Waste Management Practices of Maritime Students at Home Vis a Vis Annex V of Marpol 73/78

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Abstract — *The study was focused on determining the waste management practices that were observed at home by maritime students with regard to Annex V of MARPOL 73/78. The study used quantitative, descriptive, and correlational research design in determining the practices of waste management of maritime students at home with regard to the Annex V of Marpol 73/78 and in answering the research problems formulated. The study utilized the probability sampling method to determine the sample size. The study was conducted at the University of Cebu - Maritime Education and Training Center. The researchers used a validated researcher-made survey questionnaire to gather the data. The gathered data was treated with a weighted mean and an T test. The findings revealed a significant difference between maritime students who practice waste management before and after the implementation of Annex V of Marpol 73/78. Moreover, the researchers concluded that even before the introduction of Annex V of MARPOL 73/78, students already had the knowledge and understanding of waste management. However, because the respondents are enrolled in a maritime course with a specific subject, Marine Environment, it has helped them to better understand and broaden their knowledge of proper garbage disposal.*

Keywords — *Maritime, Annex V Marpol 73/78, Waste Management Practices, Descriptive Correlational, Cebu City, Philippines.*

INTRODUCTION

The ocean currents spread waste materials worldwide, which causes considerable environmental damage. Plastic products and other solid materials take ages to break down; the objects could perhaps travel thousands of kilometers worldwide and destroy natural ecosystems (Bakir et al., 2014). The coastal waters of Southeast Asian countries have some of the world's wealthiest ecosystems among other countries, characterized by extensive coral reefs and abundant mangrove forests. It supports marine life and human life by preventing waves and strong winds from passing through houses near coastal areas. The ocean is also one of the significant sources of livelihood for Asian people. However, the improper disposal of waste and garbage has turned into a substantial problem that continuously affects the distortion of marine life. The unhealthy disposal of solid waste resulting from human development and survival activities is one of the biggest challenges developing countries face (Osinowo, 2001; Joseph, 2006; Longe & William, 2006; Kofoworola, 2007). In addition, plastic waste becomes a massive threat to the environment because of the large amount generated, causing severe damage to any environment and its inhabitants. The marine environment is one of the primary victims of this threat. Plastic waste generated on land finds its way to move towards bodies of water, with damaging effects including flooding and poisoning of animals in the marine ecosystem (Willis K. et al., 2018).

The massive increase in solid waste production worldwide calls for the development of waste management strategies for environmental sustainability. The Life Cycle Assessment (LCA) tool can help answer the call by quantifying the environmental impacts. It assesses the Municipal Solid Waste Management System (GSWM), allowing decision-makers to select the best management strategy with minimal ecological impact (Khandelwal et al., 2019). One of the applicable techniques distinguished by families that policymakers can start in government and metropolitan areas is to build the pace of support in partition exercises and ultimately urge them to participate in practices that give practical actions for reducing waste disposal within the community. In addition to that, schools seriously understudy but come up short on mindfulness and information because they perceive errors about the obligations of humans toward the classification of trash and in the partition for reducing and recycling waste materials. As a result, the understudies possessed unrestricted judgment and vulnerable environmental information and awareness (Xue-qin, L. I., Pitpitunge, A. D., 2013). However, Eriksen et al. (2018) also note that while it has been emphasized that plastic recycling is a vital means in

economic development for many communities throughout the world, the use and subsequent waste management of plastic may be contaminated. Therefore, if these substances and contaminants are not removed during recycling, they may eventually return to river systems, which may end up causing further severe environmental problems. The best way to promote solid waste separation activities positively is to increase the accessibility of recycling facilities. One of the effective strategies identified that was used by urban authorities and government policymakers to increase participation of segregation activities and potentially encourage people to participate in recycling activities is the provision of easily accessible collection points for recyclables in all residential areas (Chen, C. L., and Liu, T. K., 2013).

The University of Cebu-Maritime Education and Training Center is an institution that trains future seafarers. Waste management is one of the aspects of the university which is being developed to prepare maritime students for their field. The value of practicing waste management is significant when working in the marine industry. It is because, aside from it being written in the regulations of the Marpol Convention, it is also beneficial for the students in nurturing their minds about the proper waste disposal on-board ship. Therefore, participating in waste management activities is a task and challenge for every student attending the school. Nonetheless, the primary objective of the researchers performing this study is to determine the scope of waste management practices seen among maritime students in their respective homes.

The primary purpose of this study is to evaluate students in maritime education regarding the necessity of practicing waste management at home and in their course, where waste management is also applicable on-board. The researchers want to raise the questions to be answered and resolved so that the maritime students, instructors, school administration, and even parents can be acquainted and informed of what necessary actions are to be taken towards the study. Also, the survey findings were utilized to understand and formulate a recommendation to enhance the topic being studied.

FRAMEWORK

The theory of diffusion of innovation by E.M Rogers in 1962, new concepts and methods are spreading in other areas and growing over time. The time factor in this theory is determinative as it is responsible for the diffusion of the different methodologies and concepts of waste management across the country and on a larger scale in the world. The theory of diffusion of innovation has formed the basis of several studies in the recent past, integrating innovation into the knowledge, attitude, and practice phases of adopting innovation. Continuous education in school about environmental education is a crucial concept of this theory, as it consists of increasing the level of education and awareness of students about environmental management by cultivating students' KAPs as K (knowledge) for perception, A (attitude) for affective and P (Practices) for behavioral acts. Behavioral acts result from the student learning some skills, while P (practice) leads to a change in behavior and better practices, according to Hubbard and Hayashi (2003). Whether it takes too much time for students to sort out waste, whether there are waste sorting facilities and tools in the dormitory, and whether there is enough space for waste storage will also affect whether college students participate in sorting and recycling (Reddi KR, Li W, Wang B, et al., 2013). It asserted that university students, most especially maritime students, were one of the most important groups of actors and promoters of household waste segregation.

It is essential for students to understand the importance of waste management to know how applying waste management helps our environment. Effective waste management, particularly of harmful materials, is a significant test for worldwide sustainable development. A scope of strategies was available for removing or treating waste, including landfilling, burning, fertilizing the soil, and recycling. However, improper waste management can cause severe health and environmental issues. Especially the emerging hazards that are dangerous and poorly managed landfill slides (Yang et al., 2018). Many researchers have examined the microbial community on biodegradable surfaces in various conditions through field investigations and laboratory studies (Mercier et al., 2017; Dussud et al., 2018; Gonzalez-Pleiter et al., 2021). They developed an understanding of the properties that distinguish biodegradable plastisphere from non-biodegradable plastisphere.

OBJECTIVES

This study determined the waste management practices that were observed among maritime students at home before and after the introduction of Annex V of Marpol 73/78. Likewise, the study also wanted to assess the impacts of implementing waste management on maritime students. Specifically, this study looked into the a) the extent of the waste management practices of the respondents before the introduction of Annex V of Marpol 73/78, b) the extent of the waste management practices of the respondents after the introduction of Annex V of Marpol 73/78, and the significant difference between the extent of practices before and after the introduction of Annex V of Marpol 73/78.

RESEARCH DESIGN

The study used a quantitative, descriptive, and correlational research design in determining the practices of waste management of maritime students at home with regard to the Annex V of Marpol 73/78. Descriptive correlational studies describe the variables and naturally occurring relationships between and among them, Sausa, VD (2007). This research design allowed the researchers to gain quantifiable data that was necessary in measuring and determining the waste management practices of maritime students at their respective homes with regard to their understanding of Annex V of Marpol 73/78.

RESEARCH SITE

The study was conducted at the University of Cebu-Maritime Education and Training Center. The researchers had chosen this environment because the University offered the specified courses and subjects in the I-Building of the College Department. The researchers collected the data from the maritime students of the University of Cebu – Maritime Education and Training Center College I-Building. The researchers chose the environment because they could quickly determine the involvement of the respondents since they are enrolled at the University that has subjects that tackle the Marpol Convention and all the annexes under its regulation.

The respondents for this study only covered maritime students in the University of Cebu-Maritime Education and Training Center who were taking maritime courses, since they could provide the data needed in determining the extent of waste management practices of maritime students regarding the Annex V of Marpol 73/78. The researcher's target respondents were only 2nd-year BSMT students. Out of 798 students, only 260 were chosen to participate in the questionnaire that the researchers provided. The study utilized the probability sampling method to determine the sample size. The researcher used stratified sampling to acquire the population based on the characteristics set by the researchers intended for the study.

INSTRUMENTATION

The researchers utilized a validated researcher-made survey questionnaire to gather the data. Questions were selected to correspond to the objectives of this study. A Likert scale questionnaire was utilized with four scales: strongly agree, agree, disagree, and strongly disagree, with each corresponding to their respective interpretations. The respondents had to put a checkmark on the scale corresponding to their honest observation of each statement provided on the questionnaire.

The instruments were utilized in order to tailor the standardized survey questionnaire to the context of this study. The survey questionnaires contain the same set of questions for every respondent. The survey questionnaires were composed of two sets of questions. The first set of questions were used to measure the extent of waste management practices of the respondents before the introduction of Annex V of Marpol 73/78. The second set of questions were used to measure the extent of waste management practices of the respondents after the introduction of Annex V of Marpol 73/78. The respondents would give their honest answers, corresponding to the agreement of each question.

To gather and provide as much informative and reliable information of the extent of waste management practices of the respondents regarding Annex V of Marpol 73/78, the Likert scale was used as the basis in the questionnaires to determine the waste management practices of the respondents' knowledge before and after the introduction of Annex V of Marpol 73/78.

The researchers used a reliability test in this quantitative-correlational study by analyzing the validity of the measurements or instruments used in the study (also referred to as instrument validation). Pilot testing was also done to confirm the instrument's reliability by giving it to at least one group of people. The pilot testing findings were statistically and practically evaluated. Researchers would do item analysis until the instrument was validated if it had been required.

RESEARCH ETHICS PROTOCOL

Respondents were invited to complete a questionnaire that was provided via Google Form during their leisure time for this study. The data is kept private, and only the researcher's adviser has access to the questionnaire. The researchers would ask the respondents to reveal or divulge personal information, which they may feel uncomfortable doing so. Respondents were not required to explain reasons for not answering a question or refusing to participate in the survey. Although there would be no immediate and direct benefits to respondents, one of the goals of this research was to expand the body of knowledge in various disciplines. The researchers know that without their willingness to participate in this study, the researchers would not be able to provide recommendations that would assist the students in utilizing the respondents' waste management practices before and after the introduction of Annex V of Marpol 73/78, as well as the significant differences between the respondents' waste management practices. The researchers would not divulge any information

about the respondents. Only the researchers would have access to the information on the respondents and their perceptions that would be acquired as part of this study.

RESULTS AND DISCUSSION

This chapter presents the gathered data from the online survey conducted on the waste management practices of maritime students at home, vis a vis Annex V of Marpol 73/78.

This chapter also presents the analysis and interpretation of data from the statement's aggregated mean, computed from the responses of students who were in favor and not in favor of the statements regarding the waste management practices of the respondents before and after the introduction of Annex V of Marpol 73/78, including the significant difference between the waste management practices of the respondents before and after the introduction of Annex V of Marpol 73/78.

TABLE 1

The extent of Waste Management Practices of the Respondents before the introduction of Annex V of Marpol 73/78

A. BEFORE MARPOL 73/78 ANNEX V was introduced to me:	**Weighted Mean**	**Description**
1. I was able to properly segregate all of my garbage in a trash bin.	2.56	Moderately Practiced
2. I was able to properly dispose of all of my garbage at the appropriate location.	2.55	Moderately Practiced
3. I was able to comprehend the differences between biodegradable and non-biodegradable materials.	2.71	Moderately Practiced
4. I was able to grasp the significance of distinguishing between biodegradable and non-biodegradable materials.	2.60	Moderately Practiced
5. I was able to avoid dumping domestic waste all over the place.	2.49	Less Practiced
6. I was able to reduce the habit of throwing garbage anywhere.	2.64	Moderately Practiced
7. I was able to recycle domestic waste instead of dumping it anywhere.	2.40	Less Practiced
8. I was able to reuse domestic waste instead of dumping it anywhere.	2.51	Moderately Practiced
9. I was able to learn the importance of proper waste Management in our course.	2.74	Moderately Practiced
10. I was aware of the environmental impact of disposing of household waste.	2.75	Moderately Practiced
AGGREGATED MEAN	**2.60**	**Moderately Practiced**

Table 1 revealed the results regarding the extent of experience of the respondents who are in favor of each statement presented in the questionnaire. It is noted that the weighted mean values for each statement do not differ that much at all, having 2.75 as the highest with a description of "Highly Practiced" and 2.40 as the lowest with a description of "Moderately Practiced". It appeared from the result that the students were prepared and strongly agreed with the statements regarding the waste management practices of the respondents before the introduction of Annex V of Marpol 73/78. The statements were moderately practicable for the maritime students, having an aggregated mean of 2.60. So, the perceptions of the respondents towards the waste management practices of the respondents before the introduction of Annex V of Marpol 73/78 were generally good.

It was believed that most of the respondents favor the statements. The respondents were aware that they understood each statement presented. Items 3, 9, and 10 had the highest means of 2.71, 2.74, and 2.75, respectively. This implied that the statements were considered moderately practiced and that maritime students agreed with the statements as they indeed were able to understand the importance of proper waste disposal and was also aware of the environmental impacts despite not having prior knowledge and teaching. They were able to comprehend the differences between biodegradable and non-biodegradable materials. In the study of (Mercier et al., 2017; Dussud et al., 2018; Gonzalez-Pleiter et al. 2021), "Through field investigation and laboratory studies, many researchers have studied the microbial community on biodegradable surfaces in different environments." They built an understanding of the characteristics of the differences between biodegradable and non-biodegradable plastisphere. They learn the importance of proper waste management in our course. According to new research, Progress and Challenges to the Global Waste Management System (2014), since 2014, the waste issue has been recognized as a global environmental problem. Inefficient waste management contributes to air pollution, affecting the health and well-being of ecosystems, species, and humans. Also, the students were aware of the environmental impact of disposing of household waste. In the study by (Sujauddin M et al,. 2022), they state that "household waste is one of the primary sources of MSW consisting of food waste, paper, plastic, rags, metal, and glass from residential areas."

Items 5 and 7 had the lowest means of 2.49 and 2.40 respectively. This implied that the statements were only slightly efficient. The studies by Davis & Song (2006) and Hopewell et al. (2009) revealed that, "In recent years, the recycling of packaging materials has increased, but the recycling rates for most plastic packaging remain low." In connection with that, the table presented above determined that the maritime students could not fully grasp the concept of avoiding and recycling domestic waste instead of dumping it all over the place. This showed that the maritime students already knew the practices of proper waste management before the introduction of Annex V of Marpol 73/78, but they still needed to be assessed. Thus, more information must be presented and discussed with them to have a full grasp of the concept of proper waste management.

Table 2
The extent of Waste Management Practices of the Respondents after the introduction of Annex V of Marpol 73/78

B. AFTER MARPOL 73/78 ANNEX V was introduced to me:	Weighted Mean	Description
1. I was able to properly segregate all of my garbage in a trash bin.	3.69	Highly Practiced
2. I was able to properly dispose of all of my garbage at the appropriate location.	3.54	Highly Practiced
3. I was able to comprehend the differences between biodegradable and non-biodegradable materials.	3.61	Highly Practiced
4. I was able to grasp the significance of distinguishing between biodegradable and non-biodegradable materials.	3.57	Highly Practiced
5. I was able to avoid dumping domestic waste all over the place.	3.52	Highly Practiced

6. I was able to reduce the habit of throwing garbage anywhere.	3.53	Highly Practiced
7. I was able to recycle domestic waste instead of dumping it anywhere.	3.37	Highly Practiced
8. I was able to reuse domestic waste instead of dumping it anywhere.	3.56	Highly Practiced
9. I was able to learn the importance of proper waste Management in our course.	3.64	Highly Practiced
10. I was aware of the environmental impact of disposing of household waste.	3.70	Highly Practiced
AGGREGATED MEAN	**3.57**	**Highly Practiced**

Table 2 revealed the results regarding the extent of the experiences of the respondents who were in favor of each statement presented in the questionnaire. It can be noted that the weighted mean values for each statement do not differ that much at all, having 3.70 as the highest and 3.37 as the lowest, both having a description of "Highly Practiced". It appeared from the result that the students were prepared and strongly agreed with the statements regarding the waste management practices of the respondents after the introduction of Annex V of Marpol 73/78. The statements are highly practicable for the maritime students, having an aggregated mean of 3.57. The perceptions of the respondents towards the waste management practices of the respondents after the introduction of Annex V of Marpol 73/78 were generally better.

It is shown in the table above that most of the respondents were in favor of the statements. In fact, the respondents were aware that they understood each of the statements presented. As stated in the table above, items 1, 9, and 10 had the highest means of 3.69, 3.64, and 3.70, respectively. This implied that maritime students undoubtedly segregate all of their garbage in trash bins correctly. They gained more knowledge of the importance of proper waste management in their course and became more aware of the environmental impact of disposing of household waste. With that, maritime students agreed with the statements as they genuinely experienced and applied them in reality. Furthermore, it is revealed in the study of (Reddi KR, Li W, Wang B, et al., 2013) "whether it takes too much time for students to sort out waste, whether there are waste sorting facilities and tools in the dormitory, and whether there is enough space for waste storage will also affect whether college students participate in sorting and recycling." It affirmed that college students, like maritime students, are one of the most important groups of participants and promoters of household waste separation. This has a similar pattern to the study of (Alhassan H. et al., 2020). Household waste (HW) separation is a reform of the traditional way of waste collection and disposal and is a scientific management method for effective waste disposal. Due to increasing waste production and deteriorating environmental conditions, HW separation is one of the most pressing issues worldwide to maximize the use of waste resources, reduce waste disposal, and improve the quality of the living environment.

As interpreted in the table above, most students strongly agreed with every statement except statements 5 with the statement "I was able to avoid dumping domestic waste all over the place" and 7 with the statement "I was able to recycle domestic waste instead of dumping it anywhere" which had the lowest means of 3.52 and 3.37, respectively, but were still considered highly practiced. This showed that even though they did not fully cope with the statement, the maritime students could still grasp the concept of recycling household waste instead of dumping it all over the place. In the study of (Wang R, Qi R, Cheng J, et al., 2020), if college students can bring the waste separation habits developed on campus to their families and society, it will undoubtedly have a more significant spread effect. This also affirmed that the introduction of Annex V of Marpol 73/78 towards the maritime students has played a vital role in influencing the students in assessing them towards having a full grasp of the concept of proper waste management.

TABLE 3
Difference between the extent of Waste Management Practices of the Respondents

Waste Management Practices	mean	Mean difference	Df	t-computed	t- critical (α= 0.05, two tailed test	Decision	Conclusion
Before the Introduction of Annex V of Marpol 73/78	25.92	9.75	271	15.21	1.9665	Reject H_0	There is a significant difference
After the Introduction of Annex V of Marpol 73/78	35.67						

Table 3 revealed the difference between the extent of waste management practices before the introduction of Annex V of Marpol 73/78 and after the introduction of Annex V of Marpol 73/78. As presented in the table, it showed 25.92 as the mean for before the introduction of Annex V of Marpol 73/78 and 35.67 as the mean for after the introduction of Annex V of Marpol 73/78, having a mean difference of 9.75. So, since t-computed 15.21 is greater than the critical value, 1.9665, the decision was to reject the null hypothesis. Therefore, there is a significant difference between the waste management practices of the respondents before and after the introduction of Annex V of Marpol 73/78.

This implied that educating maritime students about Annexes of Marpol 73/78, specifically Annex V, would increase their knowledge and understanding of proper waste management. According to the regulations of Marpol 73/78, the most essential feature of the Annex is the complete ban imposed on the disposal into the sea of all forms of plastics. Hence, encouraging the students to carry out these practices in preparation for work in the field of maritime, where protection of the marine environment from any form of pollution is very crucial. As the study of UNEP (1982) states, "Pollution can be broadly defined as any natural or human-derived substance or energy that is introduced into the environment by humans and that can have a detrimental effect on living organisms and natural environments."

Also, a similar study by (Carroll et al. 2017; Williams et al. 2015) also says that "Pollutants, including light and sound, in addition to the more commonly recognized forms, can enter the marine environment from a multitude of sources and transport mechanisms." With that being said, the introduction of Annex V of Marpol 73/78 would be a great contributor to enhancing the waste management practices that the maritime students already possessed. This also affirmed that by implementing this subject would yield lots of benefits since it assessed the maritime students in the aspects that they must know about waste management and have a full grasp of it in preparation for work in the field of maritime and also facilitated the university in producing quality seafarers.

CONCLUSION

The study showed a significant difference in maritime students' knowledge of waste management practices before and after the introduction of annex V of Marpol 73/78. Before the introduction of Annex V of Marpol 73/78, the students were prepared and strongly agreed with the statements regarding waste management practices of the respondents, indicating that it is very efficient for maritime students. On the other hand, after the introduction of annex V of Marpol 73/78, it appeared that the students were prepared and strongly agreed with the statements regarding waste management practices of the respondents after the introduction of annex V of Marpol 73/78, indicating that it is highly efficient for maritime students.

In connection to the theory that the researchers have chosen, the theory of diffusion of innovation by E.M. Rogers in 1962, which indicates diffusion of innovation has formed the basis of several studies in the recent past, integrating innovation into the knowledge, attitude, and practice phases of adopting innovation. Continuous education in school about environmental education is a crucial concept in this theory, as it consists of increasing the level of education and awareness of students about environmental management by cultivating students' KAPs as K (knowledge) for perception, A (attitude) for affective and P (Practices) for behavioral acts.

Behavioral acts result from learning some skills in the student, while P (practice) leads to a change in behavior and better practices by Hubbard and Hayashi (2003).

As a result, the researchers concluded that even before the introduction of Annex V of MARPOL 73/78, students already had the knowledge and understanding of waste management. However, because the respondents are enrolled in a maritime course with a specific subject, Marine Environment, it has helped them to better understand and broaden their knowledge of proper garbage disposal.

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