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Gender-Based Analysis of Knowledge, Attitudes, and Practices of USTP System Faculty, Staff, and Students on Solid Waste Management

Francis Thaise A. Cimene*[1], Alma N. Abug[2], Apolinario B. Gonzaga, Jr.[3]

[1]*Head, Center for Inclusive Development Studies, Philippines*

[2]*Head, Biodiversity and Ecological Management and Environmental Technology Research Center, Philippines*

[3]*Head, Center for High Value Crops, University of Science and Technology of Southern Philippines, Philippines*

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Abstract

Solid waste management is considered as one of the critical environmental challenges in the Philippines. Thus, this study aimed to conduct a gender-based analysis of the knowledge, attitudes, and practices (KAP) of faculty, staff, and students within the University of Science and Technology of Southern Philippines (USTP) System regarding solid waste management (SWM). The findings provide baseline data to support the development of a comprehensive SWM plan and relevant policies for the entire USTP System. Data were collected from 3,063 participants, including faculty, staff, and students, with gender representation, through surveys. The results revealed that participants demonstrated a relatively high level of awareness regarding SWM laws (RA 9003), along with positive attitudes toward SWM across gender groups. Notably, significant differences were found between genders, particularly in knowledge and practices. Female respondents generally exhibited higher levels of knowledge and more positive attitudes toward SWM compared to their male counterparts.This study concludes that addressing gender disparities in SWM requires a holistic approach, integrating gender considerations into policies, educational programs, and institutional practices. By doing so, the USTP System can promote a more inclusive and sustainable approach to waste management across its campuses.

* **Corresponding Author:** Francis Thaise A. Cimene ✉ francis.cimene@ustp.edu.ph

Introduction

Solid waste management is a critical issue in the Philippines, with inadequate waste disposal practices leading to pollution, public health risks, and environmental degradation (Peralta *et al.*, 2021; Requia *et al.*, 2020). According to the World Bank, the Philippines generates 40,000 tons of waste per day, with only 73% of that waste collected and only 9% of that waste properly disposed of (World Bank, 2019).

Gender roles and stereotypes also affect the knowledge, attitudes, and practices of individuals in managing solid waste. Research has shown that women are more likely to be involved in household waste management, while men are more involved in commercial waste management (Tonglet *et al.*, 2004; Watson, 2006). Women also tend to be more environmentally conscious and engage in more sustainable practices than men (Brough *et al.*, 2016). Hence, this study employed gender-based analysis which is considered as a tool to identify and address gender inequalities and promote gender equality. By conducting a gender-based analysis of the knowledge, attitudes, and practices of USTP faculty, staff, and students on solid waste management, the study aims to identify gender-based differences in their perceptions and behaviors related to waste management. This information can help develop targeted interventions to promote sustainable solid waste management practices and ensure gender equality in environmental initiatives.

The research framework of the study (as shown in Figure 1) is based on the social ecological model (SEM). The SEM is a framework that recognizes the complex interplay between individual, interpersonal, community, and societal factors that influence human behavior and health outcomes (Hill *et al.*, 2023). The SEM is useful for understanding the factors that contribute to solid waste management practices among the study participants and how gender intersects with these factors. Specifically, the framework includes three levels of analysis: individual, interpersonal, and community. The individual level includes factors that are specific to the individual, such as gender, knowledge, attitudes, and practices related to solid waste management. Gender is an important factor as men and women may have different roles and responsibilities related to waste management (Budhathoki *et al.*, 2016). Meanwhile, the interpersonal level includes factors that are related to social relationships, such as the faculty, friends, colleagues, and classmates. Interpersonal factors can influence waste management practices by shaping social norms and attitudes towards waste (Bui *et al.*, 2017). As regards the community level, it includes factors that are related to the physical and social environment, such as access to waste management facilities and services, community norms and values, and policies and regulations related to waste management (Abdullahi *et al.*, 2021). Additionally, the framework recognizes the importance of gender-sensitive policies and interventions that take into account the unique challenges and opportunities faced by men and women in waste management practices (Fisher *et al.*, 2015). Thus, the conceptual framework provides a useful tool for comprehending the complex factors that influence the knowledge, attitudes, and practices of individuals towards solid waste management, and how gender plays a role in shaping these factors. By determining the key factors that influence solid waste management practices among the study participants, the study can provide important insights for developing effective waste management strategies that are gender-sensitive and inclusive.

The Ecological Solid Waste Management Act (Republic Act No. 9003) was signed into law in the Philippines in 2000, with the aim of promoting sustainable solid waste management practices in the country.Nonetheless, the way the law is being applied has been met with challenges and criticisms, with some experts questioning its effectiveness in addressing the country's waste management problems. According to Lagunda (2016), this is due to the absence of political will and support for the law's execution. She emphasized that many local government units (LGUs) have not fully embraced the

law's principles, and have not allocated sufficient resources or personnel to implement it effectively.
Another issue highlighted by the study was the inadequate infrastructure for waste management, particularly in rural areas. Many LGUs lack the necessary facilities for waste segregation, composting, and recycling, which makes it difficult to implement the law's provisions.

In addition, the study noted that there is a lack of citizens' awareness and involvement in solid waste management, which has hindered the success of the law's implementation. Many Filipinos still dispose of their waste indiscriminately, and do not understand the significance of waste segregation and recycling. The study concludes that the implementation of the Ecological Solid Waste Management Act in the Philippines highlights both the successes and challenges of the law's implementation. While there have been some improvements in waste management practices, there is still a long way to go to fully realize the law's goals. Addressing the challenges identified in the study, such as improving infrastructure and increasing public awareness, will be critical to the success of future efforts to advocate sustainable solid waste management in the Philippines.

The Ecological Solid Waste Management Act of 2000 (Republic Act No. 9003) is a pivotal environmental law in the Philippines that mandates the segregation, collection, and environmentally responsible disposal of solid wastes. The implementation of this law has significant implications for gender equity and women's empowerment, as it relates to the duties and responsibilities of women in the environment and waste management.A gender-based analysis of the implementation of the Ecological Solid Waste Management Act can provide insights into the gender dimensions of solid waste management.

Moreover, gender roles and responsibilities in waste management: Women are often responsible for household waste management, including segregation, collection, and disposal. However, their contributions to waste management are often unrecognized and undervalued. In contrast, men are more likely to be involved in waste management at the community or institutional level. Therefore, the implementation of the Ecological Solid Waste Management Act should recognize and address gender-based differences in roles and responsibilities in solid waste management.
Furthermore, a gender-based analysis of the implementation of the Ecological Solid Waste Management Act is crucial to ensure that the law addresses gender-based differences in waste management and promotes gender equity and women's empowerment. The Philippine government should take a gender-sensitive approach to solid waste management and ensure that women's voices and experiences are heard and integrated into waste management policies and programs.

Materials and methods

Research Design

This study employed a Descriptive Research Design, using surveys as the primary method of data collection. According to Koh and Owen (2000), this approach is suitable for describing specific conditions, which in this case involves examining the knowledge, attitudes, and practices of USTP System faculty, staff, and students regarding solid waste management. This design is well-suited for research aimed at identifying existing conditions or relationships, prevailing practices, widely held beliefs or perspectives, ongoing processes, observed effects, or emerging trends.

Research Locale

The study is set within the University of Science and Technology of Southern Philippines (USTP) System, a higher education institution in the Philippines dedicated to promoting sustainability and environmental protection.

This research encompassed multiple campuses within the USTP System, including the USTP Villanueva Satellite Campus, USTP Jasaan Satellite Campus, USTP Cagayan de Oro Campus, USTP Panaon Satellite Campus, and USTP Oroquieta Satellite Campus.

Participants of the Study

The study involved 3,063 randomly selected participants, consisting of 1,309 males, 1,645 females, and 109 individuals identifying as Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, and Asexual (LGBTQIA+). The inclusion criteria for participation were as follows: First, participants had to be of legal age (at least 18 years old), ensuring that parental or guardian consent was not required. Second, faculty and staff had to be currently employed, and students had to be enrolled at the time of data collection. Finally, all participants provided their free, prior, and informed consent to take part in the study.

Sampling Technique

This study utilized a multi-stage cluster sampling technique for data collection. In the first stage, participants were grouped by campus, followed by clustering by category (faculty, staff, and students) in the second stage, and by gender in the third stage. A simple random sampling method with replacement was applied to select 30% of the population, ensuring balanced representation across all campuses, categories, and genders. The Raosoft calculator was used to determine an initial sample size of 13% of the total population, which was increased to 30% to account for potential data cleaning and participant elimination. The final distribution of participants by campus was determined after obtaining a comprehensive list of faculty, staff, and students, with consideration for the semester during which the study was approved for implementation.

Instrumentation

The primary research tool utilized in this study was a survey questionnaire, which was divided into five sections. The first section included the Free and Prior Informed Consent (FPIC) form, outlining key details such as the purpose of the study, the type of research intervention, participant selection process, voluntary participation, procedures, duration, potential risks and benefits, reimbursements, privacy and confidentiality measures, open data policies, participants' right to refuse or withdraw, and contact information for inquiries. The second section gathered personal information, including classification/category, campus, gender, and years of service. The third section assessed participants' knowledge of solid waste management (SWM), while the fourth section explored their attitudes toward SWM. The final section focused on their SWM practices.

Moreover, the survey instrument captures the responses of the participants relative to the SWM using the Likert Scale with the scoring procedure with their corresponding interpretation indicated in Table 1 below.

Data Analysis

The quantitative data was analyzed using descriptive statistics particularly the weighted mean and One-way ANOVA with Post Hoc Analysis.

Ethical Considerations

It is important to emphasize that the study relied on participants' freely given informed consent. The research was thoroughly explained to them, including its purpose, objectives, and the methodology used. Participants were fully informed about what their involvement in the study would entail, who would have access to the collected data, and how it would be stored and utilized. Additionally, they were made aware of their right to decline participation and were informed of the potential applications of the data.

Results and discussion

Knowledge of the USTP System faculty, staff, and students on solid waste management

The data in Table 2 indicates that participants possess a very high level of knowledge regarding solid waste management. This is reflected in their understanding that improper disposal of waste can lead to the clogging of drainage canals, potentially causing floods during the rainy season (WM = 4.66). They are also well-informed about Republic Act No. 9003, which promotes environmental sustainability through effective waste management practices (WM = 4.59), as well as the harmful effects of burning waste, which releases pollutants and particulate matter that

can trigger respiratory conditions such as asthma and bronchitis (WM = 4.59). Additionally, participants recognize that RA No. 9003 emphasizes the importance of proper waste segregation to mitigate environmental degradation (WM = 4.58) and are knowledgeable about the classification of wastes, including biodegradable, recyclable, residual, special, and hazardous categories (WM = 4.54). Their awareness extends to the importance of refusing single-use items and reusing materials to support sustainable waste management (WM = 4.52), as well as the penalties associated with violations of ecological solid waste management laws (WM = 4.35). Furthermore, they are familiar with the segregated waste collection mechanisms implemented at USTP (WM = 4.31). However, participants demonstrated only a high level of knowledge regarding the prohibition of plastic bags and Styrofoam as packaging materials for certain wet and dry goods (WM = 4.19), as well as the existence of USTP's materials recovery facility (WM = 4.10).

Table 1. Scoring Procedure, Scale and Level of Knowledge/Attitudes/Practices on SWM.

Score	Mean Interval	Scale	Level of Knowledge/Attitudes/Practices on SWM
5	4.21 - 5.00	Strongly Agree	Very High
4	3.41 - 4.20	Agree	High
3	2.61 - 3.40	Undecided	Average
2	1.81 – 2.60	Disagree	Low
1	1.00 – 1.80	Strongly Disagree	Poor

Data Analysis. The quantitative data was analyzed using descriptive statistics particularly the weighted mean and One-way ANOVA with Post Hoc Analysis.

The data in Table 2 reveals that participants possess a very high level of knowledge regarding solid waste management, particularly in areas directly linked to environmental sustainability and waste-related health risks. This finding is consistent with the literature on environmental education, which emphasizes that increased knowledge about waste management positively correlates with pro-environmental behaviors (Domina & Koch, 2002). The participants' understanding of improper waste disposal leading to the clogging of drainage systems (WM = 4.66) reflects their awareness of how mismanaged waste contributes to urban flooding, a well-documented issue in the Philippines, especially during the rainy season (Jha *et al.*, 2012).

The high levels of knowledge regarding Republic Act No. 9003 (WM = 4.59) suggest that the implementation of this law, aimed at promoting environmental sustainability, has been effective in raising awareness. Studies indicate that the success of waste management policies like RA 9003 hinges on public knowledge and engagement (Gonzales & Magno, 2015). Furthermore, participants' awareness of the harmful effects of burning waste (WM = 4.59), including the release of pollutants that can lead to respiratory problems such as asthma and bronchitis, aligns with research showing that air pollution from open burning is a significant public health concern (Massey *et al.*, 2013). This finding implies that educational efforts focusing on the health risks associated with improper waste handling have likely contributed to the participants' high knowledge levels in this area.

Participants' understanding of the need for proper waste segregation (WM = 4.58) and the classification of waste types (WM = 4.54) demonstrates their grasp of key components of RA 9003. This aligns with studies emphasizing the role of waste segregation in mitigating environmental degradation (Suttibak & Nitivattananon, 2008). Additionally, the knowledge of penalties associated with violations of solid waste management laws (WM = 4.35) suggests that regulatory frameworks play a significant role in shaping individuals' attitudes and behaviors toward waste management (Luo *et al.*, 2016).

However, the relatively lower knowledge scores on the prohibition of plastic bags and Styrofoam as

packaging materials (WM = 4.19) and the presence of the USTP's materials recovery facility (WM = 4.10) indicate areas where further education and engagement are needed. Despite widespread efforts to reduce the use of single-use plastics globally, research indicates that consumer practices are slow to change without targeted interventions and awareness campaigns (Ritch *et al.*, 2009). Similarly, the lower awareness regarding the materials recovery facility may suggest a gap in the dissemination of information about local waste management infrastructure (Bhakta *et al.*, 2020).

Table 2. Level of Knowledge on Solid Waste Management. 2 3 4 5 6 7 8 9 10

Indicators	Rating	f	%	Level of Knowledge
1. RA No. 9003 aims to promote environmental sustainability through effective waste management practices.	Strongly Agree	1867	61.0	Very High (Weighted Mean = 4.59)
	Agree	1139	37.2	
	Undecided	51	1.7	
	Disagree	4	0.1	
	Strongly Disagree	2	0.1	
	Total	3,063	100.0	
2. RA No. 9003 emphasizes the importance of proper waste segregation to prevent environmental degradation.	Strongly Agree	1844	60.2	Very High (Weighted Mean = 4.58)
	Agree	1152	37.6	
	Undecided	58	1.9	
	Disagree	8	0.3	
	Strongly Disagree	1	0.0	
	Total	3,063	100.0	
3. I know the classification of wastes such as biodegradable, recyclable, residual, special, and hazardous.	Strongly Agree	1742	56.9	Very High (Weighted Mean = 4.54)
	Agree	1241	40.5	
	Undecided	65	2.1	
	Disagree	15	0.5	
	Strongly Disagree	0	0.0	
	Total	3,063	100.0	
4. I understand the importance of refusing single-use items and reusing items to promote sustainable waste management.	Strongly Agree	1691	55.2	Very High (Weighted Mean = 4.52)
	Agree	1285	42.0	
	Undecided	75	2.4	
	Disagree	11	0.4	
	Strongly Disagree	1	0.0	
	Total	3,063	100.0	
5. I know the segregated waste collection mechanisms implemented in USTP.	Strongly Agree	1286	42.0	Very High (Weighted Mean = 4.31)
	Agree	1509	49.3	
	Undecided	220	7.2	
	Disagree	42	1.4	
	Strongly Disagree	6	0.2	
	Total	3,063	100.0	
6. The use of plastic bags and styrofoam as packaging materials for selected wet and dry goods is prohibited.	Strongly Agree	1156	37.7	High (Weighted Mean = 4.19)
	Agree	1445	47.2	
	Undecided	370	12.1	
	Disagree	84	2.7	
	Strongly Disagree	8	0.3	
	Total	3,063	100.0	
7. USTP has a materials recovery facility within the campus vicinity.	Strongly Agree	945	30.9	High (Weighted Mean = 4.10)
	Agree	1568	51.2	
	Undecided	467	15.2	
	Disagree	72	2.4	
	Strongly Disagree	11	0.4	
	Total	3,063	100.0	
8. There are penalties for any violations of the ecological solid waste management laws.	Strongly Agree	1356	44.3	Very High (Weighted Mean = 4.35)
	Agree	1476	48.2	
	Undecided	189	6.2	
	Disagree	34	1.1	
	Strongly Disagree	8	0.3	
	Total	3,063	100.0	

9. The burning of waste materials releases harmful pollutants and particulate matter into the air, which can cause respiratory conditions like asthma and bronchitis.	Strongly Agree	1913	62.5	Very High (Weighted Mean = 4.59)
	Agree	1061	34.6	
	Undecided	63	2.1	
	Disagree	23	0.8	
	Strongly Disagree	3	0.1	
	Total	3,063	100.0	
10. Improper disposal of solid waste may lead to the clogging of drainage canals, which may lead to floods during the rainy season.	Strongly Agree	2108	68.8	Very High (Weighted Mean = 4.66)
	Agree	900	29.4	
	Undecided	40	1.3	
	Disagree	9	0.3	
	Strongly Disagree	6	0.2	
	Total	3,063	100.0	
Grand Weighted Mean				Very High (Weighted Mean = 4.44)

Attitudes of the USTP System faculty, staff, and students on solid waste management

The data in Table 3 shows that participants have a highly positive attitude towards solid waste management, as evidenced by their high ratings on several key indicators. They strongly support the strict implementation of the USTP System's provisions under RA No. 9003, also known as the "Ecological Solid Waste Management Act of 2000" (WM = 4.64). Additionally, they believe that segregating waste at the source contributes to a cleaner and healthier environment at USTP (WM = 4.64). Participants also recognize that improper waste disposal can contaminate water sources, potentially leading to the spread of waterborne diseases such as diarrhea, cholera, and typhoid fever (WM = 4.61). They emphasize the importance of having a materials recovery facility (MRF) on campus (WM = 4.58) and express strong support for USTP's segregated waste collection mechanisms (WM = 4.57). Furthermore, they firmly believe that improper solid waste disposal can lead to the clogging of drainage systems, which may result in flooding during the rainy season (WM = 4.55).

Finally, they acknowledge the importance of refusing single-use items and reusing materials to promote sustainable waste management (WM = 4.47).

Table 3. Attitude of Participants on Solid Waste Management.

Indicators	Rating	f	%	Level of Attitudes
1. It is very important for USTP to strictly implement the provisions of Republic Act No. 9003, also known as the "Ecological Solid Wastes Management Act of 2000."	Strongly Agree	2008	65.6	Very High (Weighted Mean = 4.64)
	Agree	1008	32.9	
	Undecided	43	1.4	
	Disagree	4	0.1	
	Strongly Disagree	0	0.0	
	Total	3,063	100.0	
2. The prohibition of the use of plastic bags and styrofoam as packaging materials on selected wet and dry goods in USTP must be sustained.	Strongly Agree	1482	48.4	Very High (Weighted Mean = 4.38)
	Agree	1326	43.3	
	Undecided	201	6.6	
	Disagree	41	1.3	
	Strongly Disagree	13	0.4	
	Total	3,063	100.0	
3. I support the idea that burning waste materials releases harmful pollutants and particulate matter into the air, which can cause respiratory conditions like asthma and bronchitis.	Strongly Agree	1671	54.6	Very High (Weighted Mean = 4.31)
	Agree	1055	34.4	
	Undecided	94	3.1	
	Disagree	102	3.3	
	Strongly Disagree	141	4.6	
	Total	3,063	100.0	
4. It is important for USTP to have a materials recovery facility within the campus vicinity.	Strongly Agree	1843	60.2	Very High (Weighted Mean = 4.58)
	Agree	1156	37.7	
	Undecided	57	1.9	

	Disagree	6	0.2	
	Strongly Disagree	1	0.0	
	Total	3,063	100.0	
5. I believe improper disposal of waste can contaminate water sources, leading to the spread of waterborne diseases such as diarrhea, cholera, and typhoid fever.	Strongly Agree	1948	63.6	Very High (Weighted Mean = 4.61)
	Agree	1046	34.1	
	Undecided	49	1.6	
	Disagree	16	0.5	
	Strongly Disagree	4	0.1	
	Total	3,063	100.0	
6. I believe in the importance of refusing single-use items and reusing items to promote sustainable waste management.	Strongly Agree	1611	52.6	Very High (Weighted Mean = 4.47)
	Agree	1310	42.8	
	Undecided	113	3.7	
	Disagree	18	0.6	
	Strongly Disagree	11	0.4	
	Total	3,063	100.0	
7. I support the idea that by segregating waste at the source, it can promote a cleaner and healthier environment in USTP.	Strongly Agree	2014	65.8	Very High (Weighted Mean = 4.64)
	Agree	1000	32.6	
	Undecided	40	1.3	
	Disagree	6	0.2	
	Strongly Disagree	3	0.1	
	Total	3,063	100.0	
8. I don't care if poor solid waste management can create breeding grounds or shelter for pests such as flies, rats, and mosquitoes.	Strongly Agree	560	18.3	High (Weighted Mean = 3.31)
	Agree	637	20.8	
	Undecided	219	7.1	
	Disagree	588	19.2	
	Strongly Disagree	1059	34.6	
	Total	3,063	100.0	
9. I am strongly convinced that improper disposal of solid waste may lead to clogging of drainage canals, which may lead to floods during the rainy season.	Strongly Agree	1854	60.5	Very High (Weighted Mean = 4.55)
	Agree	1104	36.0	
	Undecided	60	2.0	
	Disagree	23	0.8	
	Strongly Disagree	22	0.7	
	Total	3,063	100.0	
10. I strongly support the segregated waste collection mechanisms implemented in USTP.	Strongly Agree	1864	60.9	Very High (Weighted Mean = 4.57)
	Agree	1099	35.9	
	Undecided	86	2.8	
	Disagree	13	0.4	
	Strongly Disagree	1	0.0	
	Total	3,063	100.0	
Grand Weighted Mean				Very High (Weighted Mean = 4.34)

The data in Table 3 underscores the participants' highly positive attitude toward solid waste management, which is reflected in their strong support for key initiatives such as the strict implementation of Republic Act No. 9003, the "Ecological Solid Waste Management Act of 2000" (WM = 4.64), and waste segregation practices. Positive attitudes towards solid waste management are critical in promoting environmental sustainability, as they directly influence behavioral intentions and actions (Ajzen, 1991). Participants' support for RA No. 9003 indicates their commitment to institutional policies that uphold environmental protection and sustainable waste practices, which align with research demonstrating that awareness of and compliance with environmental laws can lead to more effective waste management outcomes (Ojedokun & Balogun, 2011).

Their belief that segregating waste at the source promotes a cleaner and healthier environment (WM = 4.64) highlights the critical role that waste management plays in maintaining a sanitary and healthy campus.

Table 4. Practices of Participants on Solid Waste Management.

Indicators	Rating	f	%	Level of Practices
1. I actively advocate and promote the recognition of the importance of preventing soil pollution through waste segregation, in alignment with the principles outlined in Republic Act No. 9003, within USTP and among its stakeholders.	Strongly Agree	1541	50.3	Very High (Weighted Mean = 4.46)
	Agree	1398	45.6	
	Undecided	111	3.6	
	Disagree	12	0.4	
	Strongly Disagree	0	0.0	
	Total	3,063	100.0	
2. I actively engage in and advocate for waste segregation at the source to promote a cleaner and healthier environment within USTP, encouraging others to adopt this practice for sustainable waste management.	Strongly Agree	1448	47.3	Very High (Weighted Mean = 4.41)
	Agree	1446	47.2	
	Undecided	144	4.7	
	Disagree	19	0.6	
	Strongly Disagree	6	0.2	
	Total	3,063	100.0	
3. I advocate waste reduction strategies, such as reducing the amount of waste generated and practicing CLAYGO (Clean As You Go) principles, whenever I am in USTP.	Strongly Agree	1823	59.5	Very High (Weighted Mean = 4.57)
	Agree	1162	37.9	
	Undecided	67	2.2	
	Disagree	9	0.3	
	Strongly Disagree	2	0.1	
	Total	3,063	100.0	
4. I campaign on the importance of refusing single-use items and reusing items to promote sustainable waste management.	Strongly Agree	1285	42.0	Very High (Weighted Mean = 4.31)
	Agree	1489	48.6	
	Undecided	258	8.4	
	Disagree	28	0.9	
	Strongly Disagree	3	0.1	
	Total	3,063	100.0	
5. I help implement the provisions of Republic Act No. 9003, also known as the "Ecological Solid Wastes Management Act of 2000 in the USTP.	Strongly Agree	1343	43.8	Very High (Weighted Mean = 4.37)
	Agree	1538	50.2	
	Undecided	163	5.3	
	Disagree	16	0.5	
	Strongly Disagree	3	0.1	
	Total	3,063	100.0	
6. I consistently participate in and support the establishment of regular waste collection and disposal mechanisms at USTP, taking proactive steps to ensure a clean and sustainable environment within the campus.	Strongly Agree	1282	41.9	Very High (Weighted Mean = 4.34)
	Agree	1575	51.4	
	Undecided	180	5.9	
	Disagree	21	0.7	
	Strongly Disagree	5	0.2	
	Total	3,063	100.0	
7. Prohibition activities like mixing solid waste in any waste box or receptacle and unauthorized removal of recyclable materials from waste boxes or receptacles are strictly implemented in USTP.	Strongly Agree	1123	36.7	High (Weighted Mean = 4.17)
	Agree	1477	48.2	
	Undecided	340	11.1	
	Disagree	105	3.4	
	Strongly Disagree	18	0.6	
	Total	3,063	100.0	
8. I consistently participate in and adhere to the segregated waste collection mechanisms implemented in USTP.	Strongly Agree	1227	40.1	Very High (Weighted Mean = 4.33)
	Agree	1645	53.7	
	Undecided	164	5.4	
	Disagree	26	0.8	
	Strongly Disagree	1	0.0	
	Total	3,063	100.0	
9. I consistently promote and support USTP's emphasis on the importance of proper waste segregation to prevent environmental degradation, actively participating in waste segregation efforts and encouraging others to do the same.	Strongly Agree	1409	46.0	Very High (Weighted Mean = 4.41)

This is consistent with studies that show waste segregation at the source significantly improves the efficiency of waste management systems and reduces environmental contamination (Zeng *et al.*, 2016). Furthermore, participants' awareness of the health risks associated with improper waste disposal, such as contamination of water sources and the spread of waterborne diseases (WM = 4.61), demonstrates an

understanding of the broader public health implications of waste management, which is supported by literature linking poor waste disposal practices to the spread of diseases (Brinkmann *et al.*, 2019).

The emphasis on the importance of having a materials recovery facility (MRF) on campus (WM = 4.58) reflects a proactive attitude toward infrastructure that supports sustainable waste management. MRFs are essential components in modern waste management systems as they enable the recovery of recyclable materials, thus reducing landfill waste and contributing to circular economy practices (Lohri *et al.*, 2014). Participants' strong support for USTP's segregated waste collection mechanisms (WM = 4.57) further indicates a willingness to engage in practices that contribute to effective waste management, which is vital for the success of such initiatives (Zhang *et al.*, 2019).

Table 5. One Way ANOVA Test on Gender Comparison in the Participants' Knowledge on SWM.

Source	DF	Sum of Square	Mean Square	F Statistic	P-value
Groups (between groups)	2	2.681	1.341	8.869	0.000144
Error (within groups)	3060	462.571	0.151		
Total	3062	465.252	0.152		

The firm belief that improper waste disposal can clog drainage systems and lead to flooding (WM = 4.55) reflects participants' understanding of the environmental hazards posed by poor waste management. This finding is particularly relevant in the Philippine context, where urban flooding is a frequent issue exacerbated by clogged drainage systems due to improper waste disposal (Alcantara & Marfai, 2022).

Their recognition of the importance of refusing single-use items and reusing materials (WM = 4.47) also aligns with global efforts to reduce plastic waste and promote sustainability, as studies have shown that individual behavioral change is crucial in addressing the environmental impacts of single-use plastics (Nielsen *et al.*, 2020).

Practices of the USTP System faculty, staff, and students on solid waste management

The data in Table 4 shows that participants demonstrated a high level of solid waste management practices, with a grand weighted mean of 4.38.

These practices include advocating for waste reduction strategies, such as minimizing waste generation and following "clean as you go" (CLAYGO) principles (WM = 4.57); promoting the prevention of soil pollution through proper waste segregation (WM = 4.46); supporting sustainable practices aligned with institutional policies (WM = 4.43); actively promoting USTP's commitment to proper waste segregation to prevent environmental degradation, as well as participating in and encouraging others to engage in waste segregation efforts (WM = 4.41).

Table 6. Post Hoc Analysis: Tukey HSD (Honestly Significant Difference) on Knowledge on SWM.

	Female	LGBTQIA+	Male
Mean	4.49331	4.48349	4.43300

Pair	Difference	SE	Q	Lower CI	Upper CI	Critical Mean	p-value
Female – LGBTQIA+	0.00983	0.0272	0.361	-0.0803	0.1	0.0902	0.965
Female – Male	0.0603	0.0102	5.923	0.0265	0.0941	0.0338	0.0000858
LGBTQIA+ – Male	0.0505	0.0274	1.842	-0.0404	0.141	0.0909	0.394

Participants also helped implement the "Ecological Solid Waste Management Act of 2000" at USTP (WM = 4.37) and took part in regular waste collection and disposal mechanisms, contributing to a clean and sustainable campus environment (WM = 4.34). Furthermore, they adhered to the university's segregated waste collection systems (WM = 4.33), promoted the refusal of single-use items and the

reuse of materials for sustainable waste management (WM = 4.31), and discouraged activities such as mixing waste in bins or the unauthorized removal of recyclables from receptacles (WM = 4.17). However, based on the narratives of the focus group discussion (FGD) respondents, certain provisions of Republic Act No. 9003, or the "Ecological Solid Waste Management Act of 2000," are not consistently implemented on campus. Specifically, the requirement to have designated receptacles for segregating biodegradable, recyclable, residual, special, and hazardous wastes is often overlooked. This inconsistency compromises the overall waste management system and creates challenges in proper waste segregation. Additionally, despite the law's emphasis on reducing plastic use, plastic products are still commonly used across the campus. This indicates a gap between policy and practice, as the continued use of plastics undermines the sustainability goals promoted by RA 9003.

Table 7. One Way ANOVA Test on Gender Comparison in the Participants' Attitude on SWM.

Source	DF	Sum of Square	Mean Square	F Statistic	P-value
Groups (between groups)	2	5.9105	2.9553	18.0128	1.67e-8
Error (within groups)	3060	502.0382	0.1641		
Total	3062	507.9487	0.1659		

FGD respondents also highlighted the lack of awareness and education among some members of the campus community regarding the importance of proper waste segregation and plastic reduction. While efforts to promote environmental responsibility exist, they may not be effectively communicated or enforced, leading to mixed compliance. The failure to fully implement these provisions points to a need for stronger policy enforcement, better waste management infrastructure, and more comprehensive educational campaigns. Addressing these gaps is essential to achieving the long-term goals of RA 9003 and ensuring that the campus contributes meaningfully to environmental sustainability.

Moreover, respondents suggested that the campus could benefit from a stricter monitoring system to ensure compliance with the waste management protocols outlined in RA 9003. This could include regular audits, stricter penalties for non-compliance, and incentives for departments or units that adhere to sustainable practices. These measures would help bridge the gap between the legislative intent of RA 9003 and its practical application within the campus community.

Gender comparison in their knowledge on SWM

To determine whether there is significant differences in knowledge on solid waste management among the gender (i.e. female, LGBTQIA+, and male), a One-way ANOVA with Post Hoc Analysis was applied. The following are the results:

As can be gleaned from Table 5, since p-value = 0.000144<.05, the null hypothesis is rejected. This means that the gender's average knowledge on solid waste management is considered to be not equal.In other words, the difference between the sample averages of some gender is big enough to be statistically significant.

Table 8. Post Hoc Analysis: Tukey HSD (Honestly Significant Difference) on Attitude on SWM.

	Female	LGBTQIA+	Male
Mean	4.5524	4.60734	4.46937

Pair	Difference	SE	Q	Lower CI	Upper CI	Critical Mean	p-value
Female – LGBTQIA+	0.05494	0.02833	1.9394	-0.039	0.1489	0.09394	0.3561
Female – Male	0.08303	0.01061	7.8274	0.04786	0.1182	0.03518	9.945e-8
LGBTQIA+ - Male	0.138	0.02855	4.8322	0.04329	0.2327	0.09468	0.001856

Moreover, only the knowledge level on solid waste management between female and male respondents is significantly different (see Table 6).

The finding that there is a statistically significant difference in the average knowledge on solid waste management (SWM) between male and female respondents at the USTP suggests that gender plays a role in shaping individuals' understanding of this critical environmental issue. Several cultural and institutional factors may contribute to these differences. First, in many societies, including the Philippines, traditional gender roles often influence education, household responsibilities, and environmental awareness. Women are frequently tasked with domestic duties that include waste disposal and recycling, which may result in a higher level of practical knowledge on solid waste management. Conversely, men may be less exposed to these daily practices, leading to a lower average knowledge in this area. Second, women are typically seen as primary caregivers, which may position them as more knowledgeable about household management, including waste segregation and recycling. Men, on the other hand, may be more engaged in activities outside the household, potentially making them less familiar with day-to-day waste management practices.

Table 9. One Way ANOVA Test on Gender Comparison in the Participants' Practice of SWM.

Source	DF	Sum of Square	Mean Square	F Statistic	P-value
Groups (between groups)	2	3.7138	1.8569	8.5616	0.0001959
Error (within groups)	3060	663.674	0.2169		
Total	3062	667.3878	0.218		

The Tukey HSD (Honestly Significant Difference) test compares all possible pairs of gender groups. In this case, significant differences are observed between female and male respondents:

- Female – LGBTQIA+: The knowledge level difference is 0.00983 (SE = 0.0272), not statistically significant (p = 0.965).
- Female – Male: The knowledge level difference is 0.0603 (SE = 0.0102), statistically significant (p = 0.0000858).
- LGBTQIA+ – Male: The knowledge level difference is 0.0505 (SE = 0.0274), not statistically significant (p = 0.394). While the effect size is small, the ANOVA results indicate that gender significantly impacts knowledge of solid waste management. This implies that researchers and policymakers should consider these gender differences when designing waste management education programs or policies. In addition, further investigation into specific knowledge gaps and targeted interventions may be warranted.

Gender comparison in their attitude on SWM

To determine whether there is significant differences in attitude on solid waste management among the genders i.e. female, LGBTQIA+, Male, a One-way ANOVA with Post Hoc Analysis was applied. The following are the results:

The data in Table 7 revealed that the gender's average attitude on SWM is considered to be not equal as evidenced by the p-value of 1.67e-8<.05 which means the H_0 is rejected. In other words, the difference between the average attitudes of some gender is big enough to be statistically significant.Moreover, based on the Post Hoc Analysis (Tukey HSD), only the attitudes on solid waste management between: Female and Male, LGBTQIA+ and Male respondents are significantly different (Table 8).

In this regard, attitudes on solid waste management between different gender pairs are compared. The data shows that significant differences exist only between the following pairs:

- Female and Male: The mean difference is 0.08303, with a highly significant p-value of 9.945e-8.
- LGBTQIA+ and Male: The mean difference is 0.138, with a p-value of 0.001856.

In summary, the study reveals that gender significantly influences attitudes toward solid waste management. While the overall effect size is small, specific gender pairs exhibit notable differences. Researchers and policymakers should consider these findings when designing waste management programs and educational interventions.

Gender comparison in their practice on SWM

To determine whether there are significant differences in the practice of solid waste management among genders (i.e. female, LGBTQIA+, and male), a One-way ANOVA with Post Hoc Analysis was applied (see Table 9). The following are the results:

The data revealed that sincep-value=0.0001959 <.05, H_0 is rejected. This means that some of the gender's average practice in solid waste management is considered to be not equal.In other words, the difference between the average practice in solid waste management of some genders is big enough to be statistically significant.

Furthermore, Table 10 shows that Tukey's Honestly Significant Difference (HSD) test compares group means pairwise. The data revealed that only the practice on solid waste management between female and male respondents shows a significant difference. Thus, the ANOVA results indicate that gender significantly influences solid waste management practices. However, the effect size is small, suggesting that other factors may also play a role. The Tukey HSD analysis reveals specific pairwise differences, emphasizing the importance of considering gender in waste management initiatives.

Table 10. Post Hoc Analysis: Tukey HSD (Honestly Significant Difference) on Practice of SWM.

	Female	LGBTQIA+	Male
Mean	4.43015	4.44312	4.36073

Pair	Difference	SE	Q	Lower CI	Upper CI	Critical Mean	p-value
Female – LGBTQIA+	0.03257	0.3981	-0.09504	0.121	0.108	0.9573	0.03257
Female – Male	0.0122	5.6915	0.02897	0.1099	0.04045	0.0001728	0.0122
LGBTQIA+ - Male	0.03283	2.5096	-0.02648	0.1913	0.1089	0.1783	0.03283

Implications on the university's solid waste management plan and policy

These findings have several implications for policy and practice. First, the high level of knowledge among participants on critical aspects of solid waste management suggests that educational programs and legislation such as RA No. 9003 have been successful in raising awareness about the environmental and health impacts of waste mismanagement.

However, the gaps in knowledge regarding specific practices, such as the prohibition of plastic bags and the existence of the materials recovery facility, highlight the need for more targeted educational campaigns. This could involve integrating information on local waste infrastructure and sustainable alternatives to single-use plastics into university curricula and community outreach programs. Moreover, the participants' understanding of waste segregation and the harmful effects of burning waste suggests that they are equipped with the knowledge necessary to make informed decisions about waste disposal. This highlights the importance of maintaining and expanding public education efforts to reinforce pro-environmental behaviors. Furthermore, policymakers and institutions should consider strengthening the enforcement of penalties for violations of waste management laws, as this has been shown to influence public compliance (Luo *et al.*, 2016).

The highly positive attitudes displayed by the participants suggest that there is a strong foundation upon which to build further waste management initiatives at USTP. The alignment of participants' attitudes with key elements of RA No. 9003 indicates the potential for greater compliance with institutional waste management policies and practices. However,

to sustain and further enhance these positive attitudes, USTP should continue providing environmental education and awareness campaigns to reinforce the health and environmental benefits of proper waste management. Additionally, improving campus infrastructure, such as expanding the materials recovery facility, could further strengthen participants' engagement in waste segregation and recycling practices.

The positive attitude towards waste segregation and awareness of the risks of improper disposal suggests that USTP could serve as a model for other institutions in promoting sustainable waste management practices. These findings also imply that attitudes toward solid waste management can be cultivated through a combination of policy enforcement, infrastructure development, and continuous education. Moreover, the belief in the importance of refusing single-use items highlights the potential for USTP to lead in the promotion of zero-waste lifestyles and plastic reduction initiatives, further aligning with global sustainability goals.

Conclusion

This study provides valuable insights into the gender-based differences in knowledge, attitudes, and practices (KAP) regarding solid waste management (SWM) among USTP System faculty, staff, and students. The findings reveal that while overall knowledge and attitudes toward SWM are high, there are significant differences between genders, particularly in knowledge levels and practices. Female respondents generally exhibit higher levels of knowledge and positive attitudes toward SWM than their male counterparts. This suggests that future SWM interventions should be tailored to address these disparities. The study highlights the need for gender-sensitive policies and educational programs that promote equitable participation in sustainable waste management.

Recommendations

1. Integrate Gender-Sensitive Programs: USTP should develop gender-sensitive SWM programs that target the specific needs and challenges faced by male respondents. These programs could include educational workshops or campaigns that address the lower knowledge and engagement levels observed among male participants.
2. Strengthen Institutional Infrastructure: The university should improve waste management infrastructure, such as increasing awareness and accessibility to materials recovery facilities (MRFs) and enforcing the prohibition of single-use plastics on campus more effectively.
3. Conduct Further Research: Future studies should explore the underlying cultural and institutional factors that contribute to the observed gender differences in SWM. A combination of quantitative and qualitative research approaches would provide a more comprehensive understanding of the motivations and barriers faced by different gender groups in waste management practices.
4. Regular Audits and Monitoring: USTP should implement regular audits to monitor compliance with SWM policies and provide incentives for departments or units that demonstrate consistent adherence to sustainable practices. This will help bridge the gap between policy and practice.

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References

Abdullahi U, Adamu A, Umar AS. 2021. The Role of Community Participation in Solid Waste Management: A Review of the Literature. Journal of Solid Waste Technology and Management **47(1),** 21-37.

Ajzen I. 1991. The theory of planned behavior. Organizational Behavior and Human Decision Processes **50(2),** 179-211. https://doi.org/10.1016/0749-5978(91)90020-T

Alcantara AJB, Marfai MA. 2022. Examining the vulnerability of urban drainage systems to flooding in the Philippines. Journal of Flood Risk Management, **15(3),** e12824. https://doi.org/10.1111/jfr3.12824

Bhakta JN, Lawton RJ, Irianto HE. 2020. Awareness and practices regarding solid waste management among university students in developing countries: A case study from Indonesia. Journal of Cleaner Production **265,** 121734. https://doi.org/10.1016/j.jclepro.2020.121734

Brinkmann M, Eichbaum K, Buchinger S, Reifferscheid, G, Hecker M. 2019. Potential health impacts of municipal solid waste disposal sites in developing countries: A case study of landfill leachate toxicity in Lagos, Nigeria. Science of the Total Environment **696,** 134019. https://doi.org/10.1016/j.scitotenv.2019.134019

Brough AR, Wilkie EA, Ma X. 2016. A conceptual model of environmentally significant behavior in the workplace: Understanding the role of individual and organizational factors in predicting environmental outcomes. Journal of Business and Psychology **31(1),** 39-53.

Brough AR, Wilkie EA, Ma X. 2016. A conceptual model of environmentally significant behavior in the workplace: Understanding the role of individual and organizational factors in predicting environmental outcomes. Journal of Business and Psychology **31(1),** 39-53.

Budhathoki SS, Shakya R, Rai K. 2016. Gender issues in municipal solid waste management in Nepal. Waste Management & Research **34(5),** 393-400.

Bui DD, Pham TTP, Nguyen THT. 2017. A review of factors affecting the public acceptance and adoption of composting. Waste Management & Research **35(3),** 255-264.

Domina T, Koch K. 2002. Convenience and frequency of recycling: Implications for including textiles in curbside recycling programs. Environment and Behavior **34(2),** 216-238. https://doi.org/10.1177/0013916502034002004

Ecological Solid Waste Management Act of 2000. Retrieved from https://www.lawphil.net/statutes/repacts/ra2000/ra_9003_2000.html

Fisher JA, Sherren K, Dalisay G. 2015. Gender and waste: exploring the relationship between gender and the waste sector in low-and middle-income countries. Gender, Place & Culture **22(8),** 1105-1122.

Gonzales KC, Magno F. 2015. The role of education in waste management: A study of the implementation of the Ecological Solid Waste Management Act in selected cities in Metro Manila. Asian Journal of Environment **1(1),** 23-34.

Hill K, Dunham K, Grau LE, Heimer R. 2023. "It's starting to weigh on me": Exploring the Experiences and Support Needs of Harm Reduction Staff in Connecticut using the Social-Ecological Model. Harm Reduction Journal **20(1),** 168.

Jha AK, Bloch R, Lamond J. 2012. Cities and flooding: A guide to integrated urban flood risk management for the 21st century. The World Bank.

Koh ET, Owen WL. 2000. Descriptive research and qualitative research. In Introduction to Nutrition and Health research (219-248). Springer, Boston, MA.

Lagunda J. 2016. Implementing the Philippine Ecological Solid Waste Management Act: Gaps and emerging issues. Journal of Environmental Science and Management **19(1),** 19-31.

Lohri CR, Camenzind EJ, Zurbrügg C. 2014. Financial sustainability in municipal solid waste management – Costs and revenues in Bahir Dar, Ethiopia. Waste Management **34(2),** 542-552. https://doi.org/10.1016/j.wasman.2013.10.014

Luo W, He Y, Xie Y. 2016. Assessing the role of punishment in waste management: A behavioral perspective. Journal of Environmental Management **181,** 307-313. https://doi.org/10.1016/j.jenvman.2016.06.022

Massey DD, Kulshrestha A, Taneja A, Masih J. 2013. Particulate pollution and its health impacts in a tropical urban environment. Atmospheric Pollution Research **4(2),** 167-176. https://doi.org/10.5094/APR.2013.018

Nielsen TD, Holmberg K, Stripple J. 2020. Need a bag? A review of public policies on plastic carrier bags – Where, how and to what effect? Waste Management **87,** 428-440. https://doi.org/10.1016/j.wasman.2019.02.025

Ojedokun AO, Balogun SK. 2011. Psychosocial factors influencing waste management compliance among residents of an urban community in Nigeria. Waste Management **31(6),** 1711-1716. https://doi.org/10.1016/j.wasman.2011.03.014

Peralta RP, Coronado MAF, Basco CV. 2021. Solid waste management practices and the roles of stakeholders in Cagayan de Oro City, Philippines. Global Journal of Environmental Science and Management **7(1),** 15-28.

Republic Act No. 9003: Ecological Solid Waste Management Act of 2000. https://www.lawphil.net/statutes/repacts/ra2000/ra_9003_2000.html

Requia WJ, Peralta R, Rojas-Rueda D, Nieuwenhuijsen MJ. 2020. The health impacts of transitioning to a low-carbon society: A systematic review of the evidence from the Philippines. Environmental Research **184,** 109246.

Ritch E, Brennan C, MacLeod C. 2009. Plastic bag politics: Modifying consumer behavior for sustainable development. International Journal of Consumer Studies **33(2),** 168-174. https://doi.org/10.1111/j.1470-6431.2009.00749.

Suttibak S, Nitivattananon V. 2008. Assessing waste segregation efficiency in a low-income area of Bangkok, Thailand. Waste Management & Research, **26(1),** 101-111. https://doi.org/10.1177/0734242X07079297

Tonglet M, Phillips PS, Read AD. 2004. Using the theory of planned behaviour to investigate the determinants of recycling behaviour: A case study from Brixworth, UK. Resources, Conservation and Recycling **41(3),** 191-214.

Watson M. 2006. Household waste and recycling behaviour: An attitudinal and demographic analysis. Waste Management **26(1),** 62-70.

World Bank. 2019. Philippines: Solid Waste Management Project. Retrieved from https://projects.worldbank.org/en/projects-operations/project-detail/P148870

Zeng S, Dong H, Ren S. 2016. An examination of the waste hierarchy in solid waste management in the developing world: Key lessons from Hong Kong. Journal of Cleaner Production **117,** 35-42. https://doi.org/10.1016/j.jclepro.2015.12.150

Zhang Y, Li, H, Cao H, Zheng X. 2019. Waste sorting and recycling awareness in an urban Chinese community: A case study. Resources, Conservation & Recycling **140,** 212-222. https://doi.org/10.1016/j.resconrec.2018.09.023