ENHANCED KNOWLEDGE IN SCIENCES AND TECHNOLOGY
e-ISSN: 2773-6385

EKST

Vol. 6 No. 1 (2026) 353-362
https://publisher.uthm.edu.my/periodicals/index.php/ekst

Student Satisfaction with University Facilities Using Cross Tabulation Analysis, Correspondence Analysis and Analytic Hierarchy Process

Muhammad Aiman Abdul Aziz[1], Norziha Che Him[1*], Noor Azliza Abd Latif[1], Yusliandy Yusof[2]

[1] *Department of Mathematics and Statistics, Faculty of Applied Sciences and Technology, UTHM Kampus Cawangan Pagoh, Hub Pendidikan Tinggi Pagoh KM1, Jalan Panchor, 84600 Pagoh, Muar, Johor, MALAYSIA.*
[2] *Faculty of Technical and Vocational Education, UTHM Kampus Parit Raja, 86400 Parit Raja, Batu Pahat, Johor, MALAYSIA.*

*Corresponding Author: norziha@uthm.edu.my
DOI: https://doi.org/10.30880/ekst.2026.06.01.042

Article Info

Received: 4 January 2026
Accepted: 20 January 2026
Available online: 9 July 2026

Keywords

Student Satisfaction, University Facilities, Correspondence Analysis, Analytic Hierarchy Process, Cross Tabulation Analysis

Abstract

University student satisfaction with facilities is a significant factor in determining the overall student learning process and welfare. This study investigates undergraduate student satisfaction with the facilities offered by Malaysian public universities and identifies the facilities that are most important in achieving overall satisfaction. This study employed secondary data obtained from Mendeley Data, which encompassed 280 respondents from the diploma, undergraduate, and postgraduate levels. To investigate the relationship between demographic features and the degree of satisfaction, the Cross Tabulation Analysis was applied. Correspondence Analysis was then used to examine the pattern of association between the categories of satisfaction and facilities of the university, and the Analytic Hierarchy Process was used to rank facilities in accordance with their relative significance in overall satisfaction. The results indicate significant associations between demographic characteristics and student satisfaction levels when the p-values < 0.05, suggesting that perceptions of university facilities vary substantially across gender, religion, age, and level of study. It also shows distinct association patterns between university facilities and satisfaction categories, with academic and support facilities clustering closer to high satisfaction, while infrastructure-related facilities are more strongly associated with lower satisfaction levels. AHP findings reveal that Bursary has the highest priority (0.2187) compared to Welfare, Health Centre, Islamic Centre and Library for Academic and Student Support Facilities. For Campus Infrastructure and Utilities, Wireless Internet has the most weight (0.2268) followed by Parking Lot, Toilet, Cleanliness and Cafeteria, while for Student Life and Campus Services, Transportation Centre has the highest weight (0.2815) followed by Auto-teller Machine, Sports Centre and Residential College. In conclusion, this study has provided a useful implication for university administrators in terms of setting priorities for improvement of facilities and encouraging data-driven decision-making to improve campus life for

students. Future research may extend this study by conducting primary surveys with larger sample sizes to improve the generalisability of findings on student satisfaction with university facilities.

1. Introduction

Student satisfaction is a fundamental concept in higher education, closely tied to the success and sustainability of academic institutions. It is usually seen as the reaction students have when what they expect from the university is delivered. Satisfaction is explained by [1] as the pleasure one experiences when comparing an actual product quality to what they expected based on the information available. Within education, satisfaction includes aspects such as how well the school serves students, offers educational opportunities and keeps the campus facilities to a high standard [2]. [3] explain that this increased attention toward student satisfaction is due to realising that students are customers, and how pleased they are will reflect on their commitment to the school as well as its image.

Analytic Hierarchy Process (AHP) is a good way to examine both how good university facilities are and how satisfied students are. By organising complex aspects such as academic resources and accommodation and asking users to two-by-two compare them, AHP guides the decision-making process. For universities interested in making improvements according to each criteria's importance, this is the right approach. [4] describes how AHP can assess faculty achievements and analyse the strengths and weaknesses of a university by combining several points of view, making it useful for enhancing both student happiness and a good reputation for the institution. Previous studies have demonstrated the effectiveness of the Analytic Hierarchy Process in evaluating student satisfaction, such as the work by [5], who applied AHP to prioritise academic service factors influencing students' satisfaction levels.

Similarly, Cross Tabulation Analysis (CTA) can be used to show how different demographic groups, such as gender or faculty, perceive university facilities. Looking at the links between these variables and student satisfaction, CTA can discover where dissatisfaction is primarily found. Demographic findings help universities to improve areas that match the different needs of their students. Previously, [6] investigated the perceptions of IEQ held by University College London students and the impact this had on their satisfaction using CTA. The research demonstrated that students in neutral or cooler indoor environments reported higher thermal satisfaction than those who were thermally uncomfortable. These results support the significance of facility enhancements that are based on the environment

Besides CTA and AHP, there is another method of investigation that can be utilised, called the Correspondence Analysis (CA). It is a method that is employed to investigate the association between various categorical variables in a contingency table [7]. It is a visual depiction of the association between row and column categories, projected to a low-dimensional display, usually two-dimensional. Complex relationships can be interpreted with the help of this graphical approach, and it is easy to see some hidden formations in the data with its help [8].

This study aims to identify the association between demographic groups and university student satisfaction levels with university facilities using Cross Tabulation Analysis, to investigate association patterns between university facilities and satisfaction rating using Correspondence Analysis and to evaluate the most critical university facilities contributing to overall university satisfaction using the Analytic Hierarchy Process.

2. Method

This part describes the data and methods used in this study to identify the association between demographic groups and university student satisfaction levels with university facilities, to investigate association patterns between university facilities and satisfaction rating and to evaluate the most critical university facilities contributing to overall university satisfaction.

2.1 Data Description

The data for this study were secondary data, which was obtain from a free-access data website called Mendeley Data, and were used to measure the level of students' satisfaction with university facilities, which are provided by the university as well as the government. This study involved 280 respondents comprising diploma, bachelor's degree and postgraduate students at the Malaysian Public University. Based on an online sample size calculator, Qualtrics, by using a 95% confidence level, estimated the population size to be 1000000, with a margin of error is 6% falls within acceptable thresholds for perception-based research when broader national representation is challenging to achieve, and the ideal sample size was estimated to be 267, indicating that the obtained sample of 280 respondents is sufficient for analysis [9].

Enhanced Knowledge in Sciences and Technology Vol. 6 No. 1 (2026) 353-362

2.2 Cross Tabulation Analysis

Cross Tabulation Analysis (CTA) makes it simple to explore the connections between various categorical variables. Using a cross-tabulation analysis, it is common to identify trends in the results of a survey for social purposes [10]. [11] suggest that using cross-tabulation, researchers can find associations between demographic information and important outcomes.

According to [12] CTA assists researchers in finding out if a single categorical variable is distributed differently according to the values of another. It is best applied in survey research when the variables involve categories. Usually, the chi-square test of independence is applied with CTA to measure if the pattern in the contingency table is a significant finding. If the chi-square result indicates a difference, it means student satisfaction is an area to focus on for certain student subgroups.

There are four steps in CTA; 1) data preparation, 2) construct the cross tabulation table, 3) Pearson's chi-square test of independence, and 4) interpret the result. Pearson's chi-square test of independence is defined as Equation (1)[13];

$$\chi^2 = \sum \frac{\left(O_{ij} - E_{ij}\right)^2}{E_{ij}} \tag{1}$$

where:

O_{ij} is the observed frequency in each category,

E_{ij} is the expected frequency in each category.

2.3 Correspondence Analysis

CA is a statistical technique that depicts a graphical representation of contingency tables. Data analysis generally involves the use of contingency tables, and mainly the data is arranged [7]. They are divided into different sets of categories. The graphical form or graphic Outline presentation is actually a demonstration of types of traits by plotting a graph of points, and most often on a 2-dimensional coordinate system. CA falls in the same camp as dimensional exploratory methods [14]. CA was used in the study to analyse the factors that affected heart disease. The correspondence map will be seen in terms of looking at the locations of points that represent the categories of the plotted variables. The points are sets of various criteria that were lying close to one another; the other refers to the reality of relationships that exist among categories. Equation (2) shows the formula to calculate Chi square distance [15];

$$d\left(i,i'\right) = \sqrt{\sum_j \left(\frac{\left(P_{ij} - P_{i'j}\right)}{P_{+j}} \right)} \tag{2}$$

where:

P_{ij} is the relative frequency for row *i*

$P_{i'j}$ is the relative frequency for row *i'*

P_{+j} is the marginal relative frequency.

Inertia in CA is a measure of the total variance or dispersion in the data [15]. It reflects how far the profiles deviate from what would be expected under statistical independence. Equation (3) presents how to calculate Inertia.

$$\Lambda^2 = \sum_i P_i + d_i^2 \tag{3}$$

where:

P_i is the observed frequency in each category,

d_i^2 is the chi-square distance.

There are seven steps in CA; 1) construct the contingency table, 2) calculate relative frequencies, 3) compute the chi-square distance, 4) calculate inertia, 5) perform singular value decomposition, 6) generate the perceptual map and 7) interpret the result.

2.4 Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) was employed in this study to determine the most prioritised criteria for identifying an ideal partner. This method was applied using data gathered through questionnaires. Developed by Thomas Saaty in the 1970s, AHP is a structured decision-making approach that assists in selecting the best option among several alternatives based on defined criteria [16]. Equation (4) shows how to calculate the priority vector[4];

$$w_i = \frac{\sum_{j=1}^{n} n_{ij}}{n} \tag{4}$$

where:

n_{ij} is the sample size for *ij*,

n is the sample size.

The weighted sum vector must be calculated to check if the ratings are consistent. All that is needed is to multiply the original pairwise comparison matrix by the priority vector to finish this step. As a result, a new vector is made, and every element in it is divided by the associated element in the priority vector as in Equation (5)[17];

$$Aw = \lambda_{max} w_i \tag{5}$$

where:

λ_{max} is principle eigenvalue,

w_i is priority vector (Weight).

The principal eigenvalue, called λ_{max}, is calculated by dividing the average of the vector obtained from the weighted sum by the values in the priority vector, as shown in Equation (6). The main role of the principal eigenvalue is to judge how consistent the pairwise comparison.

$$\lambda_{max} = \frac{\sum_{i=1}^{n} \frac{(Aw)_i}{w_i}}{n} \tag{6}$$

where:

Aw is weighted sum vector,

w_i is weight score for decision criteria,

n is sample size.

The Consistency Index (CI) is calculated using the formula in Equation (7)[17]. The CI is an indicator of how regularly the necessary judgments have been given in pairwise comparisons;

$$CI = \frac{\lambda_{max} - n}{n-1} \tag{7}$$

where:

$\lambda_{\max}$ is principle eigenvalue,

n is sample size.

The CR says how much we trust the pairwise rankings. Usually, a CR value lower than 0.10 is regarded as satisfactory. If CR goes beyond 0.10, the judges' ratings might not be accurate, so their pairwise comparisons should be corrected. The Consistency Ratio (CR) is computed by using Equation (9), where CI is the consistency index and RI is the random index [18];

$$CR = \frac{CI}{RI} \tag{8}$$

where:

CI is the consistency index,

RI is the random index.

Enhanced Knowledge in Sciences and Technology Vol. 6 No. 1 (2026) 353-362

There are 10 steps in AHP; 1) define the problem and hierarchical structure, 2) construct a pairwise comparison matrices, 3) normalize the pairwise comparison matrix, 4) compute the priority vector or weights, 5) compute the weighted sum vector, 6) eliminate the principal eigenvalue, 7) calculate the consistency index, 8) obtain the random index, 9) compute the consistency ratio and 10) aggregate weights across hierarchy.

3. Results and Discussion

This section shows the findings obtained from the descriptive analysis, CTA, CA and AHP. The results are interpreted to identify the association between demographic groups and university student satisfaction levels with university facilities, to investigate association patterns between university facilities and satisfaction rating and to evaluate the most critical university facilities contributing to overall university satisfaction.

3.1 Cross Tabulation Analysis

The purpose of the cross tabulation analysis is to determine whether student demographics and satisfaction levels for each facility were significantly association. The findings demonstrate that different demographic groups have different perceptions of university facilities by revealing numerous significant associations across multiple facilities. The chi-square test of independence confirmed that student demographic characteristics and satisfaction levels for university facilities are significantly associated, as all reported relationships yielded p-values less than 0.05, leading to the rejection of the null hypothesis of no association. Rather, this study indicates that students' perceptions of their campus environment were influenced by a variety of criteria, including age, gender, race, religion, and level of studies. This study is divided into three, Part 1, Part 2 and Part 3.

3.1.1 Part 1: Academic & Student Support Facilities

Table 1 shows the association between demographic variables and student's satisfaction with support facilities.

Table 1 Association between demographic variables and student's satisfaction with support facilities

Demographic	Facility	Chi Square	p-value
Religion	Islamic Centre	86.254	0
Religion	Welfare	51.751	0.0432
Race	Islamic Centre	52.043	0.0008
Level of Studies	Bursary	43.387	0.0007
Level of Studies	Library	33.42	0.0065
University	Islamic Centre	206.828	0.0074
Ages	Bursary	122.175	0
Ages	Health Centre	90.311	0
Ages	Islamic Centre	44.659	0.0064

According to Table 1, it is quite clear that the level of satisfaction with the academic and student support facilities differs greatly in demographic groups. High levels of association between religion and satisfaction with the Islamic Centre indicate that students belonging to various religious groups will vary in their level of participation and expectations with the students who attend the facility more often and hold more opinions being either positive or negative. In like manner, the strong significant relationship between religion and welfare satisfaction means that cultural or religious values affect the perceptions of welfare programmes, support services, and responsiveness of the staff. The racial differences also influence the satisfaction of the Islamic Centre,

probably because of the differences in the cultural or religious needs and frequency of use. The age factor is also significant, and the younger the student, the higher the level of satisfaction with the Islamic Centre, Health Centre, and bursary, as older students may be more critical with that kind of services. Also, the level of study and satisfaction with the bursary and library have strong relationships, which indicate varying levels of expectation, especially among postgraduate students who are dependent on the services delivered to a larger extent. Altogether, these findings prove the idea that demographic factors are a potent determinant of satisfaction which means that not all groups are affected by the support services provided to students.

3.1.2 Part 2: Campus Infrastructure & Utilities

Table 2 shows the association between demographic variables and students' satisfaction with campus infrastructure and utilities.

Table 2 Association between demographic variables and students' satisfaction with campus infrastructure and utilities

Demographic	Facility	Chi Square	p-value
Religion	Cleanliness	56.781	0.0151
Gender	Wireless Internet	19.358	0.0223
Level of Studies	Cleanliness	32.051	0.0217
Level of Studies	Toilet	30.408	0.0337

The demographics have a great impact on satisfaction with campus infrastructure and facilities like wireless internet, cleanliness and toilets. The gender and satisfaction with wireless internet association could be in terms of difference in the use of online platforms, the deployment of instructional systems, or recreation internet by men and women students and differences in preferred learning environments or learning behaviours. There are also significant association between satisfaction with toilet facilities and cleanliness especially among undergraduate students who spend more time in the campus, and thus have more knowledge on the toilet facilities than graduate students. Moreover, the issue of satisfaction with cleanliness associate with religion and this implies that cultural or religious beliefs may affect the prioritisation of cleanliness amongst students. Altogether, the results show that the level of satisfaction with campus infrastructure is influenced not only by the quality of facilities but also by the expectations and use patterns as well as cultural norms of students.

3.1.3 Part 3: Student Life & Campus Services

Table 3 shows the association between demographic variables and students' satisfaction with Student Life and Campus Services.

Table 3 Association between demographic variables and students' satisfaction with student life and campus services

Demographic	Facility	Chi Square	p-value
Religion	Sport Centre	113.387	0
Gender	Sport Centre	23.276	0.0056
Level of Studies	Residential College	34.099	0.0122

From Table 3, it shows a high level of disparity among the different demographics regarding satisfaction with facilities related to student life. Gender and religion have strong association with the degree of satisfaction with

sports facilities, where students of various religious orientations can have particular requirements concerning the use of gender-segregated sports or proper attire that can influence their comfort, and satisfaction. Gender differences also conform to the general trends in the use of athletic facility, male and female students might differ in their preferences regarding the training conditions, time or equipment. Moreover, the degree of satisfaction with residential college facilities depends on the level of study, as diploma students tend to have a higher contact with the facilities since they live on campus in their first years and postgraduate students live off campus thus, expectations vary with the academic level and thus satellite differences in the level of satisfaction.

3.2 Correspondence Analysis

Correspondence Analysis was used to investigate the patterns of association of university facilities and various levels of student satisfaction. The approach enables the researcher to determine the relationship between the categorical variables visually, which is more convenient in identifying the facilities that are strongly related to the high, medium, or low levels of satisfaction. The CA results are very insightful in knowing how the students perceive the facilities offered by the universities and enable the universities to know what services are doing well and those that need their attention. Fig. 1 displays the biplot for facilities and satisfaction categories.

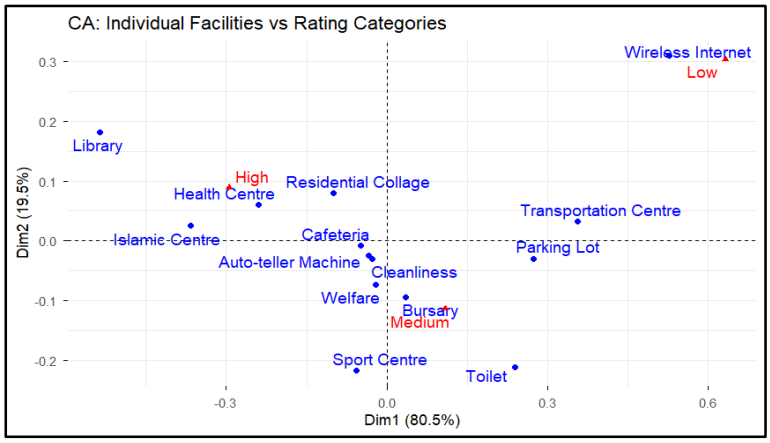

Fig. 1 Biplot for facilities and satisfaction categories

The association patterns between university amenities and the three satisfaction categories (High, Medium, Low) are shown in the Correspondence Analysis (CA) biplot. The first dimension (Dim1), accounting for 80.5% of the variation, separates facilities linked to lower versus higher satisfaction. Wireless Internet, the Transportation Centre, the Parking Lot, and the Toilet appear on the right side near "Low," indicating they are often seen as unsatisfactory. Conversely, the Library, Islamic Centre, Health Centre, and Auto-teller Machine on the left are closer to "High," suggesting these facilities enhance the campus experience. The Library, positioned far to the left, is consistently associated with high satisfaction.

The second dimension (Dim2), explaining 19.5% of the variation, differentiates facilities with moderate versus extreme satisfaction. The Cafeteria, Bursary, cleanliness, and residential college near the centre show mixed reactions from students. The Sport Centre and Welfare, slightly lower on the plot, indicate poorer satisfaction, while the Toilet's location in the lower right quadrant reinforces its link to dissatisfaction.

Overall, the CA plot highlights that academic and religious/support facilities are rated higher than critical infrastructure, which tends to receive poorer ratings. Facilities near the centre elicit varying opinions, pointing to areas needing improvement. These patterns align with the cross-tabulation results, confirming that satisfaction varies across facility types.

3.3 Analytic Hierarchy Process

The Analytic Hierarchy Process was used to identify the relative importance of each facility within its respective category. The study can identify which facilities have the greatest impact on overall student happiness according to the weighted rankings provided by the AHP results. These results are essential for assisting universities in setting priorities for improvement projects.

3.3.1 Part 1: Academic & Student Support Facilities

Table 4 shows the AHP weight distribution for Academic and Student Support Facilities, indicating their relative importance in contributing to overall student satisfaction.

Table 4 Analytic hierarchy process weights for academic and student support facilities

Rank	Facilities	Weight
1	Bursary	0.2187
2	Welfare	0.2112
3	Health Centre	0.1993
4	Islamic Centre	0.1910
5	Library	0.1798

The results show that bursary and welfare services are services which are most essential in the academic and student support facilities. This implies that financial support, welfare provision, and advice on how to handle the academic life is of great significance to the students. The fact that health centre is ranked high also demonstrates the importance of physical and mental health of the students. The Islamic Centre and library come next to suggest that, although academic and spiritual facilities are still significant, students prefer to spend more on the overall well-being and support facilities as opposed to an academic facility.

3.3.2 Part 2: Campus Infrastructure & Utilities

Table 5 shows the AHP weight distribution for Campus Infrastructure and Utilities, indicating their relative importance in contributing to overall student satisfaction.

Table 5 Analytic hierarchy process weights for campus infrastructure and utilities

Rank	Facilities	Weight
1	Wireless Internet	0.2268
2	Parking Lot	0.2039
3	Toilet	0.2003
4	Cleanliness	0.1853
5	Cafeteria	0.1837

The most important facility for campus infrastructure and utilities is wireless internet. Given our increasing reliance on technology and digital learning resources, this makes sense. In addition to academic work, communication, online submission, virtual classes, and information access all depend on dependable internet access. Parking, toilets, and cleanliness are also highly valued, demonstrating how the campus environment and everyday convenience greatly influence students' overall university experience. Although it still makes a significant contribution to student life, the cafeteria is given a little less weight.

3.3.3 Part 3: Student Life & Campus Services

Table 6 shows the AHP weight distribution for Student Life and Campus Services, indicating their relative importance in contributing to overall student satisfaction.

Table 6 Analytic hierarchy process weights for Student Life and Campus Services

Rank	Facilities	Weight
1	Transportation Centre	0.2815
2	Auto-teller Machine	0.2421
3	Sport Centre	0.2417
4	Residential Collage	0.2346

The transportation centre is the most important component of student life and campus services. This implies that students' everyday experiences are greatly enhanced by mobility and the capacity to move between buildings, faculties, and dorms. Access to financial services and recreational activities is crucial, as evidenced by the high rankings of the sports centre and ATM services. Although the weight is relatively near to the other facilities, residential colleges are ranked last in this category, indicating that housing is still important but not as important as financial or transportation access.

4. Conclusion and Recommendations

In conclusion, this study points to the fact that demographic factors, performance of a particular facility in the university, and the relative role of the facilities in the overall satisfaction of the students of the Malaysian public universities determine the levels of their satisfaction with the facilities. The results show that some of the facilities will play more crucial roles in the overall perceptions of students, which suggests that improvement strategies have to be prioritised. It is then suggested that the university administrators should channel their strength and invest their resources in the facilities that are considered to be critical and regularly review the satisfaction of the students by using the regular evaluations to make sure that the facility planning and management meet the needs and expectations of students. Future studies are encouraged to conduct primary data collection through self-administered surveys with larger sample sizes to enhance the representativeness and robustness of findings on student satisfaction with university facilities.

Acknowledgement

The authors would like to thank the Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia, for its support.

Conflict of Interest

The authors declare no conflict of interest in the paper's publication

Author Contribution

The authors confirm their contribution to the paper as follows: ***study conception and design:*** *Muhammad Aiman Abdul Aziz, Norziha Che Him;* ***data collection:*** *Muhammad Aiman Abdul Aziz;* ***analysis and interpretation of results:*** *Muhammad Aiman Abdul Aziz, Norziha Che Him;* ***draft manuscript preparation:*** *Muhammad Aiman Abdul Aziz, Norziha Che Him, Noor Azliza Abd Latif, Yusliandy Yusof. All authors reviewed the results and approved the final version of the manuscript.*

References

[1] P. Kotler. (1997). *Marketing Management: Analysis, Planning, Implementation, And Control*, 9th ed. Prentice Hall of India Private Limited.

[2] Launi, A. U., Adeyemi, A., Bello, M. U., & Yahaya, M. U. (2024). Impact Of Facilities Management Service Quality And Students' Satisfaction On Institution Image (A Case Study of Abubakar Tafawa Balewa University Bauchi). International Journal of Management Sciences, 12(2), 286–299. https://doi.org/27751456211240

[3] F. Khurshid and M. Arshad. (2012). Student satisfaction with campus facilities. *Elixir Soc. Sci.*

[4] N. Moradi. (2022). Performance Evaluation Of University Facility By Combining BSC, AHP And TOPSIS: From Students' Perspective. *International Journal of the Analytic Hierarchy Process*, vol. 14, no. 2. doi: 10.13033/ijahp.v14i2.915.

[5] Armawan Saka, G., & Halim Hasugian, A. (2024). Analytical Hierarchy Process Method to Determine Student Satisfaction Level with Academic Services. Architecture and High Performance Computing, 6(3). https://doi.org/10.47709/cnapc.v6i3.4021
[6] Lyu, J., & Pitt, M. (2025). Cross-tabulation Analysis of the Impact of University Students on IEQ Factors. Journal of Operations Intelligence, 3(1), 76–95. https://doi.org/10.31181/jopi31202535
[7] M. Greenacre. (2007). *Correspondence Analysis in Practice Second Edition*.
[8] F. Husson, S. Lê, and J. Pagès. (2017). *Exploratory Multivariate Analysis by Example Using R*. Chapman & Hall/CRC.
[9] S. Bhalerao and P. Kadam. (2010). Sample size calculation. *Int J Ayurveda Res*, vol. 1, no. 1, p. 55. doi: 10.4103/0974-7788.59946.
[10] Mohd Pakri, M. A., Arif Shah, J., Mohamed Haris, N. B., & Mazlan, N. (2024). The Perspective of Vegetable Farmers in Readiness to Face the Post Covid-19 Pandemic: A Cross-Tabulation Analysis. Advances in Agricultural and Food Research Journal, 5(1). https://doi.org/10.36877/aafrj.a0000502
[11] J. N. Agumba. (2016). Cross Tabulation Analysis: Determinants of Mathematics Success among Civil and Built Environment Students. *Integrated Solutions for Infrastructure Development*.
[12] D. R. White. (2004). A Student's Guide to Statistics for Analysis of Cross Tabulations. [Online]. Available: http://www.roulette.sh/,
[13] Nihan, S. T. (2020). Karl Pearsons chi-square tests. Educational Research and Reviews, 15(9), 575–580. https://doi.org/10.5897/err2019.3817
[14] H. Abdi and M. Béra. (2007). Correspondence Analysis. *Encyclopedia of Measurement and Statistics*.
[15] Sourial, N., Wolfson, C., Zhu, B., Quail, J., Fletcher, J., Karunananthan, S., Bandeen-Roche, K., Béland, F., & Bergman, H. (2010). Correspondence analysis is a useful tool to uncover the relationships among categorical variables. Journal of Clinical Epidemiology, 63(6), 638–646. https://doi.org/10.1016/j.jclinepi.2009.08.008
[16] T. L. Saaty. (2008). Decision making with the analytic hierarchy process.
[17] Taherdoost, H. (2017). Decision Making Using the Analytic Hierarchy Process (AHP); A Step by Step Approach. International Journal of Economics and Management Systems, 2, 244–246. http://www.ahooraltd.comhttp://www.hamta.org
[18] Munisa, T. (2025). An Analytic Hierarchy Process (AHP) Approach For Prioritization Of Export Development Strategies In Uzbekistan. Ilg'or Iqtisodiyot va Pedagogik Texnologiyalar, 2(3), 111–117. https://doi.org/10.60078/3060-4842-2025-vol2-iss3- pp111-117