Journal of Mathematics and Computing Science, 2022,
Volume 8, No 2, 21-29

# Multiple Linear Regression Modelling on the Factors Affecting Student's Awareness on Cleanliness: A Case Study in Tertiary Institutions

**Faten Ainon Najwa Arba, Nor Hazreeni Hamzah* [2], Nur Safwati Ibrahim [3] , Nurul Bariyah Ibrahim[4], Shamsunarnie Mohamed Zukri [5] and Noor Zafarina Mohd Fauzi[6]**

[2,3,4,5,6]Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Kelantan, Bukit Ilmu, Machang, Kelantan, Malaysia

*reeni683@uitm.edu.my

**Abstract**: Cleanliness is a state of being clean. Today's pandemic of Coronavirus 2019, also known as Covid-19, is greatly associated with cleanliness where those who practice good hygiene are less likely to be infected. This research was done to identify the awareness of cleanliness among students of UiTM Kota Bharu based on gender, academic achievement, peer, and environmental influence. One of the aims of this research was to identify the mean different between gender and academic achievement on the awareness of cleanliness. Besides, this research also aimed to identify the influential factor towards the awareness of cleanliness. A cross-sectional correlational design was used in this research with a sample of 301 respondents. Independent t-test, one-way ANOVA and multiple linear regression was used in order to answer the objectives. It was found that both gender and academic achievement had no significant difference on the awareness of cleanliness. However, it was revealed that peer and environmental influence significantly trigger the awareness of cleanliness among students. Environmental influence contributed more on the awareness of cleanliness as compared to peer influence. For future research, it is recommended for other researchers to add more influential factors to the awareness of cleanliness and enlarge the sample size to improve the quality of data analysis.

**Keywords**: Cleanliness, Independent t-test, Multiple linear regression, One-way ANOVA

## 1 Introduction

Cleanliness is not an alienated term for individuals. It is a state of being clean, according to Oxford Learner's Dictionary. A study shows that proper cleaning can minimize infectious viruses from spreading by 80 to 90 percent (Gerba et al. [5]). With the existence of a new virus which was discovered in the late 2019, Coronavirus Disease 2019, which is also known as Covid-19 today, has led the World Health Organization (WHO) to announce that keeping clean can help a person avoid from becoming a victim of the disease. This disease alone has recorded 101 million infected cases as of the end of January 2021, with 26 million recorded deaths around the world. It is undeniable that most time spent by a student is studying. It is also undeniable that studying in a tidy, clean, and organized working space can enhance their study sessions more as this will ensure a calm surrounding as proven by a study where 88% of students were apparently distracted in their academic atmosphere by mild inattention against cleanliness (Alimi et al. [1]). The lack of properly cleaned surroundings can lead to disease, chronic truancy, and students falling behind colleagues (Alimi et al. [1]). Hence, it is beyond doubt that staying clean in every aspect is indeed important. The main concern is to know what is the level of peoples' awareness regarding their cleanliness. Therefore, this research was done to know the awareness of cleanliness among UiTM Kota Bharu students based on gender, academic achievement, peer, and environmental influences.

## 2 Literature Review

Juma, Chawene, and Mfinanga [9], in their study where they examined the role of genders in household sanitation and hygiene, have found that women were not only responsible for hygiene but also dish preparations. Another study done by Cairncross et al. [2] in Kerala, India identified that 57.7% of their female respondents would wash their hands with soap, male showed a smaller percentage to do the same. Jankowska et al. [8], in their study, stated that low physical fitness is a result of mental health and academic problems. Hence, to improve academic performance, a person's physical health must be taken care of where it is highly related to the state of being clean. Alimi et al. [1] found in their study that 88% out of 1,481 students reported that lack of cleanliness becomes a distraction while studying where it will later affect their academic achievement. They also discovered that students who have low awareness on cleanliness are often left out in their studies. A study did by Choukas-Bradley et al. [3] stated that peer influence is not necessarily a harmful process as they proved that positive behaviour among peers can lead to a positive behaviour in a person. Ma et al. [10] also agreed that perceived influence was significantly correlated with good behaviour. These two studies have shown that when a person has peers who are prone to hygiene, he or she is more likely to have a hygienic trait which will later improve his or her awareness of cleanliness. Hasana [7], in her study on marketers' influence towards environmental cleanliness, found that market hygiene is highly related to the environment around the market where densely populated housing area markets were overlooked while elite housing areas tend to have clean markets. She stated that the poor awareness of cleanliness shown by the marketers often led to losing several customers where it proved that environmental influence is correlated with the awareness of cleanliness. Devi and Lenin [4], in their study, also found that there is a significant difference in students' environment with their hygiene habit. They believed that students with good parents' education status, suitable number of family members, and a good level of education can enhance their awareness of cleanliness. This has been proven when they identified that more than 70% of secondary school students have moderate level on the awareness of environmental cleanliness.

## 3 Methodology

This research was done using a cross-sectional correctional design where the data was only collected once from respondents who are UiTM Kota Bharu students from the academic session of October 2020 to February 2021. The respondents were also students who have sat for examinations at least once. Raosoft [12] were used to determine the number of samples suitable for the research. 301 respondents were randomly selected out of 1,377 students from six different programmes available in UiTM Kota Bharu. The questionnaires consisted of four sections (A, B, C and D) and were distributed to the respondents by using simple random sampling. The questionnaire was adapted from a number of research and details of the questionnaire were summarized in Table 1.

A pilot study was done before the actual research where it was found that the questionnaire was suitable for the research as the values of all Cronbach's alpha were greater than 0.7 using measure of reliability. Descriptive statistics was done to further assist data distribution. It was graphically analysed using a frequency table. Independent t-test was done to identify the significant difference between gender and the awareness of cleanliness while one-way ANOVA was done to test the significance of academic achievement. Several assumptions were required to be fulfilled before running these two tests. Both tests required the assumptions of normality and homogeneity of variance to be met. In addition, Multiple Linear Regression (MLR) was also done to identify the relationship between student's awareness of cleanliness with four independent variables which are gender, academic achievement, peer, and environmental influence. Like the previous tests, several assumptions were to be met before running the MLR. These assumptions include normality, homogeneity of variances, linearity, and multicollinearity assumption.

Table 1: Summary of Questionnaire

| Section | Description | Measurement | Sources |
|---|---|---|---|
| **A** | Demographic factors | Combination of nominal and ordinal scales | - |
| **B** | Awareness of cleanliness | Likert scale ranging from 1 (Strongly Disagree) to 10 (Strongly Agree) | Çelik and Yüce (2019), Kiplagat et al. (2017), and Aunger (2016) |
| **C** | Peer influence | Likert scale ranging from 1 (Strongly Disagree) to 10 (Strongly Agree) | Kiplagat et al. (2017) |
| **D** | Environmental influence | Likert scale ranging from 1 (Strongly Disagree) to 10 (Strongly Agree) | Kiplagat et al. (2017), and Yoo (2012) |

## 4 Results and Analysis

### *A Reliability Test*

Reliability test was carried out to confirm the reliability of the questionnaire used. As shown in Table 2, all sections were reliable since the values of Cronbach's alpha were greater than 0.7.

Table 2: Reliability Statistics

| Section: Variables | Cronbach's Alpha |
|---|---|
| Section B: Awareness of Cleanliness | 0.702 |
| Section C: Peer Influence | 0.913 |
| Section D: Environmental Influence | 0.911 |
| Overall | 0.926 |

### *B Descriptive Statistics*

The descriptive statistics are as shown in Table 3. Based on the table, mode value for each variable were female for gender, CS241 for programme, fifth semester for semester, those aged within 21 and 24 years old for age and CGPA between 3.0 and 3.5 for academic achievement.

Table 3: Summary of Descriptive Statistics

| Variable | Group | Frequency | Percentage (%) |
|---|---|---|---|
| **Gender** | Female | 250 | 83.1 |
| | Male | 51 | 16.9 |
| **Programme** | Bachelor of Business Administration (Hons) Marketing (BA240) | 38 | 12.6 |
| | Bachelor of Business Administration (Hons) Finance (BA242) | 71 | 23.6 |
| | Bachelor of Business Administration (Hons) Islamic Banking (BA249) | 63 | 20.9 |
| | Bachelor of Business Administration (Hons) Economics (BA250) | 41 | 13.6 |
| | Bachelor of Science (Hons) Statistics (CS241) | 88 | 29.2 |
| **Semester** | 2 | 13 | 4.3 |
| | 3 | 71 | 23.6 |
| | 4 | 38 | 12.6 |
| | 5 | 109 | 36.2 |
| | 6 | 60 | 19.9 |
| | 7 | 8 | 2.7 |
| | 8 | 2 | 0.7 |
| **Age** | ≤ 20 years old | 13 | 4.3 |
| | Within 21 and 24 years old | 287 | 95.4 |
| | ≥ 25 years old | 1 | 0.3 |
| **Academic Achievement** | CGPA ≤ 3.0 | 46 | 15.3 |
| | CGPA between 3.0 and 3.5 | 138 | 45.8 |
| | CGPA ≥ 3.5 | 117 | 38.9 |

### *C Independent t-test*

Table 4 shows the skewness value of normality to test the normality assumption for independent t-test for the variable Awareness of Cleanliness by gender. Since all the skewness values were between -1.0 and +1.0, thus, the assumption of normality was satisfied. Levene's Test of Equality Variance was done to fulfil the second assumption of independent t-test, homogeneity of variance. Based on Table 5, the p-value, 0.549 was greater than alpha 0.5 which confirmed that the assumption was satisfied, and hence independent t-test can proceed. The result for independent t-test in Table 6 was found to be not significant as the p-value, 0.201 was less than alpha, 0.05. Therefore, it could be said that there was no significant different between gender and the awareness of cleanliness among students of UiTM Kota Bharu. Thus, this variable was dropped from future tests.

Table 4: Skewness Value of Normality for Gender

| **Group** | **Skewness Value** |
|---|---|
| Male | -0.721 |
| Female | -0.194 |
| All | -0.622 |

Table 5: Levene's Test of Equality Variance for Awareness of Cleanliness and Gender

| **Variable** | **p-value** |
|---|---|
| Awareness of Cleanliness* Gender | 0.549 |

Table 6: Summary of Independent t-test

| **t statistic** | **df** | **p-value** |
|---|---|---|
| 0.84 | 299 | 0.201 |

### *D One-Way ANOVA*

Table 7 shows the level of skewness for academic achievement between the group CGPA. It could be said the assumption of normality was satisfied as the skewness value were all within -1.0 and +1.0.

Table 7: Skewness Value of Normality for CGPA

| **Group** | **Skewness Value** |
|---|---|
| CGPA ≤ 3.0 | -0.561 |
| CGPA 3.0 – 3.5 | -0.437 |
| CGPA ≥ 3.5 | -0.822 |
| All | -0.622 |

The homogeneity of variance assumption was fulfilled as the p-value of the Levene's Test as shown in Table 8 was greater than alpha, 0.05 (p-value=0.658). With these results, One-Way ANOVA was carried out.

Table 8: Levene's Test of Equality Variance for Awareness of Cleanliness and Academic Performance

| **Variable** | **p-value** |
|---|---|
| Awareness of Cleanliness* Academic Performance | 0.658 |

Based on the results obtained from the ANOVA table in Table 9, it can be concluded that there was no significant difference between academic achievement and the awareness of cleanliness among students as the p-value, 0.306 is less than alpha, 0.05. This variable was also to be dropped from further testing.

Table 9: Summary of ANOVA

| **F statistic** | **p-value** |
|---|---|
| 1.26 | 0.306 |

### *E Multiple Linear Regression*

Normal P-P Plot was used to test the normality of the residual in order to satisfy one of the assumptions of MLR. The plot in Figure 1 shows that all points lie approximately along the straight line, hence the residuals were approximately normally distributed.

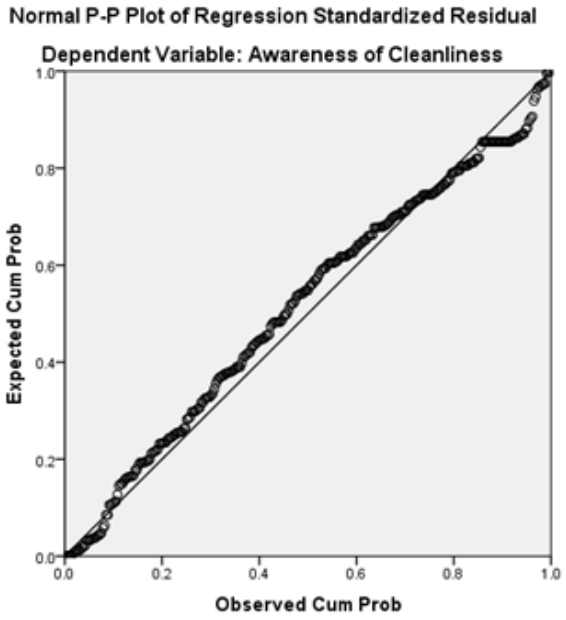


Figure 1: Normal P-P Plot of Residual

Homoscedasticity of variance assumption was satisfied as shown in Figure 2 as no obvious pattern exists in the scatter plot of residual against predicted value.

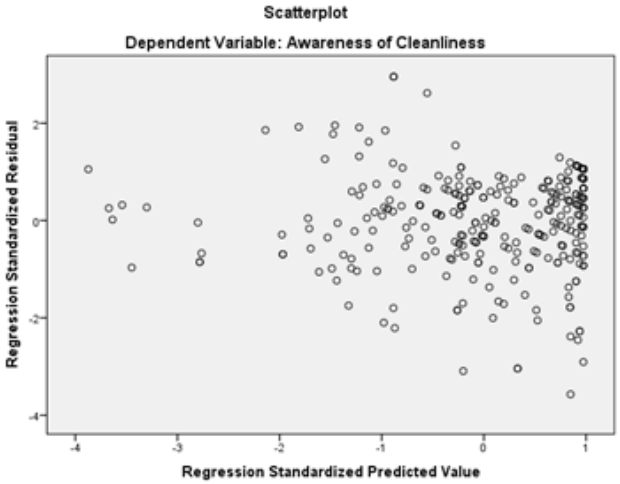


Figure 2: Scatterplot of Residual against Predicted Value

The p-value of variable peer and environmental influence were both < 0.001 based on a linearity of variable in Table 10. This indicates that both variables were linearly correlated with the dependent variable, the Awareness of Cleanliness. Thus, the assumption of linearity was fulfilled.

Table 10: Linearity of Variable

| Variable | p-value |
|---|---|
| Peer Infuence | < 0.001 |
| Environment Influence | < 0.001 |

Based on Table 11, multicollinearity problem did not exist among the independent variables as the values of tolerance were greater than 0.1 while VIF were less than 10.[11]

Table 11: Collinearity Statistics between Independent Variables

| Variable | Tolerance | VIF |
|---|---|---|
| Peer Infuence | 0.650 | 1.538 |
| Environment Influence | 0.650 | 1.538 |

From the coefficient of determination value in Table 12, it can be concluded that 71.6% of the total variation in the dependent variable, the awareness of cleanliness among students can be explained by the total variation in peer and environmental influence. The remaining 28.4% can be explained by other factors. Hence, it can be said that the model was in good fit.

Table 12: Coefficient of Determination

| R Square |
|---|
| 0.716 |

Model significance was identified using ANOVA. The result, based on Table 13, indicated that at least one of the independent variables (peer and environmental influence) significantly contributed to the level of awareness of cleanliness among students since the p-value was < 0.001 which is less than alpha 0.05.

Table 13: Summary of ANOVA in MLR

| Model | p-value |
|---|---|
| Regression | < 0.001 |

Each independent variable significance was tested to obtain the final model of the awareness of cleanliness among students. Table 14 shows the summary of the result. As variables peer influence and environment infuence have p-value that are less than alpha, 0.05, then both variables were significant and can be included in the final model.

Table 14: Significant Value of Independent Variable

| Variable | B | p-value |
|---|---|---|
| (Constant) | 0.284 | 0.544 |
| Peer Infuence | 0.132 | 0.004 |
| Environment Influence | 0.763 | < 0.001 |

The final model obtained for this research were as in Eq. (1):

$$Y = 0.284 + 0.132X_4 + 0.763X_5 \quad (1)$$

Where:
Y : Awareness of Cleanliness Among Students of UiTM Kota Bharu
$X_4$ : Peer Influence
$X_5$ : Environmental Influence

## 5 Conclusion and Recommendations

The first objective was satisfied by having no significant difference between gender and the awareness of cleanliness among students as tested using an independent t-test. This can be supported where in a study of examining the role of genders in household sanitation and hygiene done by Juma, Chawene, and Mfinanga [9], it was found that women were solely responsible for hygiene. For the second objective, there is also no significant difference between academic achievement for CGPA less than 3.0, between 3.0 and 3.5, and more than 3.5 with the awareness of cleanliness. Finally, the third objective was accomplished with environmental influence as the most influential factor that contributes to the level of awareness of cleanliness among UiTM Kota Bharu students since it has the highest Beta coefficient. Several recommendations can be made to future researchers for improvements when conducting this study. It is better for future researchers add more related factors to the awareness of cleanliness among students in order to have a better-quality analysis. Another aspect worth considering it to increase the sample size in order to achieve a better accuracy in the data.

## References


[1] Alimi, O. S., Ehinola, G. B., & Alabi, F. O. (2012). *School Types, Facilities and Academic Performance of Students in Senior Secondary Schools in Ondo State, Nigeria*. International Education Studies, 44 - 48.

[2] Cairncross, S., Hunt, C., Boisson, S., Bostoen, K., Curtis, V., Isaac, C. F., & Schmidt, W.-P. (2006). *Water, Sanitation and Hygiene for the Prevention of Diarrhea.* International Journal of Epidemiology, 39(1), 193-205.

[3] Choukas-Bradley, S., Giletta, M., Cohen, G. L., & Prinstein, M. J. (2015). *Peer Influence, Peer Status, and Prosocial Behavior: An Experimental Investigation of Peer Socialization of Adolescents' Intentions to Volunteer*. J Youth Adolesc., 2197 - 2210.

[4] Devi, E. D., & Lenin, S. (2018). *Environmental Cleanliness Among Secondary School Students.* International Journal of Innovative Research and Advanced Studies (IJIRAS) Volume 5 Issue 8, 123 - 125.

[5] Gerba, C. P., Betancourt, W. Q., Kitajima, M., & Rock, C. M. (2018). *Reducing uncertainty in estimating virus reduction by advanced water treatment processes.* Water Research Volume 133, 282 - 288.

[6] Harahap, T. A., Saefuddin, A., & Etty Riani, B. I. (2018). *The Relationship Between Clean School Environment And Student's Clean Lifestyle Behaviour In Indonesia Junior And Senior High School.* International Journal of Scientific & Technology Research Volume 7, Issue 3. 100 - 104.

[7] Hasana, M. (2018). *Comparison of Sellers's Awareness to Environmental Hygiene of Market Bulak, Market Klender and Market Rawamangun, East Jakarta.* The 2nd International Conference on Energy, Environmental and Information System.

[8] Jankowska, A., Polotskaia, A., Gomes, P., & Shaw, S. R. (2015). *The relationship between student health and academic performance: Implications for school psychologists.* School Psychology International. 36, 115-134.

[9] Juma, M. S., Chawene, A. B., & Mfinanga, F. A. (2018). *Men Spoilers, Women Cleaners. Gender roles and household sanitation and hygiene practices in Geita District, Tanzania.* Managing Development in Africa Volume 3 Issue 1, pp. 288-29, 288-296.

[10] Ma, H. K., Shek, D. T., Cheung, P. C., & Lam, C. O. (2016). *Parental, Peer, and Teacher Influences on the Social Behavior of Hong Kong Chinese Adolescents.* The Journal of Genetic Psychology, 65 – 78

[11] Miles J (2015). *Tolerance and Variance Infkation Factor*. [online] Available at : https://onlinelibrary.wiley.com/doi/book/10.1002/9781118445112 [Accessed on 15 December 2020]

[12] Raosoft.com. 2016. *Sample Size Calculator*. [online] Available at: http://www.raosoft.com/samplesize.html [Accessed 7 November 2020].