



INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES



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To Link this Article: <http://dx.doi.org/10.6007/IJARBSS/v13-i6/17370>

DOI:10.6007/IJARBSS/v13-i6/17370

Received: 03 April 2023, **Revised:** 06 May 2023, **Accepted:** 20 May 2023

Published Online: 05 June 2023

In-Text Citation: (Zulkipli et al., 2023)

To Cite this Article: Zulkipli, F., Akbar, N. F. N., Salleh, N. S., & Khalid, K. I. (2023). Students' Awareness on Solid Waste Management and Environmental Care: A Case Study at UiTM Negeri Sembilan Branch, Seremban Campus. *International Journal of Academic Research in Business and Social Sciences*, 13(6), 45 – 54.

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Vol. 13, No. 6, 2023, Pg. 45 – 54

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www.hrmars.com

ISSN: 2222-6990

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Abstract

Solid waste management is one of the crucial environmental issues in Malaysia whereby it contributes to the sustainable development for current and future generation. However, a lack of awareness among community in achieving sustainability in solid is relatively low. Information related to this environmental issue needs to be shared among the community, such as students, in order to educate them and create a conducive environment. Thus, this study is conducted to identify the relationship between knowledge, practice, attitude, and perception against awareness and to find the significant factors that contributes on students' awareness on solid waste management (SWM) and environmental care (EC) at UiTM Negeri Sembilan Branch, Seremban Campus. A set of questionnaires is distributed among the students from the College of Computing, Informatics and Media, Faculty of Sport Science and Recreation and Faculty of Administrative and Policy Studies using an online platform such as WhatsApp and Telegram. A total of 355 respondents participated in this study. The questionnaire is divided into two parts, which are Part A for respondents' demography and Part B for student's awareness on solid waste management and environmental care. The results obtained in Part A are analyzed using descriptive statistics, while the results obtained in Part B are analyzed using Multiple Linear Regression. The overall results obtained in this study show that students' knowledge, practice, attitude and perception have positive relationship towards students' awareness of solid waste management and environmental care.

Keywords: Solid Waste Management, Environmental Care, Multiple Linear Regression, Students' Awareness

Introduction

Growing global population and economic expansion are increasing on a regular basis; these scenarios have significantly increased the generation of municipal solid waste. As a result, dealing with human waste clean-up can be difficult (Chua et al., 2019). Waste disposal was an immediate and critical issues for the community now and ineffective or irresponsible disposal of solid waste pollutes the environment and pose health risk to public. Solid waste management was considered as one of the complex and dynamics problems worldwide due to rapid population, changing lifestyle, urbanization process towards sustainable development and uncontrollable increment in solid waste generation. The raising number of municipal solid waste management in Malaysia was one of the greatest environmental problems that need to be concerned and solved (Zulkipli & Jamian, 2021; Tang et al., 2021). In addition, solid waste management is a global issue that impacts climate change and environmental sustainability. Inadequate waste management would generate a substantial amount of solid waste. This occurred as a result of the public's lack of awareness of solid waste management (Zulkipli et al., 2022).

The increasing volume of solid waste generation yearly capturing an alarming wave of unsustainable environment and leads to climate change impact. Growth of solid waste generation in Malaysia reach an increase annually due to an increment in the number of populations. Economic growth and rapid urbanisation are significantly influence in the increment number of solid waste generation respectively. Currently the amount of solid waste generation in Malaysia is 38,209.041kg/capita/day in 2020 has increase by 0.4% compared to 38,051.91kg/capita/day in 2019 as report by Department of Statistics Malaysia (DOSM, 2023). This amount of solid waste generation is predicted to rise gradually year by year. This is the consequence of many parties' commitment and effort to carry out development projects such as new urban construction planning, infrastructural facilities and so on.

Previous researchers had conducted a survey on public awareness towards solid waste management. Bashir et al (2018) investigated on public concerns and behaviours towards solid waste minimization using composting in Kampar district, Malaysia. The result shows that more than 50% respondents are willing to practice the correct ways on solid waste management, while 37.77% are not willing to practice. The unwillingness is due to lack understanding on how to manage the solid waste in a proper way with 72.9% feedback from respondents. Moreover, only 23.33% of respondents contribute in participate to solid waste management activities conducted in Kampar, Perak.

Another study conducted by Chung et al (2019) on level of recycling awareness among household in Selangor. The results show that only 16% of the respondents had a moderate level of awareness on recycling, while the 18% of the respondents had a low level of awareness on recycling. It can be concluded that the awareness and mismanagement on solid waste are the main causes of present human health damage and ecosystem quality deterioration (Hasan, Hanafiah & Satchet, 2019).

Unfortunately, these advances and the less caring and responsible society's attitude have serious consequences for ecosystems, the environment, and human quality of life. Biodiversity problems, natural resource depletion, global warming and other forms of pollution make this a nuisance and a frightening future challenge for environmental conservation (Ferronato & Torretta, 2019). Given the growing urgency of environmental preservation, the need to establish a more environmentally responsible society is also pressing.

The young generation who are considered as the state's heirs should be educated in order to promote awareness about the consequences of future actions related to environmental protection. In order to attain a sustainable environmental environment, this preparation is critical in order to develop caring human capital and a more favourable attitude toward the environment. Therefore, the solid waste management should continuously efficient and sustainable. In order to overcome this problem, the awareness on solid waste management among citizen especially should be growth organically in every mind set. These issues and problems lead to motivate the authors to further determine the students' awareness on solid waste management and environmental care at UiTM Negeri Sembilan Branch, Seremban Campus. Thus, the objectives are: i) to identify the relationship between knowledge, practice, attitude, perception and awareness on solid waste management and environmental care and ii) to develop students' awareness model on solid waste management (SWM) and environmental care (EC) at UiTM Negeri Sembilan Branch, Seremban Campus. Descriptive statistics are applied for respondents' background for Section A. While for Section B, a multiple linear regression method is implemented to analyse the results.

Methodology

The methodology is divided into several sections. Firstly, the explanation on population, sample size, sampling technique and data collection method. Secondly, the presentation of research framework. Thirdly, the analysis of questionnaire based on Section A for respondents' background and Section B for students' awareness on solid waste management and environmental care at UiTM Negeri Sembilan Branch, Seremban Campus. Finally, highlighted the discussion on findings and draw a conclusion.

A) Research Framework

The research framework is adopted from Zulkipli and Jamian (2021) as shown in Figure 1.

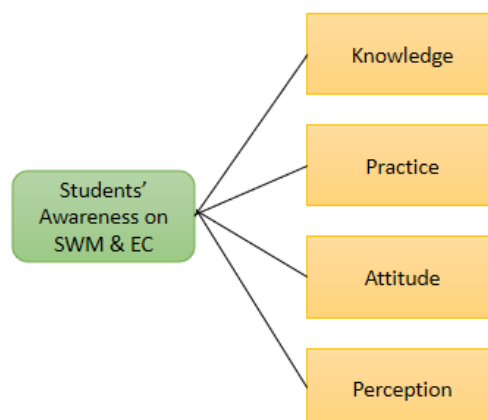


Figure 1. Research Framework

B) Population, sample size, sampling technique and data collection method

Population for this study is involved all students at UiTM Negeri Sembilan Branch, Seremban Campus, which were from College of Computing, Informatics and Media (CCIM), Faculty of Sport Science and Recreation (FSR) and Faculty of Administrative and Policy Studies (FSPPP). The sample size was 355 respondents and were selected using a probability sampling technique called simple random sampling. The set of questionnaire were distributed via online platforms such as WhatsApp and Telegram.

C) Correlation Analysis

The correlation Coefficient is tested using Pearson's product moment correlation coefficient. The correlation analysis is used when the researcher wants to describe the relationship between two or more quantitative variables. The mathematical formula for Pearson's correlation coefficient r is:

$$r = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{n}\right) \left(\sum y^2 - \frac{(\sum y)^2}{n}\right)}}$$

where;

r = correlation coefficient

n = number of observations

$\sum x$ = sum of the product x

$\sum y$ = sum of product y

$\sum xy$ = sum of the product x and y

$\sum x^2$ = sum of square of values of variable x

$\sum y^2$ = sum of square of values of variable y

$(\sum x)^2$ = square of the sum of all values of variable x

$(\sum y)^2$ = square of the sum of all values of variable y

The value of correlation defines the strength of the linear relationship between independent variables and dependent variables, in order to prove the degree of relationship of covariant exists between them. The range and relationship of variables as illustrated in Table 1.

Table 1

Description Range of Relationship

Range Relationship	Description
$0.9 \leq r \leq 1$ ($-0.9 \leq r \leq -1$)	Very strong positive (negative)
$0.7 \leq r < 0.9$ ($-0.7 \leq r \leq -0.9$)	Strong positive (negative)
$0.5 \leq r < 0.7$ ($-0.5 \leq r \leq -0.7$)	Moderate positive (negative)
$0.3 \leq r < 0.5$ ($-0.3 \leq r \leq -0.5$)	Weak positive (negative)
$0.0 \leq r < 0.3$ ($0.00 \leq r \leq -0.3$)	Very Weak positive (negative)

D) Multiple Linear Regression Method

The multiple linear regression (MLR) has been performed in order to explain the relationship between two or more independent variables and one dependent variable. This analysis was used to determine the significant factors that contributes on students's awareness solid waste management and environmental care in UiTM Negeri Sembilan Branch, Seremban Campus. The independent variables used in this study are knowledge, practice, attitude and perception and dependent variable is student's awareness. The MLR model can be described by Y as the student's awareness in UiTM Negeri Sembilan Branch, Seremban Campus. For X_1 , X_2 , X_3 and X_4 was the knowledge, practice, attitude and perception, respectively. The equation of MLR as follow:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + \varepsilon_i$$

where;

Y_i = predicted value of the dependent variable

β_0 = constant term

β_k = regression coefficient of independent variables

X_k = independent variables

ε_i = random error terms

Results and Discussions

Section A and Section B were used to present the findings of the analysis. To begin, section A used descriptive statistics to discuss the demographics of respondents. Section B, on the other hand, presented and highlighted the results of correlation analysis and multiple linear regression model. The study aims to determine the students' awareness on solid waste management and environmental care based on knowledge, practice, attitude, and perception at UiTM Negeri Sembilan Branch, Seremban Campus.

A) Descriptive statistics on respondents' background

The descriptive statistics on respondents' background are summarized in Table 2. There are 16.06% of males and 83.94% of females among the 355 respondents. The age ranges were divided into four categories: 18-19 years old, 20-21 years old, 22-23 years old and 24-25 years old. Most of the respondents were between 20-23 years old which contributed 76.61%. The highest number of the respondents were from Faculty of Administrative and Policy Studies (45.35%), then followed by respondents from College of Computing, Informatics and Media (38.59%) and the least number of respondents were from Faculty of Sport Science and Recreation (16.06%); respectively.

Table 2

Summary of Respondents' Background

Variables		Frequency	Percentage (%)
Gender	Male	57	16.06
	Female	298	83.94
	Total	355	100
Age	18-19	78	21.97
	20-21	119	33.52
	22-23	153	43.09
	24-25	5	1.42
	Total	355	100
Faculty/College	CCIM	137	38.59
	FSR	57	16.06
	FSPPP	161	45.35
	Total	355	100

B) The relationship between students' awareness towards knowledge, practise, attitude and perception

The correlation analysis is implemented in this study in order to identify the relationship between dependent variable (students' awareness) and independent variables (knowledge, practise, attitude and perception). The result obtained are presented in Table 3. As a result, the strength of relationship between all variables are weak and moderate positive relationship.

Table 3

Pearson Correlation Coefficient Results

Dependent variable	Independent variables	Pearson Correlation coefficient	Intepretation
Students' awareness	Knowledge	0.431	Weak positive
	Practice	0.500	Moderate positive
	Attitude	0.514	Moderate positive
	Perception	0.459	Weak positive

C) Multiple linear regression model of students' awareness on solid waste management and environmental care.

Before the multiple linear regression is developed, there were four assumptions need to be checked and satisfied. Which were normality assumption, Homoscedasticity, error terms are independent and no multicollinearity exists.

i. Normality Assumption

The P-P plot of the residuals were observed in order to verify this condition as in Figure 2. The normal probability plot of residuals produces a plot of residuals against their probability on a 45-degree line. The P-P plot shows that all the points lie in a reasonably straight diagonal line from bottom left to top right. This would suggest no major deviations from normality.

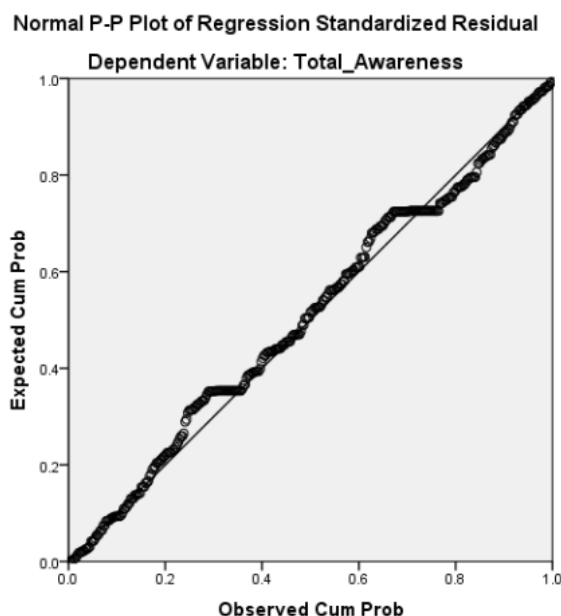


Figure 2. The Normal P-P Plot of Regression Standardized Residual

ii. Homoscedasticity

The constancy of the error variance (homoscedasticity) were examined by the plot of residuals against predicted values. The plot appeared to be randomly scattered and spread along a horizontal bar. Based on Figure 3, the plots are scattered equally showing that the variance is constant.

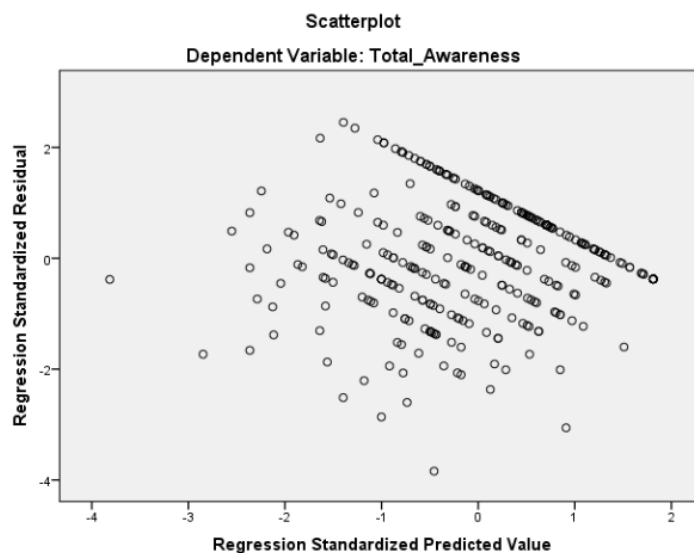


Figure 3. Scatter Plot

iii. Error terms are independent

This assumption is examined for time series data where Durbin-Watson statistic is obtained. It can be assumed that the error terms are independent if the statistic's value is between 1.5 and 2.5. In this study, the value of Durbin-Watson was 1.743. Therefore, there is no autocorrelation which means the error terms are independent.

iv. Multicollinearity

Multicollinearity occurs when independent variables used in multiple regression model are highly correlated. This assumption is usually examined by using Variance Inflation Factor (VIF) and the Tolerance Statistics coefficient. If the value of VIF value greater than 10, then it indicates the presence of multicollinearity. While, the Tolerance Statistics must be greater than 0.1. Based on results yielded in Table 4, all the VIF values are less than 10 and the tolerance also greater than 0.1. thus, there is no multicollinearity exists.

Table 4

Multicollinearity Testing for Independent Variables

Variables	Collinearity Statistics	
	Tolerance	VIF
Total Knowledge	0.884	1.132
Total Practice	0.661	1.513
Total Attitude	0.601	1.664
Total Perception	0.776	1.288

v. Multiple linear regression model

The output of coefficient of model are presented in Table 5. all the variables are significance with the p-value are less than 0.05.

Table 5

The Coefficients Output

Variables	Unstandardized Coefficient	Sig
Contant	0.784	
Total Knowledge	0.429	0.000
Total Practice	0.215	0.000
Total Attitude	0.177	0.000
Total Perception	0.178	0.000

The multiple linear regression model are as folow

$$Y = 0.784 + 0.429\text{Knowledge} + 0.215\text{Practice} + 0.177\text{Attitude} + 0.178\text{Perception}$$

Moreover, the coefficient of determination (r^2) was 0.440. It indicated that the 44% of the total variation in students' awareness can be explained by knowledge, practice, attitude and perception. Where else, another 56% of the total variation in students' awareness are explained by other factors.

Conclusion

A total of 355 students from the UiTM Negeri Sembilan Branch, Seremban Campus, participated in the survey. The purpose of the study is to ascertain the students' knowledge of environmental protection and solid waste management. According to the results, the relationships between students' awareness and knowledge, practise, attitude, and perception are weak to moderate. After that, the development of multiple linear regression models is provided, and all of the variables involved are statistically significant. This helped the students become more conscious of the importance of environmental care and solid waste management. Suggestion for future research: it is advised to explore the level of students' awareness, because the respondents are from the group of young people who are the lining of the next generation.

Acknowledgement

The authors would like to express an appreciation to College of Computing, Informatics and Media, UiTM Perak Branch, Campus Tapah and College of Computing, Informatics and Media, UiTM Negeri Sembilan, Seremban Campus for supporting this study. Special thanks to all the respondents for their cooperation in participating in this study.

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