laboratory high school (College of Education Training Department) and a Senior High School. MSU-Buug, as observed, is facing issues on solid waste mismanagement. There were al-

ready measures undertaken to improve solid waste management in the campus but solid wastes were still seen scattered around the university vicinities. Thus, this study was conducted in order to determine the perception, characteristics and management of solid waste in MSU-Buug Campus. The result of this study is relevant as the basis on making solid waste management plan to address the solid waste mismanagement problem in the University. The objective of this study was to find the level of awareness and practices on solid waste management among MSU- Buug constituents. Specifically, it aimed to achieve the following:

1. To determine the level of awareness among junior high, senior high, and college students on solid waste management;

2. To determine if there is a significant relationship on the level of awareness among students on solid waste management in terms of: age, sex, year level, tract, and course.

3. To determine characterization of solid waste generated in the university in terms of types and weight?

4. To identify the solid waste management practices already initiated in the university.

## II. METHODOLOGY

This study was conducted at Mindanao State University – Buug Campus which is located at Datu Panas, Buug, Zamboanga Sibugay with coordinates 7.7238° N, 123.0589° E.



Figure 1. Locale of the Study. A. Map of Mindanao; B. Map of Buug; and C. Map of MSU-Buug (https://www.maps.google.ph).

This study employed the descriptive - correlational research design to show the relationship on the level of awareness on the student's age, course/tract and year level. Moreover, this was also an action research on which the result of the study could bring solution on the problem of solid waste mismanagement in the university. The respondents of the study were the students of Mindanao State University - Buug Campus. The number of sample points was taken from the total population, which was selected randomly from each department to ensure equal representa-

Table 1 shows the number of respondents. It further presents that 94 (30.32%) of the respondents belong to the Junior High

tives of the subjects. Instructors and staff were interviewed in the study. Out of 1,378 total number of the students, there were 310 randomly selected students during the 2nd semester in the Academic Year 2018-2019. The sample size was determined using the Slovin's formula:

$$n = N/1 + Ne^2$$

Where:
$n$ = sample size
$N$ = population size
$e$ = degree of error

The formula of sample size for proportional allocation was used to determine the respondents taken from each department because the number of students in each department is not equal.

$$n_i = (N_i/N)n$$

Where:
$n_i$ = proportional allocation in every department
$n$ = sample size
$N$ = total number students in MSU-Buug
$N_i$ = number of students in every department

The main instrument used in data gathering was a questionnaire. This was administered to the subjects supplemented with one-on-one interview. The instrument used in determining the weight of solid waste was the weighing scale. For the characterization of solid waste, hand manual sorting on the solid waste from the different trash bins of College/ Department in MSU-Buug was done. Relationship on the student's profile and level of awareness was determined through chi-square. Characteristics of wastes were identified through direct observation. Present solid waste management measures and suggested solid waste management measures were obtained through key informant interviews to the Chairman of the Solid Waste Management (SWM) Committee, some members of the SWM, some MSU-Buug officials, instructors, utility workers and some students.

The data were analyzed using frequency, means, percentage and chi-square test. Moreover, data gathered from the interviews were tabulated, analyzed and interpreted.

To interpret the level of awareness on solid waste management of the students, the scale below was used:

| | |
|---|---|
| 1.0 - 1.7 | Low |
| 1.8 - 2.4 | Moderate |
| 2.5 - 3.0 | High |

## III. RESULTS AND DISCUSSIONS

School Department; 56 (18.06%) of them belong to the Senior High School Department; 22 (7.1%) of them belong to CFES

Department; 24 (7.74%) of them belong to COED Department; 42 (13.55%) of them belong to COAF Department; and 72 (23.23%) of them belong to CAS department. Majority (30.32%) of the respondents belong to the Junior High School. Table 2 presents the responses on the level of solid waste management awareness.

Table 1
Distribution of respondents per department.

| Department | No. of Respondents | Percentage |
|---|---|---|
| Junior High School | 94 | 30.32 |
| Senior High School | 56 | 18.06 |
| College of Agriculture and Fisheries | 42 | 13.55 |
| College of Forestry and Environmental Studies | 22 | 7.1 |
| College of Education | 24 | 7.74 |
| College of Arts and Social Sciences | 72 | 23.23 |

School-based solid waste management practices are measures to observe, implement, and ensure proper waste disposal because paper, cardboard, and other school-related materials generate the majority of municipal waste (Feisel et al., 2015). As a result, institutions such as schools, private and public universities, and community colleges must serve as role models for responsible solid waste management in terms of waste re-use, waste reduction, waste collection, waste recycling, waste treatment, and final waste disposal (Gequinto, 2016).

Based on the results of the interview as shown in Table 2, it depicts that the highest weighted mean fell on items 4, 7 and 10, " Recyclable wastes include tin cans and mineral bottles; The 3 R's are reduce, re-use and recycle; and solid waste has the potential to cause flooding ", these items were interpreted as "high". And the least weighted fell on items 1 and 9, "Waste are considered as trash and material having no use; and landfill is the last option on solid waste management", interpreted as "moderate". The findings suggested that respondents were knowledgeable in the potential consequences of poor solid waste management. The respondents were already aware of the issues caused by solid waste. Nonetheless, despite the respondents' knowledge of solid waste, problems related to waste mismanagement are still prevalent in the university premise.

Table 2
Responses on the Level of Solid Waste Management Awareness.

| Questions | Fully Aware | Aware | Not aware | Weighted Mean | Interpretation |
|---|---|---|---|---|---|
| 1. Wastes are considered as trash or materials having no use? | 117 | 62 | 131 | 2.0 | M |
| 2. Solid waste could be biodegradable, and recyclable? | 261 | 20 | 2.9 | 2.7 | H |
| 3. Biodegradable wastes are compostable waste? | 264 | 35 | 11 | 2.8 | H |
| 4. Recyclable wastes include tin cans and mineral bottles? | 293 | 10 | 7 | 2.9 | H |
| 5. Non-biodegradable wastes do not decompose easily? | 254 | 40 | 16 | 2.8 | H |
| 6. Burning of waste is prohibited by law? | 244 | 41 | 25 | 2.7 | H |
| 7. The 3 R's are reduce, re-use and recycle. | 293 | 16 | 1 | 2.9 | H |
| 8. Leachate is a liquid substance coming from solid wastes. | 185 | 109 | 16 | 2.5 | H |

| | | | | | |
|---|---|---|---|---|---|
| 9. Landfill is the last option on solid waste management? | 177 | 89 | 44 | 2.4 | M |
| 10. Solid waste has the potential to cause flooding? | 2.77 | 26 | 7 | 2.9 | H |
| **Average weighted mean** | | | | **2.7** | **H** |

Table 3 presented the respondents' level of awareness in relation to their age, gender, year level, tract, and course. The results show that the respondents' level of awareness among the ages 18-23 had the highest weighted mean, implying that this age group has a high level of awareness on solid waste management. Even students aged 12 to 17 and 24 to 29 had a good understanding of solid waste management. As a result, the age of the student has no influence on the awareness of solid waste. Furthermore, the findings present the average results of the respondents' level of awareness regarding their sex. It demonstrated that both men and women have a strong understanding of how to properly manage solid waste. Likewise, both of them had come up with the same weighted mean of 2.6, which interpreted as "high". For the respondents' level of awareness regarding their year-level. According to the results, only Grade-8 respondents have a lower weighted mean of 2.6, implying a lesser understanding of solid waste management than Grade-7, 9, and 10. The results also depicted the average of the respondents' level of awareness regarding their tract in senior high school. It was discovered that respondents in the senior high school level have a high level of knowledge about proper waste management. Likewise, as shown in the table, all courses have a weighted mean that corresponds to the interpretation "high." This indicates that the students in different department and discipline have enough understanding and knowledge when it comes to proper waste management.

Table 3
Summary responses on the Level of Solid Waste Management Awareness with respect to their age, sex, year level, tract, and course

| Variables | Fully aware | Aware | Not aware | Weighted Mean | Interpretation |
|---|---|---|---|---|---|
| **AGE** | | | | | |
| 12-17 | 91 | 19 | 12 | 2.6 | H |
| 18-23 | 128 | 26 | 18 | 2.7 | H |
| 24-29 | 14 | 2 | 0 | 2.6 | H |
| **Ave. Weighted mean** | | | | **2.6** | **H** |
| **SEX** | | | | | |
| Male | 75 | 17 | 10 | 2.6 | H |
| Female | 163 | 15 | 31 | 2.7 | H |
| **Ave. Weighted mean** | | | | **2.6** | **H** |
| **YEAR LEVEL** | | | | | |
| Grade 7 | 23 | 5 | 4 | 2.7 | H |
| Grade 8 | 16 | 4 | 4 | 2.6 | H |
| Grade 9 | 15 | 3 | 2 | 2.7 | H |
| Grade 10 | 16 | 3 | 1 | 2.7 | H |
| **Ave. Weighted mean** | | | | **2.7** | **H** |
| **TRACT** | | | | | |
| STEM *(Science Technology Engineering and Mathematics)* | 11 | 2 | 2 | 2.6 | H |
| ABM *(Accountancy and Business Management)* | 9 | 2 | 2 | 2.5 | H |
| HUMMS *(Humanities and Social Sciences)* | 22 | 4 | 1 | 2.7 | H |
| **Ave. Weighted mean** | | | | **2.6** | **H** |
| **COURSE** | | | | | |
| BS-Environmental Science | 9 | 2 | 1 | 2.7 | H |
| BS-Agroforestry | 8 | 2 | 2 | 2.7 | H |

| | | | | | |
|---|---|---|---|---|---|
| BS-Agronomy | 16 | 5 | 2 | 2.6 | H |
| BS-Animal Science | 8 | 1 | 1 | 2.7 | H |
| BS-Fisheries | 6 | 2 | 1 | 2.5 | H |
| Diploma of Fisheries Technology | 1 | 0 | 0 | 2.5 | H |
| BS-Nursing | 7 | 1 | 1 | 2.5 | H |
| BS-Mathematics | 1 | 1 | 0 | 2.7 | H |
| BS-Information Technology | 6 | 0 | 1 | 2.8 | H |
| BS-Hotel and Restaurant Management | 7 | 0 | 0 | 2.8 | H |
| BS-Public Administration | 10 | 1 | 1 | 2.5 | H |
| AB-English | 7 | 2 | 0 | 2.5 | H |
| AB-Filipino | 12 | 4 | 2 | 2.6 | H |
| AB-English and Linguistics Studies | 4 | 1 | 0 | 2.7 | H |
| BS-Hospitality Management | 2 | 0 | 0 | 2.9 | H |
| Bachelor of Elementary Education | 2 | 0 | 0 | 2.7 | H |
| BSED-Filipino | 8 | 1 | 1 | 2.7 | H |
| BSED-Biology | 4 | 0 | 0 | 2.8 | H |
| AB-English | 7 | 2 | 0 | 2.5 | H |
| BSED-Math | 4 | 0 | 3 | 2.7 | H |
| BSED-English | 5 | 0 | 6 | 2.8 | H |
| BSED-Natural Science | 1 | 0 | 0 | 3 | H |
| **Ave. Weighted mean** | | | | **2.7** | **H** |

Table 4 reveals the summary data about the significance of the relationship between the level of solid waste management awareness with respect to students' age, sex, year level, tract, and course.

The computed chi-square value of 3.237 was lesser than the critical value of 9.488 at 0.05 level of probability with 4 degrees of freedom. Hence, the null hypothesis was accepted. This implies that there is no significant relationship between the level of awareness of the students with respect to their age

As seen in the table, the obtained chi-square value of 6.277 was greater than the critical value of 9.488 at 0.05 level of probability with 2 degrees of freedom. Hence, the null hypothesis was rejected. This implies that there is a significant relationship between the level of awareness of the students with respect to their sex. This result strengthened by the study of Ifegbesan (2010) that there is significant relationship between students' sex and the level of solid waste awareness.

As shown in the table, the obtained chi-square value of 5.131 was lesser than the critical value of 12.592 at 0.05 level of probability with 6 degrees of freedom. Hence, the null hypothesis was accepted. This implies that there is no significant relationship between the level of awareness of the students with respect to their year-level.

As observed in Table 3, the obtained chi-square value of 1.018 was lesser than the critical value of 9.488 at 0.05 level of probability with 4 degrees of freedom. Hence, the null hypothesis was accepted. This implies that there is no significant relationship between the level of awareness of the students with respect to their tract.

As manifested in the table, the obtained chi-square value of 23.83 was lesser than the critical value of 55.758 at 0.05 level of probability with 40 degrees of freedom. Hence, the null hypothesis was accepted. This implies that there is no significant relationship between the level of awareness of the students with respect to their course.

Table 4
Summary Table on the Significance of the Relationship between the Awareness of the Students
with their respective age, sex, year-level, tract, and course

| Solid Waste Management Awareness with respect to: | $n$ | Computed $X^2$ | $df$ | $X^2$ Critical Value 5% | Results |
|---|---|---|---|---|---|
| Age | 310 | 3.237 | 4 | 9.488 | Accepted |
| Sex | 310 | 6.277 | 2 | 5.991 | Rejected |
| Year Level | 94 | 5.131 | 6 | 12.592 | Accepted |
| Tract | 56 | 1.018 | 4 | 9.488 | Accepted |
| Course | 160 | 23.83 | 40 | 55.758 | Accepted |

Table 5 displayed the types and grand total results of waste generation in the university for one month. The findings revealed that only five types of waste were generated: biodegradable waste, non-biodegradable waste, recyclable waste, special waste, and hazardous waste. It consists of leaves, papers, and packaging boxes for the waste characterization of biodegradable waste. Plastic cellophane, wrapper, straw, aluminum cans, Styrofoam, and tin cans are examples of non-biodegradable waste. Plastic bottle, plastic cup, and bottle are examples of recyclable waste. The special waste consists solely of syringes, and the hazardous waste consists solely of light bulbs. As shown in the table, out of 5 types of solid waste, the non-biodegradable waste got the high amount of volume generated in the University for the entire month with the volume of 325.5 kg or 53.35%, followed by the biodegradable waste with the volume of 217.5 kg or 35.43%, next is the recyclable waste with the volume of 68.5 kg or 11.15%, the special waste has a volume of 2 grams or 0.0003% and the hazardous waste has 1 gram or 0.0001% generated. And the overall total the total waste generated in one month is 613.8 kg.

Table 5
Waste total generation in the University for 1 month

| Type of Solid Waste | Total Weight of Waste (kg) | Percentage (%) | Grand Total (kg) | Percentage (%) |
|---|---|---|---|---|
| Biodegradable Wastes | | | | |
| Leaves | 131.5 | 21.42 | | |
| Paper | 70.5 | 11.48 | 217.5 | 35.43 |
| Packaging Box | 15.5 | 2.52 | | |
| Non-Biodegradable Wastes | | | | |
| Plastic Cellophane | 261.5 | 42.6 | | |
| Wrappers and straw | 47.5 | 7.73 | | |
| Styrofoam | 8.5 | 1.38 | 327.5 | 53.35 |
| Aluminum cans | 4 | 0.65 | | |
| Tin cans | 6 | 0.97 | | |
| Recyclable Wastes | | | | |
| Plastic Bottles | 61.5 | 10 | | |
| Plastic cups | 1 | 0.16 | 68.5 | 11.15 |
| Bottle | 6 | 0.97 | | |
| Hazardous Wastes | | | | |
| Light bulbs | 1 gm | 0.0001 | 1 gm | 0.0001 |
| Special Wastes | | | | |
| Syringes | 2 gm | 0.0003 | 2 gm | 0.0003 |
| **Waste for 1 month** | **613.8 kg** | **100** | **613.8 kg** | **100** |

Based on the results of the key informant interview it revealed that there were several solid waste management practices being initiated in the university. These are the following: checking and cleaning every afternoon in the senior high school area; no garbage policy inside the classroom; search for the cleanest and greenest department/office; proper waste segregation; ban of Incineration; reuse scratched, conduct of solid waste orientation to students; faculty members and staff in the University; and imposition of University solid waste ordinances.

## IV. Conclusion

This study disclosed the following as its findings: The awareness of the students with respect to their respective age, sex, year-level, tract, and course were resulted as high. The awareness of the students had no connection to their management on solid waste in terms of their age, year-level, tract, and course while the awareness of the students in terms of sex had a significant relationship of their management on solid waste management. And this study revealed that the university had several initiated solid waste management practices.

On the basis of the findings of the study, the following conclusions were drawn: The constituents of MSU-Buug principally the students were knowledgeable and most of them were fully aware on the nature of solid waste, its management, and most importantly its cost if they fail to properly manage their solid waste well. The awareness on solid waste management of the students was not correlated with respect to their age, year-level, tract, and course. The university had been already practicing several solid waste management. However, as manifested of the results gleaned in this study, constituents of the university have an enough knowledge and understanding about solid waste and the practices that had been initiated but still solid wastes were palpable in the university premise. As observed, students' ignorance was the root cause of the daunting problem being faced by the university though they have been infused with much of information but they fail to put them into practice and acting as if they were illiterate on the issue.

The researchers with their desires to find meaning to the effort of this study, submit the following recommendations for possible implications: Public awareness should be strictly promoted especially to all students to embrace the importance of proper solid waste management and encourage them to actively participate in every programs on solid waste management; sanctions and penalties of waste mismanagement should be put in place and strictly followed; the utility workers should be trained properly in cleaning and collecting of wastes in the university; provide many garbage bins in the garbage area near the guardhouse to accommodate all the wastes generated in the university; continue the program of clean and green competition; allocation of funds to the solid waste management office and projects; and formulation of solid waste management plan in the university should be accomplished.

## Acknowledgment

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