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The Impact of Environmental Knowledge on Food Waste Reduction and Sustainability Practices among Hospitality Students in Malaysia

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Abstract: Environmental sustainability and food waste reduction are among the critical challenges facing the hospitality industry worldwide. This study was conducted to identify the impact of environmental knowledge on food waste reduction and sustainability practices among hospitality students in Malaysia. A quantitative approach was used, and we surveyed 94 hospitality students from various programs at UiTM Penang. The online questionnaire was conducted and analyzed using Pearson correlation and multiple regression analysis. There is a significant positive correlation between environmental knowledge, food waste behaviors and sustainability-related behaviors. The strongest relationship was found between food waste behaviors and sustainability-related behaviors, suggesting that environmental knowledge and food waste practices are closely related to broader sustainability behaviors in hospitality education. The study contributes to the understanding of how environmental education can shape the future of hospitality professional practice, offering valuable insights for the development of industry curricula and training programs aimed at promoting sustainable practices in the hospitality sector.

Keywords: *Environmental Knowledge, Food Waste, Sustainability, Hospitality Education*

1. Introduction

The hospitality industry is currently at a critical phase, facing the challenges of environmental sustainability and resource management. Of particular concern within the industry is the industry's significant contribution to food waste, a problem that causes significant economic losses but also exacerbates environmental degradation. This issue has received growing attention from researchers, policymakers, and industry leaders, as evidenced by a growing body of literature on sustainable practices in hospitality (Gössling et al., 2015; Filimonau & De Coteau, 2019).

In Malaysia, there is a very urgent need to address the issue of food waste in the particularly bad hospitality sector. Bernama (2021) has reported that the Solid Waste Management and Public Cleansing Corporation (SWCorp) found that Malaysians generate about 16,687.5 tonnes of food waste every day, a figure that has seen an alarming increase in recent years. The hospitality industry, including hotels and restaurants, is a significant contributor to this waste, underlining the need for targeted interventions and research in the sector.

The United Nations outlined that the fundamental SDGs agenda is comprised of 17 ambitious sustainable development goals (SDGs), which include 169 targets and 231 different indicators (Russell-Bennett et al., 2024). Sustainable Development Goal 12 (SDG12) is particularly pertinent as it encompasses various avenues essential for promoting responsible consumption and production. The global material footprint is increasing at a rate that surpasses both population increase and economic productivity. SDG12 specifically tackled urgent concerns related to material footprints, the comparison between disposal and recycling rates, waste reduction, waste management, food loss in the supply chain, and food waste management. Additionally, SDG12 is intricately linked to SDG4 (Quality Education) due to the pivotal role that education plays. This study underscores the power of education in enhancing awareness and comprehension of sustainability, and ways action can be taken in our respective fields to combat food waste.

It has been noted that food waste, despite its inclusion in the agendas of numerous nations and organizations poses a significant challenge that hinders the attainment of certain sustainable development goals (SDGs). Food waste (FW) is well-known for its role in causing many types of pollution that have negative impacts on public health and social justice, as well as leading to economic losses (Leal Filho et al., 2023). Universities, comparable

to mini-cities or large enterprises, are locations where FW (food waste) is a significant challenge (Lazell, 2016). This indicates the necessity for further investigation to gain a more comprehensive understanding of this significant matter and to evaluate the potential shifts in attitudes and behavior among young individuals following their exposure to information regarding food waste and its consequences (Kaur et al., 2020; Principato et al., 2015). Students, particularly university students are the future stakeholders of the world and hence their behavior towards the environment dictates their actions about environmental issues like food waste.

There is a significant gap in understanding how these factors specifically influence food waste reduction behavior among hospitality students in Malaysia, although previous studies have explored environmental knowledge and sustainable practices in various contexts. This study was conducted to address this gap by investigating the relationship between environmental knowledge, food waste behaviors, and broader sustainability practices among hospitality students.

The objectives of this study are:

- To examine the level of environmental knowledge among hospitality students in Malaysia.
- To assess the relationship between environmental knowledge and food waste reduction behaviors.
- To investigate the link between food waste behaviors and broader sustainability practices.
- To provide recommendations for enhancing sustainability education in hospitality programs.

Therefore, the objectives of this study can contribute to the growing body of literature on sustainability in hospitality education and offer practical insights that can be applied to the development of curricula and industry training programs.

2. Literature Review

Environmental Knowledge

Environmental knowledge refers to the information individuals have on the state of the environment, climate change, environmental views, and the ecological effects of consumption and production and sustainability practices (Pagiaslis and Krontalis, 2014). In recent years, environmental knowledge has been found to have an indirect impact on individuals' intention to participate in conservation efforts; it can thus be regarded as being important in models that aim at predicting individuals' environmental behavior (Gkargkavouzi et al., 2019; Paço and Lavrador, 2017).

Recent studies show that knowledge could indirectly result in behavioral change by affecting the intention to engage in conservation efforts and could hence be used to predict behavioral intention and environmental behavior (Gkargkavouzi et al., 2019). This finding suggests that knowledge serves as a foundation for developing pro-environmental attitudes and behaviors. Similar findings on the significant impact of environmental knowledge on behavior have been presented by Otto and Pensini (2017) and Paço and Lavrador (2017). The development of environmental concerns depends on what people learn about environmental issues rather than vice versa. Moreover, even though environmental knowledge is responsible for inducing environmental concern, people could be interested in learning more about environmental issues after showing initial environmental concern (Saari et. al, 2021). In the context of hospitality education, Barr (2007) found that students with a deep understanding and knowledge of the issue of food waste are more expected to refrain from wasting food. These findings emphasize the impending impact of integrating environmental education into hospitality curricula to foster more sustainable practices among future industry professionals.

Food Wastage Behavior

The issue of food waste is one of the most critical issues in the hospitality industry with very significant economic, environmental and social implications. Every year third of the food produced globally is either lost or wasted along the food supply chain (FSC) causing significant economic, environmental, and social damage (Principato et. al, 2021). Food wastage behavior is significantly related to one’s understanding of the issue as stated by Barr (2007) where those who possess a strong understanding of the issues associated with food waste are more inclined to refrain from wasting food. Based on this premise, we anticipate a favorable impact on the

decrease of food waste among those who possess a comprehensive understanding of the food waste issue, including its spread and measurement.

However, Peschel et al. (206) found that, while less knowledge might make one less likely to make an environmentally friendly choice, better knowledge might not make one significantly more likely to choose it either as people tend to balance between factors such as price and the environment. Household food consumption has been regarded as a key point in food waste generation and significant efforts by e.g., the Food and Agricultural Organization of the United Nations and the European Commission have been directed to assist consumers in reducing food waste (Toma et. al 2020). Another factor affecting food waste behavior is date labeling as a report in their study -date labeling influences the selection of food at the point of purchase and its subsequent consumption and most likely has a strong effect on consumers' decision of what to eat or throw out (Toma et. al, 2020).

Whereas, in the context of higher education, Lazell (2016) identified universities as significant generators of food waste, comparable to mini-cities or large enterprises. This study highlights the importance of addressing food waste behaviors among students, particularly those in hospitality programs who will go on to influence industry practices. Kaur et al. (2021) conducted a systematic literature review of food waste in educational institutions, emphasizing the need for more research on interventions to reduce food waste in these settings. The findings of their study have underlined the potential of education to play an important role in shaping sustainable food consumption behaviors.

Sustainability Related Behavior

Sustainability-related behaviors encompass a range of actions aimed at reducing the negative impact on the environment and leading to ecological balance in the long term. In the context of hospitality, these behaviors can include energy conservation, water management, and responsible sourcing practices. According to Han (2021), the essential drivers of environmentally sustainable consumer behavior include (green image, pro-environmental behavior in everyday life, environmental knowledge, green product attachment, descriptive social norm, anticipated pride and guilt, environmental corporate social responsibility, perceived effectiveness, connectedness to nature, and green value). However, this study focuses on sustainable consumption behavior since the samples are hospitality students who undertake hands-on training in the kitchen, barista lab and mock restaurant.

Sustainable consumption behavior is often associated with pro-environmental consumption behavior, which is an aspect of individuals' behavior that helps reduce their negative impact on the environment (Dhandra, 2019). Pro-environmental behavior can be defined as behavior that causes minimal harm or is beneficial to the environment (Steg and Vlek, 2009). In consumer research, the theory of planned behavior (TPB; Ajzen, 1991), has been predominant in research on sustainable consumer behavior, for example, when predicting the behavior of individuals in connection with the disposal of household waste (Ari and Yilmaz, 2016; Mannetti et al., 2004), water conservation, and green consumerism (Turaga et al., 2010). The TPB (Ajzen, 1991) is often used to measure pro-environmental behavioral intention and actual behavior. Many studies using the TPB indicate that attitudes, subjective norms, and behavioral control can strongly influence consumers' purchasing intentions (Yadav and Pathak, 2017). In addition, knowledge and awareness of environmental issues have been highlighted as having an important influence on pro-environmental behavior (Eom et al., 2016; Klockner, 2013; Tam and Chan, 2018). Saari et al. (2021) have developed a theoretical model that studies sustainable consumption behavior, by incorporating various practices related to individuals' efforts to behave more sustainably. Their models include actions such as buying pesticide-free products, reducing energy consumption, and avoiding products that are not environmentally friendly. This holistic approach to sustainability behavior is very much in line with our study of hospitality students, who may face these issues in their future professional roles.

Interconnections and Synthesis

Past literature discloses a robust interconnection between environmental knowledge, food waste behavior, and broader sustainability practices. Environmental knowledge acts as a foundation, to understand the effects of an individual's actions. As such, it can influence certain behaviors such as food waste reduction, as well as broader sustainability practices. However, the relationship between knowledge and behavior does not occur

directly. Factors such as attitudes, social norms, and behavioral control play a very important role in translating knowledge into action. These issues have highlighted the need for a multifaceted approach to promote sustainable practices in hospitality education and the industry in general. Recent studies (e.g., Principato et al., 2021; Han, 2021) have emphasized the need for a compressive approach that addresses both specific behaviors (such as food waste reduction) and broader sustainability practices. This holistic perspective is in line with the purpose of the study we conducted to examine the relationship between environmental knowledge, food waste behaviors, and sustainability-related behaviors among hospitality students. Thus, while there is a wide range of literature available that can provide useful insights into the individual components of our study, there are still gaps that exist in understanding how these factors interact specifically in the context of hospitality education in Malaysia. Our research was conducted to address this gap, while at the same time contributing to a more comprehensive understanding of how environmental knowledge shapes future hospitality professional practice related to food waste and sustainability.

3. Methodology

This study uses a quantitative approach to examine the relationship between environmental knowledge, food waste behavior, and sustainability-related behaviors among hospitality students in Malaysia. The target population for this study consists of hospitality students at UiTM Penang. We have used a combination of two techniques, namely the convenience and the snowball sampling technique to reach the participants. To collect data for this study, we leveraged modern communication channels that are familiar to our target demographic. The digital survey was created using Google Forms, a user-friendly platform that allows for easy access and completion by participants. We initially shared survey links through various student WhatsApp groups, leveraging existing social networks in the hospitality program. Recognizing the potential for wider reach, we also encourage participants to present surveys to their peers, using a snowball sampling approach. This method has proven to be effective in growing our group of participants beyond our immediate contacts, as students share links with classmates and friends in relevant programs. The combination of direct distribution and peer-to-peer sharing helps us cast a wider network, capturing multiple perspectives from within the hospitality student community. After data cleaning, our final sample consisted of 94 valid responses.

Measurement Instrument:
The questionnaire for this study consisted of four parts. Among them is demographic information: Including gender, age, year of study, current level of study and type of program. Then, the Environmental Knowledge scale: Adapted from Kaiser and Fuhrer (2003), this scale includes 10 items that measure students' understanding of environmental issues, especially those related to food waste and sustainability in the hospitality industry. Responses were measured on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Next, the Food Waste Behavior Scale: Item is based on Principato et al. (2015), this 8-item scale evaluates student behavior related to food waste reduction. Responses were measured on a 5-point Likert scale (1 = Never to 5 = Always). Finally, the Sustainability-Related Behaviors scale adapted from Han (2021), this 12-item scale measures a broader range of sustainability practices. Responses were measured on a 5-point Likert scale (1 = Never to 5 = Always). A total of 20 hospitality students were involved in the pilot test to ensure clarity and relevance. The Cronbach alpha used to assess the reliability of each scale showed good internal consistency ($\alpha > 0.80$).

4. Findings and Discussion

The data for this study was analyzed using IBM SPSS Statistics 26. Descriptive statistics were calculated for demographic variables and scale items. Pearson correlation analysis was conducted to examine the relationship between variables. Multiple regression analyses were conducted to assess the predictive power of environmental knowledge on food waste behaviors and sustainability-related behaviors.

Descriptive Analysis
In the study, we initially had a total of 100 respondents. However, during the data cleaning process, we identified that 6 of the respondents were not from the hospitality program, which was a requirement for inclusion in the study. Consequently, we excluded these 6 invalid responses, leaving us with a final sample of 94 valid participants (Table 1).

The gender breakdown of the valid respondents shows that the majority, 73 participants (77.7%), identified as female, while the remaining 21 participants (22.3%) identified as male. When examining the age distribution, we found an equal split between the 18-20 and 21-23 age groups, each comprising 40 participants (42.6%). The remaining 14 participants (14.9%) were in the 24-26 age range. Looking at the year of study, we had a fairly even representation, with 21 first-year students (22.3%), 36 second-year students (38.3%), and 37 third-year students (39.4%). In terms of the current level of study, 44 participants (46.8%) were pursuing a bachelor's degree, while 50 participants (53.2%) were enrolled in a diploma program. Finally, the program types represented in the sample were diverse, with 51 participants (54.3%) studying Hotel Management, 27 (28.7%) in Pastry Arts, 14 (14.9%) in Culinary Arts, and 2 (2.1%) in Food Service Management.

This descriptive overview provides valuable insights into the characteristics of the 94 valid respondents included in our study, allowing us to better understand the composition of the sample and lay the groundwork for further analyses.

Table 1: **Descriptive Analysis**

Characteristic	Frequency	Percent	Valid Percent	Cumulative Percent
Gender				
Female	73	77.7%	77.7%	77.7%
Male	21	22.3%	22.3%	100.0%
Age				
18-20	40	42.6%	42.6%	42.6%
21-23	40	42.6%	42.6%	85.1%
24-26	14	14.9%	14.9%	100.0%
Year of Study				
1st year	21	22.3%	22.3%	22.3%
2nd year	36	38.3%	38.3%	60.6%
3rd year	37	39.4%	39.4%	100.0%
Current Level of Study				
Bachelor's degree	44	46.8%	46.8%	46.8%
Diploma program	50	53.2%	53.2%	100.0%
Program Type				
Culinary Arts	14	14.9%	14.9%	14.9%
Food Service Management	2	2.1%	2.1%	17.0%
Hotel Management	51	54.3%	54.3%	71.3%
Pastry Arts	27	28.7%	28.7%	100.0%

Correlation Analysis

A Pearson correlation analysis was undertaken to investigate the associations between Environmental Knowledge (EnvKnow), Food Waste Behaviour (FoodW), and Sustainability-Related Behaviour (SustainB). The results are presented in Table 2.

Table 2: Correlations Between Environmental Knowledge, Food Waste Behavior, and Sustainability-Related Behavior

		Correlations		
		EnvKnow	**FoodW**	**SustainB**
EnvKnow	Pearson Correlation	1	.462**	.476**
	Sig. (2-tailed)		<.001	<.001
	N	94	94	94
FoodW	Pearson Correlation	.462**	1	.651**
	Sig. (2-tailed)	<.001		<.001
	N	94	94	94
SustainB	Pearson Correlation	.476**	.651**	1

Sig. (2-tailed)	<.001	<.001	
N	94	94	94

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

The results of the above correlation analysis have shown that students' environmental knowledge increases and they will tend to engage in more responsible food waste behavior and general sustainability practices. The analysis revealed significant positive correlations between all variables. Environmental Knowledge showed moderate positive correlations with both Food Waste Behavior ($r = .462$, $p < .001$) and Sustainability-Related Behavior ($r = .476$, $p < .001$). This suggests that as hospitality students' environmental knowledge increases, they are inclined to engage in more positive food waste behaviors and general sustainability practices. Particularly, the strongest correlation was observed between Food Waste Behavior and Sustainability-Related Behavior ($r = .651$, $p < .001$). This strong positive relationship suggests that students who establish more responsible food waste behaviors are also expected to participate in broader sustainability practices. These findings support our hypothesis that environmental knowledge is associated with both specific food-related behaviors and general sustainability practices among hospitality students. The strong correlation between food waste and sustainability behaviors proposes that concentrating on food waste reduction in hospitality education could have stronger impacts on overall sustainability behavior.

These results support previous research (e.g., Kaiser & Fuhrer, 2003; Redman & Redman, 2014) signifying the importance of both knowledge and specific behaviors in stimulating overall sustainability practices. They also emphasize the interconnected nature of food-specific behaviors and broader sustainability actions in the context of hospitality education.

Multiple Regression Analysis

To further examine the predictive power of environmental knowledge on food waste behavior and sustainability-related behavior, we conducted multiple regression analyses. The regression analysis revealed that Environmental Knowledge significantly predicts both Food Waste Behavior ($\beta = 0.462$, $p < .001$) and Sustainability-Related Behavior ($\beta = 0.476$, $p < .001$). These results suggest that environmental knowledge explains approximately 21.3% of the variance in Food Waste Behavior ($R^2 = 0.213$) and 22.7% of the variance in Sustainability-Related Behavior ($R^2 = 0.227$).

Table 3: Multiple Regression Results

Dependent Variable	Predictor	B	SE B	β	t	p
Food Waste Behavior	(Constant)	1.872		0.328	5.707	<.001
	EnvKnow	0.497	0.097	0.462	5.124	<.001
Sustainability-Related Behavior	(Constant)	1.763	0.313		5.632	<.001
	EnvKnow	0.518	0.093	0.476	5.570	<.001

5. Conclusion

The findings from this study have provided very valuable insights into the relationship between environmental knowledge, food waste behavior, and sustainability-related behaviors among hospitality students in Malaysia. A positive correlation can be seen between environmental knowledge and both food waste behavior ($r = .462$, p. <.001) and sustainability-related behavior ($r = .476$, p. <.001). This has shown that as hospitality students' environmental knowledge increases, they tend to engage in more responsible food waste behaviors and general sustainability practices. The results from results of this study have also shown that focusing on reducing food waste in hospitality education can have a wider influence on students' sustainability behaviors. These findings have provided an important insight for educators and policymakers. The positive correlation between environments. By amalgamating environmental education and stressing the importance of reducing food waste in the hospitality curriculum, educators have the potential to foster a more stable-oriented generation of hospitality professionals. This, in turn, can contribute to the broader goal of promoting environmentally sustainable practices in the hospitality industry.

Suggestions for Future Research

Future research should prioritize examining the detailed practices and instructional strategies that effectively transform environmental knowledge into tangible sustainable behavior among hospitality students. The study was limited and focused on only one institution in Malaysia and its reliance on self-reported behavior. Future research should be more detailed and extend the study to multiple institutions that have hospitality-related programs in Malaysia. Furthermore, longitudinal studies can examine the enduring effects of educational interventions on the occupational durability of graduates in real-life settings over an extended duration.

In conclusion, this study strongly emphasizes the importance of environmental knowledge in fostering sustainable practices among students and who will become future hospitality professionals. The hospitality industry can move towards more environmentally responsible operations, contributing to global sustainability goals by addressing food waste and broader sustainability issues through education.

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