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Assessing Integrity Determinant among UiTM Tapah Students on Solid Waste Management and Environmental Care using Logistic Regression

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Abstract

Solid waste (SW) refers to non-liquid waste generated by households, individuals, small businesses, or institutions. The increasing production of waste poses significant challenges for environmental management, affecting air, water, soil, and public health, and leading to landfill space shortages and rising costs of waste management. These challenges are influenced by population growth and economic advancement, which impact people's behaviors, lifestyles, and consumption patterns. There is a lack of studies investigating the role of individual integrity in the context of environmental care and solid waste management. This study aims to fill this research gap by examining how awareness, attitude, knowledge, practice, and perception influence the integrity levels of students in relation to environmental care and solid waste management. A questionnaire was created using Google Forms with 23 questions on a 7-point Likert scale. The study included 44 students from various faculties at UiTM Tapah, chosen through convenience sampling. The study had six variables: Level of Integrity towards Environmental Care and Solid Waste Management (dependent variable), and Awareness, Attitude, Knowledge, Practice, and Perception (independent variables). Logistic Regression Analysis was used to analyze the data. Findings revealed that Awareness, Attitude, and Practice had a significant impact on the Level of Integrity, while Knowledge and Perception did not. Specifically, Awareness, Knowledge, Practice, and Perception strongly influenced the Integrity Level, but Attitude had a slight negative impact.

Keywords: Environmental Care, Solid Waste Management, Level of Integrity, Awareness, Attitude, Knowledge, Practice, Perception

Introduction

Solid waste (SW) pertains to any waste that is not liquid and is produced by households, individuals, small businesses, or institutions (Baawain et al., 2017). The production of waste is among the significant challenges facing environmental management in the present era with

direct effects on air, water, soil, and public health. In addition, the increase in waste creation has caused a severe shortage of landfills and higher costs for waste management (Kranert et al., 2012). It due to the surge in population and the advancement of the economic level that shape the way people behave, live, and consume goods and services (Laohalidanond et al., 2015). According to projections by the World Bank Group (2022), the annual generation of waste is anticipated to surge by 73% from 2020, reaching a staggering 3.88 billion tonnes by 2050. This led the growing volume of waste generated worldwide significantly complicates the proper execution of waste management endeavors (Audina, 2018; Poldnurk, 2015) and an augmented requirement for management facilities (Ratnawati et al., 2023; Poldnurk, 2015). Therefore, effective solid waste management (SWM) plays a crucial role in mitigating the negative consequences of rising urbanization on both urban and rural areas (Hoang & Fogarassy, 2020).

As per data from the Malaysian Investment Development Authority (Malaysian Investment Development Authority, 2022), Malaysia's growing population of 32.8 million in 2021 results in a substantial amount of solid waste, estimated at 38,427 metric tonnes per day (1.17 kg/capita/day), with approximately 82.5% of it being disposed of in landfills. This figure is expected to have a significant impact on the total amount of municipal solid waste (MSW) collected, as it follows the established pattern from the previous year. In Malaysia, food waste constitutes 32% of the total waste, with plastic waste accounting for 21%, and other plastics comprising 14% of the waste composition (Ramli et al., 2022). Malaysia generates approximately 17,000 tonnes of food waste per day, of which 4,005 tonnes (or 24%) are still edible or easily avoidable (Hani, 2022).

To address solid waste (SW) and environmental issues in developing countries, it is crucial to incorporate formal education for sustainable development at all levels of education, as it has the potential to catalyze transformative changes throughout society. To ensure effective environmental sustainability and waste management education, it is imperative to have well-equipped educators who possess the necessary knowledge, attitudes, skills, and innovation. However, there is a dearth of research that has explored the relationship between formal education and solid waste management practices in developing countries. Besides, it is widely believed that changes in human behavior can have a positive impact on addressing the waste problem. However, promoting behavior change is more effective when it is systematically planned, implemented, and evaluated.

Furthermore, it is imperative for humanity to recognize and respect the limitations of the physical environment, which serves as both a source of inputs and a "sink" for wastes (Serageldin, 1993). As human beings, entrusted with the role of caliphs, maintaining integrity, and fostering positive social relationships is crucial. Environmental care, which encompasses aspects such as health and economy, is an integral part of this integrity, benefiting all individuals (Kadir et al., 2022). A search in the online database indicates that there is a paucity of studies examining the role of individual integrity in environmental care and solid waste management. The current literature on environmental care and solid waste management has yet to thoroughly investigate the concept of integrity in this context. Consequently, this study seeks to address this gap by assessing the influence of awareness, attitude, knowledge, practice, and perception on the integrity levels of students towards environmental care and solid waste management

Literature Review

Human behavior influences a variety of environmental challenges, including the MSW problem (Gardner & Stern, 1996; Koger & Winter, 2010). Furthermore, environmental education is considered essential in cultivating positive attitudes towards the environment (Michelsen & Fischer, 2018). The aim of environmental education is to cultivate a society that is environmentally aware and equipped with the knowledge, skills, attitudes, motivations, and commitment necessary to address existing environmental issues and proactively prevent new ones (Unesco-Unep, 1976). Due to their diverse organizational cultures that emphasize and promote learning, universities have a crucial role to play in educating and shaping the values of upcoming generations of citizens and leaders (Bursztyn & Drummond, 2014).

Results of a study revealed that in Malaysia, a substantial proportion of the respondents exhibited a high level of awareness, knowledge, practice, attitude, and perception with regards to solid waste management (Zulkipli et al., 2022). A study by Zulkipli et al. (2022) revealed that age, practice, attitude, and perceptions are the key factors that significantly influence the establishment of sustainable public awareness regarding solid waste management and environmental care. Another study by Zulkipli et al. (2019) found that four variables such as gender, knowledge, perceptions, and attitude were significantly influencing the level of awareness among students towards environmental care. A finding obtained from a study by Zulkifli et al. (2019) indicated that the students' knowledge, practice, and attitude have a significant impact on environmental sanitation. According to the findings of a study conducted by Jamian et al. (2018), most students demonstrated a high level of knowledge, attitude, and awareness towards environmental care.

However, their level of practice and perception towards environmental care was moderate. Furthermore, the study concluded that there were significant differences between male and female students in terms of practice, attitude, and awareness, with female students displaying higher levels of practice, attitude, and awareness towards environmental care compared to male students. However, integrity is considered as an essential value that must be taken into consideration when addressing environmental care and solid waste management. The concept of integrity encompasses sincerity as an inner virtue and faith as its external manifestation. It entails being honest and truthful, as well as fulfilling promises made by individuals (Wang, 2018).

A hypothesis stated in a study by Liu et al. (2022) was Integrity level and perceived effectiveness of the penalty system affects residents' domestic waste recycling behavior through their willingness to classify domestic waste. It aims to investigate the underlying mechanism that drives household waste sorting behavior through the construction of relevant models. Additionally, sociodemographic variables such as personal characteristics (e.g., gender, age, educational background, personal monthly income) and family characteristics (e.g., family size) are considered as influencing factors on domestic waste classification willingness and behavior, both domestically and internationally. Consequently, the theoretical model proposed in this study adopted from Liu et al., 2022 which encompasses the three basic variables of the theory of planned behavior, as well as socio-demographic variables and other relevant factors, to comprehensively examine residents' willingness and behavior towards domestic waste classification. The constructed theoretical model is depicted in Figure 1.

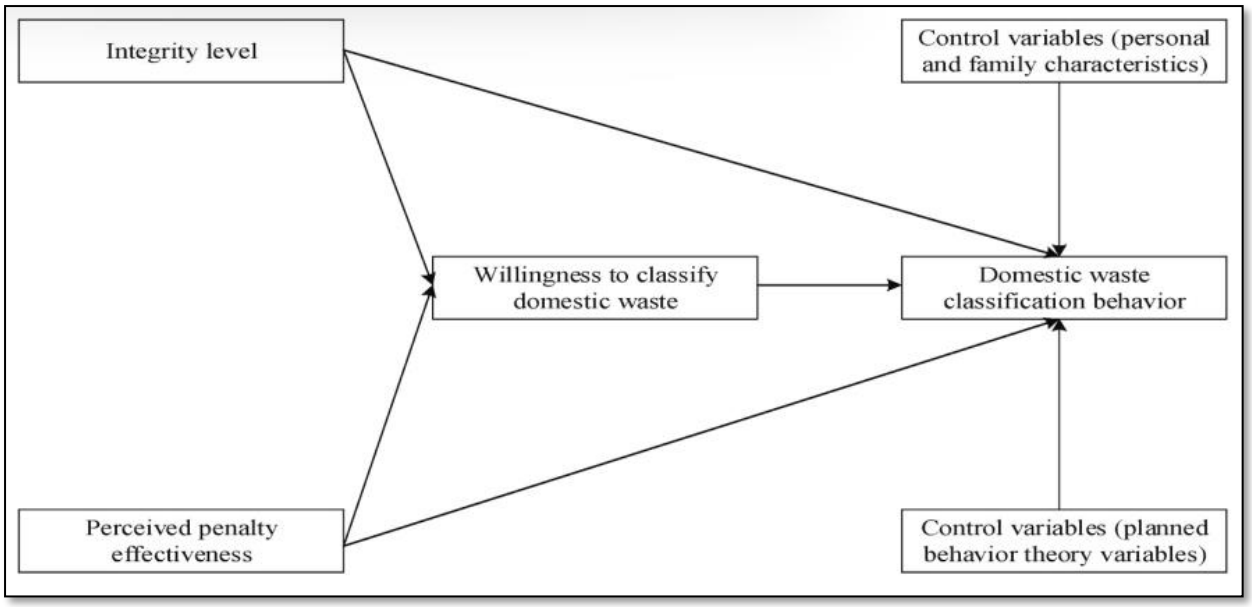

Figure 1. Influence Mechanism Model of Integrity Level and Perceived Effectiveness of Penalty System on Household Waste Sorting Behavior

This study using data obtained from a field survey of 1293 residents in Jinan. An empirical analysis to examine the influence of integrity level and economic punishment on residents' willingness and behavior towards waste classification. The findings reveal that both integrity level and perceived penalty effectiveness directly promote recycling intention and behavior. Specifically, integrity level has the greatest impact on recycling intention (30.8%), while perceived penalty effectiveness has the greatest impact on recycling behavior (23.6%). Moreover, recycling intention serves as a mediator in the relationship between integrity level and recycling behavior, as well as between perceived penalty effectiveness and recycling behavior. Furthermore, the mechanism through which integrity level and perceived penalty effectiveness promote classification behavior via recycling intention is more prevalent among individuals with higher education levels and those under 40 years old.

Methodology

The data collection for this study involved the creation of a questionnaire using Google Forms adopted from Zulkipli et al. (2019), which consisted of two sections: Personal Information and Environmental Care Behavior. The first section included five questions, while the second section contained 23 questions. However, the primary focus of this study is on the analysis of the second section. To ensure the questionnaire's validity, experts, including educators and students, were invited to review and provide feedback via WhatsApp. The questionnaire was revised based on their comments and suggestions. A 7-point Likert scale was used in the questionnaire to capture responses, ranging from 1 (strongly disagree) to 7 (strongly agree). The study population included all diploma students enrolled at UiTM Tapah, and a sample of 44 students from various faculties participated in the survey. Convenience sampling was chosen as the sampling method due to its convenience, simplicity, and cost-effectiveness.

In this study, there are six variables included, with the Level of Integrity towards Environmental Care and Solid Waste Management serving as the dependent variable, while Awareness, Attitude, Knowledge, Practice, and Perception are considered as independent

variables as illustrated in Figure 2. Table 1 shows the description of the variables used in this study.

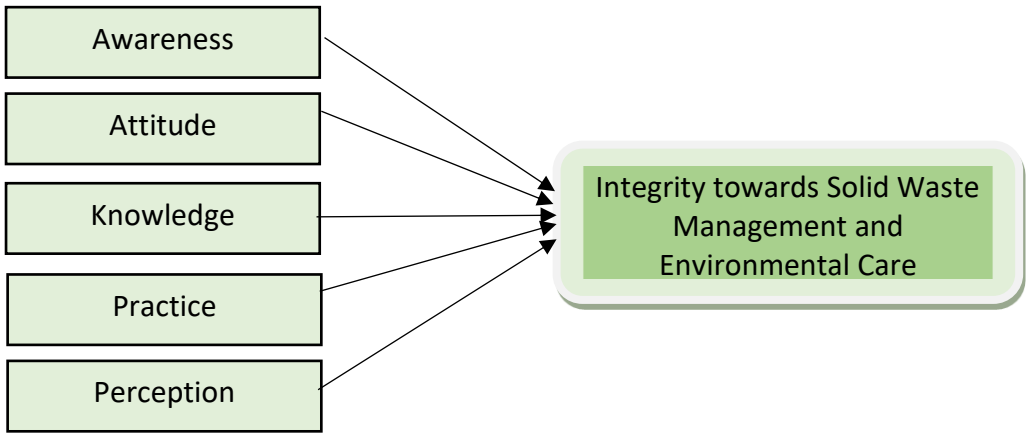

Figure 2. Framework on Level of Integrity towards Environmental Care and Solid Waste Management

Table 1. Description of the Variables in this Study

Variable	Scale of Measurement	Level of Variable
Level of Integrity towards Environmental Care and Solid Waste Management	Nominal	1: Low Integrity 2: High Integrity
Awareness	Interval	1 (Strongly disagree) until 7 (Strongly agree)
Attitude		
Knowledge		
Practice		
Perception		

The data obtained is examined through a Logistic Regression analysis to achieve the objective of the study using IBM SPSS Statistic software. The analysis procedures are outlined as follows.

A) The Classification Table

The focus is to evaluate the accuracy of the classification. The classification table presents the number of cases in which the predicted values of the dependent variable (1 or 0) align with the observed values. A perfect model would have all cases falling on the diagonal, resulting in a 100% overall accuracy rate (Hosmer & Lameshow, 2000). It is anticipated that the overall percentage of correct classification should surpass 80%.

B) Chi-Square Test Model

The overall significance of the model is evaluated using Chi-square test Model, which involves comparing the likelihood of observing the actual data under the assumption that the fitted model is accurate. The resulting p-value is then compared to a significance level of 0.05 to ascertain the statistical significance of the overall model (Hosmer & Lameshow, 2000).

C) Likelihood ratio (Odd ratio)

The Exp(B) value in logistic regression simplifies interpretation of changes in the dependent variable due to changes in the independent variable. It represents the odds ratio, calculated

as the exponent of the 'b' value. For example, if 'b' is 1.5, the corresponding odds ratio, Exp(B) in the SPSS table would be 4.48. This means that a one-unit increase in the independent variable is associated with approximately 4.5 times increase in the odds of predicting the dependent variable, while controlling for other variables. Another example is with income as an IV, where a one-unit increase (e.g., RM10,000) in income (with 'b' value of 1.5) would increase the odds of home ownership by about 4.5 times, as calculated using Exp (1.5) = 4.48.
The hypotheses of study are as follows.
H_0 = Awareness, Attitude, Knowledge, Practice, and Perception do not influence the Integrity Level of students towards Environmental Care and Solid Waste Management
H_1 = Awareness, Attitude, Knowledge, Practice, and Perception have an influence on the Integrity Level of students towards Environmental Care and Solid Waste Management.
The data collected is analyzed using a Logistic Regression to achieve the objective of this study by considering the Classification Table, Model Chi-Square Test, and Likelihood Ratio.
The logistic regression model is in (1)

$$Log\left(\frac{P_i}{1-P_i}\right)=\beta_0+\beta_i X_i+\varepsilon \quad (1)$$

where

P_i= 1 if integrity Level on Environmental Care and Solid Waste Management is high
P_i = 0 for otherwise
X_i= independent variables
β_0= constant term
β_i= coefficient of independent variables
ε = the error term
i = 1, 2, 3, …, n

Results and Discussions

The findings from Table 2, which included all independent variables, revealed that the model accuracy increased from 84.1% to 90.9%. This suggests that the model performed well, correctly classifying 90.9% of the questions. Specifically, 97.3% of students were correctly classified as having a High Integrity level towards Environmental Care and Solid Waste Management, while 57.1% of students were correctly classified as belonging to the Low Integrity group.

Table 2. Classification Table

Observed (Level of Integrity)	Predicted (Level of Integrity)		Percentage Correct
	Low Integrity	High Integrity	
Low Integrity	4	3	57.1
High Integrity	1	36	97.3
Overall Percentage			90.9

According to the findings presented in Table 3, the Chi Square statistic was calculated to be 16.317 with a degree of freedom (df) of 3, and the p-value was less than the significance level of 0.05, indicating that the model met the requirement for a good fit. This implies that the

Environmental Care factors had a significant influence on the Level of Integrity towards Environmental Care and Solid Waste Management. As a result, the logistic regression model used in this study was found to be statistically significant and meaningful.

Table 3. Omnibus Tests of Model Coefficients of Logistic Regression

Model	Statistic
Chi-square	16.317
Degree of freedom	3
p-value	0.001*

Note: *p-value<0.05

Table 4 presented no issues of multicollinearity were detected as the standard error estimates for each variable fell within the range of -2 to +2. The findings of the study demonstrated that the Level of Integrity towards Environmental Care and Solid Waste Management was significantly influenced by Awareness, Attitude, and Practice, as indicated by the p-values being less than the significance level of 0.05. The study also revealed that the odds ratios, Exp(B) for Awareness, Knowledge, Practice, and Perception were greater than 1, suggesting that an increase of one level in these factors led to higher levels of integrity towards Environmental Care and Solid Waste Management among the students, with values of 6.799, 1.454, 6.84, and 1.383, respectively. In contrast, the odds ratio (Exp(B)) for Attitude was found to be less than 1, indicating that an increase of one level in Attitude was associated with a 0.941 percent decrease in the odds of having a high level of integrity.

Table 4. Results of Logistic Regression Analysis

Variable	Coefficient (β)	Standard Error	p-value	Exp (B)
Constant	-4.236	2.411	0.049*	0.014
Awareness	1.917	1.196	0.019*	6.799
Attitude	-2.827	1.409	0.045*	0.059
Knowledge	0.374	0.612	0.541	1.454
Practice	1.923	0.914	0.035*	6.840
Perception	0.324	0.821	0.693	1.383

The equation (2) presents the logistic regression model that pertains to the integrity level of Environmental Care and Solid Waste Management.

$$Log\left(\frac{P_i}{1-P_i}\right) = -4.236 + 1.917Awareness - 2.827Attitude + 0.374Knowledge + 1.923\Pr actice + 0.324Perception + \varepsilon \quad (2)$$

Conclusion

In conclusion, the findings of this study revealed that Awareness, Attitude, and Practice had a significant influence on the Level of Integrity towards Environmental Care and Solid Waste Management, whereas Knowledge and Perception did not show a significant impact. The results highlighted that Awareness, Knowledge, Practice, and Perception were strong determinants of the Integrity Level towards Environmental Care and Solid Waste Management. However, Attitude had a slight negative effect on the Integrity Level. These findings are expected to provide valuable insights to stakeholders, including the government,

policymakers, and solid waste management authorities, regarding areas that need improvement to ensure environmental sustainability, particularly in solid waste management. Furthermore, this study is anticipated to contribute to the achievement of the 12th Malaysian Plan Agenda, which aims to promote environmental sustainability by 2025 and aligns with the Sustainable Development Goals (SDGs).

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