A study of UTHM students' knowledge, attitudes, and perceptions on plastic and microplastics

Alya Aqilah Mohamad, Ruhi Athirah Kahar Aliman, Norain Ahmad Nordin#

Department of Science and Mathematics, Centre for Diploma Studies, Universiti Tun Hussein Onn Malaysia, Pagoh Higher Education Hub, 84600 Pagoh, Johor, MALAYSIA.
Corresponding author. E-Mail: norainn@uthm.edu.my; Tel: +60169411410.

ABSTRACT The study aims to assess the knowledge of plastic and microplastic pollution as well as the issues, determine students' attitudes and perceptions about the best practices for reducing plastic and microplastic pollution, and analyze the correlation between awareness, attitude, and opinion on the current efforts to decrease plastic pollution among UTHM students. An online survey was distributed over social media platforms like WhatsApp and Telegram. Four sections were utilized to collect data: demographic information; knowledge, attitudes, and perceptions about plastic and microplastic pollution. The 120 students who responded were 60 from each diploma and degree program. UTHM students showed a great awareness of plastic and microplastics, and as a result, they had a favorable attitude toward pollution reduction. Consequently, participants also had a positive opinion of current initiatives to reduce plastic and microplastic contamination. Besides, a moderate positive correlation exists between attitude and opinion on current efforts with a Pearson correlation of 0.574, implying that students should be taught plastic reduction and encouraged to participate in current initiatives. Plastic or microplastic pollution education via organized education, mass media, and substituting non-biodegradable plastics with eco-friendly alternatives may assist in alleviating the existing problem of plastic or microplastic pollution.

KEYWORDS: Awareness; Plastic pollution; Microplastic pollution; Correlation; Recycling
Received 1 February 2025 **Revised** 24 February 2025 **Accepted** 3 March 2025 **In press** 18 March 2025 **Online** 25 March 2025

Original Article

TRANSACTIONS ON SCIENCE AND TECHNOLOGY

INTRODUCTION

Plastic is a substance widely used daily in this age of globalization, and it is becoming more and more prevalent. As an illustration, plastic is now being manufactured in toys, eyeglass frames, food and drink containers, plastic bags, containers, and envelopes. Plastic is commonly employed in the manufacture of things nowadays since it is a material that is simple to mold and shape and takes less energy to create (Brydson, 2013). Microplastics are plastic particles found in the environment. The U.S. Oceanic and Atmospheric Administration classifies this type of plastic based on its size of less than 5 mm (Baker *et al.*, 2009) but there are also disputes about this specification. According to Hale *et al.* (2020), these particles come from a variety of sources, including cosmetics, clothing, and industrial processes. A large "garbage patch" of microplastics (1 to 5,000 μm particles) has been discovered in the world's largest maritime gyres, attracting significant attention. Concern arose over potential harm to marine life. Even though environmental plastic waste is a global and multifaceted problem, scientific and public media attention has mostly focused on the ocean (Ammala, 2011).

Microplastics may be divided into two groups, which are primary and secondary (National Geographic, 2023). Plastics used in synthetic textiles like nylon, plastic pellets used in industrial manufacturing, and microbeads found in cosmetics and toiletries are a few examples of the primary group of microplastics. Primary microplastics can enter the environment directly through several different pathways, including product use which is personal care products from homes that are often washed into wastewater systems, unintentional loss from spills during production or transport, or abrasion during washing, including clothing made of synthetic textiles. Secondary microplastics are formed from the degradation of larger plastics due to environmental factors such as wave action,

wind erosion, and UV radiation (Rogers, 2025). It can be concluded that microplastics pose a significant environmental concern with adverse implications for both ecosystems and animal health.

Nowadays, plastic pollution is a significant environmental issue, affecting ecosystems across terrestrial and aquatic environments globally. According to Kühn *et al.* (2015), large plastic debris negatively impacts animal species through entanglements, ingestion, and lacerations. Microplastics, or microscopic plastic waste, were previously overlooked as a source of contamination. The definition of microplastics proposed by Arthur *et al.* (2009), which includes fragments and primary-sourced plastics measuring less than 5 mm, was utilized as the primary criterion for identifying a specific size category of plastic pollution. Microplastics have been detected in everyday items such as drinking water (Eerkes-Medrano, 2019), tea bags (Hernandez, 2019), food products (De-La-Torre, 2019), and table salt (Zhang, 2020). It has also recently been found in human placentas (Ragusa, 2021). Their small size makes it easy to transmit from one habitat to another, making their prevalence global. It is crucial for students to be aware of this issue to prevent plastic pollution from worsening. Conducting surveys can help students control their use of plastic and encourage them to adopt sustainable practices, such as rejecting plastic bags, bringing recycling bags, bringing reusable food utensils, and reusing plastic items like plastic bottles.

Hence, this study aims to assess UTHM students' knowledge of plastic and microplastic pollution and determine students' attitudes and perceptions about the best practices for reducing plastic and microplastic pollution. Furthermore, this study intends to analyze the correlation between knowledge, attitudes, and perceptions regarding the current efforts to decrease plastic pollution.

MATERIAL AND METHODS

Sample of the Study

Minimum sample size (Hammami *et al.*, 2017) was determined using Equation (1) which is

$$n = \frac{Z^2 P(1-p)}{ME^2} \tag{1}$$

where n is the minimum required sample size, Z is confidence level, P is expected prevalence, and ME is the margin of error. A research survey's optimal ME should range between 5% and 10%. Consequently, n was determined to be 100 by considering P to be 50%, or 0.5, and ME to be 6% at a confidence level of 90%, or 1.645. During a probability sample, individuals answered this questionnaire at random. There is an identical possibility or likelihood that any component of the population will be chosen as a sample. In this study, the number of respondents was 120. The data was analysed in terms of gender, levels of education, and areas of study. The levels of education were divided into diploma and degree. In addition, respondents were grouped according to the subject or field of their study.

Design of the Study

Primary data was collected using a Google Form questionnaire from 120 respondents through social media platforms such as WhatsApp and Telegram. The set of questionnaires consisted of four sections which were demographics, awareness, attitudes, and opinions. There were 20 questions including 7 questions for awareness and 7 questions for attitude and 6 for opinion.

Section A, which is the demographics section, is to know the respondent's data, such as name, age, gender, education level, and matriculation number. Section B, which is awareness, has seven questions. This section included questions with correct and incorrect answers. Each correct answer received a score of one while incorrect answers received a score of zero. Sections C and D, which were attitude and opinion, had 13 questions. These sections were made up of a five-point Likert scale, with the answers being strongly agree, agree, neutral, disagree, and strongly disagree. A response that demonstrated a good attitude towards reducing plastic use received a score of five, while responses on the other end of the range received a score of one.

Data Analysis

Data was gathered in MS Excel and analysed in SPSS version 27 software. The knowledge scores were calculated by adding the scores for each right answer in the section. Meanwhile, individuals' attitude and perception scores were calculated using the mean. The strength of the relationships between the variables was evaluated using correlation analysis. The statistical significance threshold was defined as a *p*-value less than 0.05.

RESULT AND DISCUSSION

Demographics

There was a total of 120 respondents in this study. Table 1 presents the participants' demographics.

Table 1. Demographics of the respondents

	Category	Number of respondents	Percentage (%)	Mean Scores		
				Awareness	Attitude	Opinion
Gender	Male	47	39.2	6.2766	3.8906	4.1525
	Female	73	60.8	6.3562	3.8924	4.1598
Level of education	Diploma	60	50	6.2000	3.8762	4.0806
	Degree	60	50	6.4500	3.9071	4.2333
Field of study	Science	65	54.2	6.4769	3.8176	4.1282
	Others	55	45.8	6.1455	3.9792	4.1909

Based on Table 1, the respondents were categorized by gender: male and female. 39.2% of the respondents were male and 60.8% were female. The level of education was divided into two categories: diploma and degree. Both categories had a percentage of 50%. Fields of study were grouped into science-related disciplines and non-science disciplines. The results showed that 54.2% were Science students while 45.8% were from other fields of study.

Besides, the means of awareness and attitude across different levels of variability including gender, level of education, and field of study toward plastic and microplastic pollution are illustrated in Table 1. Female respondents showed higher awareness (6.3562) and more positive attitudes (3.8924) compared to male respondents (6.2766 and 3.8906, respectively). Gender disparities were found to be comparable to those found in other investigations (Kong *et al.*, 2014). Research reveals that women are more inclined than males to perceive environmental concerns, such as pollution, as urgent and significant issues (Hunter *et al.*, 2004).

Respondents with higher education levels showed greater awareness and more positive attitudes. The mean scores (awareness) of respondents pursuing a degree and diploma were 6.45 and 6.20 respectively. Meanwhile, the respondents pursuing a degree seem to have a more positive attitude

compared to a diploma with a mean score of 3.9071 and 3.8762 respectively. Advanced education could increase exposure to environmental education and critical thinking skills, potentially explaining the observed trends (Kollmuss & Agyeman, 2002). However, slight differences in scores imply that environmental education such as media campaigns could have had an impact on awareness and attitudes.

As indicated in Table 1, science-related disciplines exhibited higher awareness than non-science disciplines with mean scores of 6.4769 and 6.1455 respectively. The greater awareness observed among science students can be attributed to their curriculum, which probably addresses environmental issues, and consequently encourages a deeper understanding of plastic pollution (Heidbreder *et al.*, 2019). However, the students of non-science disciplines had a slightly more positive attitude (3.9792) compared to science-related disciplines (3.8176). This indicates that various fields of study were not key factors in fostering a positive attitude. Instead, elements such as personal values, cultural norms, and media exposure might significantly influence the development of positive attitudes among individuals.

Knowledge

The knowledge about plastic and microplastic among UTHM students was tabulated in Table 2.

Table 2. Knowledge of plastic and microplastic

Statement		N	Percentage (%)
1 Have you heard about biodegradable plastic?	No	6	5.0
	Yes (correct answer)	114	95.0
2 Have you heard about microplastic?	No	22	18.3
	Yes (correct answer)	98	81.7
3 Plastic burning is not harmful to the environment.	Yes	9	7.5
	No (correct answer)	111	92.5
4 Plastic littering is not a major problem in Malaysia.	Yes	12	10.0
	No (correct answer)	108	90.0
5 Does plastic pollution is a threat to a living species?	No	1	0.8
	Yes (correct answer)	119	99.2
6 Microplastics are present in our daily consumables such as salt, bottled water, and seafood.	No	8	6.7
	Yes (correct answer)	112	93.3
7 News related to plastic concerns are common.	No	23	19.2
	Yes (correct answer)	97	80.8

From Table 2, most of the respondents had heard about biodegradable plastic and microplastic with a percentage of 95.0% and 81.7% respectively. 92.5% of students chose the correct answer which is plastic burning is harmful to the environment. Only 10.0 % of students claimed that plastic littering is not a major problem in Malaysia. Based on Statement 2 and 3, it seems that the students were aware of the consequences of improper plastic disposal in the environment. Besides, 99.2% of the students knew that plastic pollution poses a hazard to living species. When they were asked about the presence of microplastics in daily consumables such as salt, bottled water, and seafood, 93.3% correctly

responded to the statement. It indicates that the students were concerned about the prevalence of microplastics in their environment. Finally, 80.8% of students chose the correct answer for Statement 7, which is news about plastic pollution is prevalent. Hence, the majority of the students were aware of plastic and microplastic since the mean knowledge score is 6.3 out of 7.

Attitude

Table 3 depicts the attitude of UTHM students regarding the practice of reducing plastic and microplastic pollution. The students were required to answer the questions using a Likert scale which ranged from 1-5. The mean scores were computed for each question. It can be verbally interpreted in the following ranges:4.51-5.00: very high score, 3.51-4.50: high score, 2.51-3.50: moderately high score, 1.51-2.50: low score, 0.00 – 1.50: very low score (Ab Latif *et al*., 2017).

Table 3. The attitude of students toward reducing plastic and microplastic pollution

Statement	Mean	Std. Deviation
1 Do you employ the greatest techniques for getting rid of plastic?	3.80	0.922
2 I don't often use single-use plastic.	3.68	1.216
3 I am willing to pay more for biodegradable plastic alternatives.	3.61	1.140
4 When I finish using a plastic product, I either reuse it or recycle it.	4.36	0.986
5 I prefer other packaging made from natural materials such as paper, jute, or cloth to plastic bags.	3.97	1.166
6 I bring reusable shopping bags with me to the market or store.	3.40	1.162
7 I am willing to spread awareness about plastic pollution to my friends and family.	4.42	0.857

According to Table 3, the mean scores of all statements were considered high since they ranged from 3.51-4.50. The mean score of Statement 1 was 3.80, which implies that the students had been properly disposing of plastic. The participants also had a favorable attitude towards reducing plastic consumption since they did not discard plastic and reused it on several occasions, with a mean score of 3.68. Besides, the respondents also agreed (3.61) that they were willing to spend their money on biodegradable plastic alternatives. Meanwhile, the mean score for Statement 4 was 4.36. This shows that the students were consistent in recycling or reusing plastic products, which can also aid in the reduction of plastic and microplastic pollution. Statement 5 has a high mean score of 3.97. This indicates that students preferred natural materials such as paper, jute, or fabric to plastic bags. However, Statement 6 has a mean score of 3.40, which is moderately high. This is because some of the students did not carry their plastic to go shopping. After all, most stores give plastic, and they are willing to pay for it. Finally, most of the students (4.42) were willing to raise awareness about plastic pollution among their friends and family, and it is seen as a simple measure to minimize plastic and microplastic pollution. Overall, this study indicates a high level of positive attitude toward reducing plastic and microplastic among UTHM students.

Correlation Analysis

The correlation between knowledge, attitude, and perception was determined using the Pearson correlation coefficient as shown in Table 5. The relationship between the variables can be interpreted in the following ranges: 0.00-0.19: very weak, 0.20-0.39: weak, 0.40-0.59: moderate, 0.60-0.79: strong, 0.80-1.00: very strong (Meghanathan, 2016).

Table 5. Correlations between knowledge, attitude, and perception

		Knowledge	Attitude	Perception
Knowledge	Person correlation	1	.243**	.160
	Sig. (2-tailed)		.008	.081
	N	120	120	120
Attitude	Person correlation	.243**	1	.574**
	Sig. (2-tailed)	.008		.000
	N	120	120	120
Perception	Person correlation	.160	.574**	1
	Sig. (2-tailed)	.081	.000	
	N	120	120	120

** Correlation is significant at the 0.01 level (2-tailed).

Based on Table 5, knowledge was weakly positively related to attitude $(r = 0.243, P < 0.05)$. This could imply that knowledge does not always translate into a more positive attitude. Besides, there is also a moderately positive relationship between attitude and perception $(r = 0.574, P < 0.05)$. As a result, UTHM students who had a positive attitude towards reducing plastic and microplastic pollution were more likely to have a favorable opinion of efforts to reduce plastic and microplastic pollution.

Discussion

In this study, the majority of UTHM students were knowledgeable about plastic and microplastic, as the mean knowledge score was 6.3 out of 7. This finding might suggest that online awareness or media could have impacted educating and raising awareness about the risks of plastic and microplastic pollution, given that 80.8% said news related to plastic concerns is common. Similarly, a positive attitude among UTHM students led to a higher motivation to participate and make a difference, either by helping raise awareness among others around them or via self-involvement. Furthermore, they expressed a good impression of existing initiatives to reduce plastic and microplastic contamination. They believe that campaigns are an important way to increase awareness about plastic and microplastic pollution, in addition to the institution's role in imparting knowledge and motivating students to change their behavior for the better.

Reliability Test

Table 6 illustrates the reliability test of every question in the questionnaire. It shows that Cronbach's alpha analysis in this study was 0.813 with 20 items. Hence, the data were consistent and reliable.

Table 6. Cronbach's Alpha analysis

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of items
0.813	0.800	20

CONCLUSION

UTHM students have a firm knowledge of plastic and microplastics. Besides, they also had a positive attitude about the best practices for reducing plastic and microplastic pollution. However, further action needs to be taken, such as organizing events to reduce plastic and microplastic pollution to instill more value among the students. This study also highlighted there was a weak positive relationship between knowledge and attitude $(r = 0.243, P < 0.05)$ which demonstrates that the knowledge does not necessarily translate into a more positive attitude. There is also a moderately positive correlation between attitude and perception of current efforts to reduce plastic and

microplastic pollution $(r = 0.574, P < 0.05)$. Accordingly, UTHM students who possess a positive attitude toward the reduction of plastic and microplastic pollution are more likely to support initiatives aimed at tackling this critical environmental issue.

Numerous measures can be implemented to tackle plastic and microplastic pollution. Environmental and waste management education should be integrated into school and university curriculums. This could be supported by mass media campaigns as the media plays a crucial role in educating the public about the risks associated with plastic and microplastic pollution. Informational campaigns on social media can further enhance awareness and encourage the adoption of reusable products.

Additionally, enforcing regulations and standards concerning plastic pollution would encourage positive behavior change. This can be achieved through regulatory and economic policy instruments such as fees, levies, or taxes imposed on the retail sector or the consumers. Furthermore, the implementation of a policy strategy known as 'Extended Producer Responsibility' (EPR) transfers the responsibility for products after their use back to the producers. In this context, manufacturers would be obligated to take back, reuse, or recycle their products, thereby being held accountable for the entire lifecycle of the plastic.

Investing in infrastructure for plastic disposal and recycling by civic authorities is crucial to fostering behavioral change among individuals and significantly reducing plastic pollution. Moreover, increasing the availability of recycling stations can effectively promote recycling behaviors. In addition, replacing non-biodegradable plastics with eco-friendly alternatives will contribute to mitigating plastic and microplastic pollution. Therefore, to successfully mitigate plastic and microplastic pollution, collective efforts are needed from educators, policymakers, industry leaders, trade organizations, and the public. It is imperative that all stakeholders collaborate to develop sustainable solutions.

ACKNOWLEDGEMENTS

The authors would like to thank the Centre for Diploma Studies, Universiti Tun Hussein Onn Malaysia for its support.

REFERENCES

[1] Ab Latif, R., Dahlan, A., Abdul Mulud, Z. & Mat Nor, M. Z. 2017. The impact of rusnani concept mapping (RCM) on academic achievement and Clinical Practices Among Diploma Nursing Students. *Education in Medicine Journal*, 9(4), 1–12.

[2] Ammala, A., Bateman, S., Dean, K., Petinakis, E., Sangwan, P., Wong, S., Yuan, Q., Yu, L., Patrick, C.R. & Leong, K.H. 2011. An overview of degradable and biodegradable polyolefins. *Progress in Polymer Science*, 36(8), 1015–1049.

[3] Arthur, C., Baker, J., & Bamford, H. 2009. *Proceedings of the International Research Workshop on the Occurrence, Effects and Fate of Microplastic Marine Debris.* NOAA Technical Memorandum NOS-OR&R-30.

[4] Baker, J. E., Arthur, C. & Bamford, H. A. 2009. *Proceedings of the International Research Workshop on the Occurrence, Effects, and Fate of Microplastic Marine Debris*. September 9-11, 2008, University of Washington Tacoma, Tacoma, WA, USA.

[5] De-La-Torre, G. E. 2019. Microplastics: an emerging threat to food security and human health. *Journal of Food Science and Technology*, 57(5), 1601–1608.

[6] Dowarah, K., Duarah, H. & Devipriya, S. P. 2022. A preliminary survey to assess the awareness, attitudes/behaviours, and opinions pertaining to plastic and microplastic pollution among students in India. *Marine Policy,* 144, 105220.

[7] Eerkes-Medrano, D., Leslie, H. A. & Quinn, B. 2019. Microplastics in drinking water: A review and assessment. *Current Opinion in Environmental Science & Health, 7,* 69–75.

[8] Hale, R. C., Seeley, M. E., La Guardia, M. J., Mai, L. & Zeng, E. Y. 2020. A Global Perspective on Microplastics. *Journal of Geophysical Research: Oceans,* 125(1), e2018JC014719.

[9] Hammami, M., Mohammed, E. Q., Hashem, A., Al-Khafaji, M. A., Al-Qahtani, F., Alzaabi, S. & Dash, N. R. 2017. Survey on awareness and attitudes of secondary school students regarding plastic pollution: implications for environmental education and public health in Sharjah city, UAE. *Environmental Science and Pollution Research,* 24(25), 20626–20633.

[10] Heidbreder, L. M., Bablok, I., Drews, S., & Menzel, C. 2019. Tackling the plastic problem: A review on perceptions, behaviors, and interventions. *Science of the Total Environment*, 668, 1077-1093.

[11] Hernandez, L. M., Xu, E. G., Larsson, H. C. E., Tahara, R., Maisuria, V. B. & Tufenkji, N. 2019. Plastic Teabags Release Billions of Microparticles and Nanoparticles into Tea. *Environmental Science & Technology,* 53(21), 12300–12310.

[12] Hunter, L. M., Hatch, A. & Johnson, A. 2004. Cross-National Gender Variation in Environmental Behaviors. *Social Science Quarterly*, 85(3), 677–694.

[13] Kühn, S., Rebolledo, E. & Van Franeker, J. 2015. Deleterious effects of litter on marine life. *In:* Bergmann, M., Gutow, L. & Klages, M. (eds). *Marine Anthropogenic Litter*. Springer, Cham. pp 75–116.

[14] Kollmuss, A. & Agyeman, J. 2000. Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8(3), 239–260.

[15] Kong, D., Ytrehus, E., Hvatum, A. J. & Lin. H. 2014. Survey on environmental awareness of Shanghai college students. *Environmental Science and Pollution Research,* 21(23), 13672-13683.

[16] Meghanathan, N. 2016. Assortativity Analysis of Real-World Network Graphs based on Centrality Metrics. *Computer and Information Science,* 9(3), 7.

[17] National Geographic Society. 2023. *Microplastics* (https://education.nationalgeographic.org/resource/microplastics/). Last accessed on 28 February 2025.

[18] Ragusa, A., Svelato, A., Santacroce, C., Catalano, P., Notarstefano, V., Carnevali, O., Papa, F., Rongioletti, M., Baiocco, F., Draghi, S., D'Amore, E., Rinaldo, D., Matta, M. & Giorgini, E. 2021. Plasticenta: First evidence of microplastics in human placenta. *Environment International,* 146, 106274.

[19] Rogers, K. 2025. *Microplastics* (https://www.britannica.com/science/plastic-pollution). Last accessed on 28 February 2025.

[20] Zhang, Q., Xu, E. G., Li, J., Chen, Q., Ma, L., Zeng, E. Y. & Shi, H. 2020. A review of microplastics in table salt, drinking water, and air: Direct Human exposure. *Environmental Science & Technology,* 54(7), 3740–3751.