ASSESSMENT OF FACTORS INFLUENCING STUDENTS' DECISION AFTER SECONDARY SCHOOL: A STUDY ON THE DECLINING ENROLLMENT TREND IN TERTIARY EDUCATION

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Abstract:

Tertiary education plays a crucial role in promoting economic growth and development. Investing in tertiary education can contribute to economic growth by providing a skilled workforce, fostering innovation, and advancing research and development (World Bank, 2021). The Department of Statistics Malaysia (DOSM) released a report in 2019 revealed that, of the 560,000 SPM candidates, 390,000 were interested in starting a job right away and just 170,000 were interested in continuing their education. These concerning findings drive this study to identify the factor and subfactor that impact the student's decision not to pursue higher education. The factors considered are financial constraints, student attributes and social influence. The subfactors are family background, high fees, availability of scholarships, dissatisfaction with the offered course, academic performance, social media, peer pressure, and a lack of motivation. This paper utilises the Fuzzy AHP Method to identify and rank the main factor and subfactor influencing the respondents' decision, which are students from SMK Sungai Layar, Sungai Petani. Results show that financial constraint is the most preferred factor, while student attribute is the second-best factor. Meanwhile, social influence is found to be the lowest ranked factor.

Introduction

Education is a crucial component of growth and development. Good education provides and improves both physical and mental standards for individuals (Rasberry et al., 2011). People can increase their knowledge and abilities through a proper education. A nation's foundation is also said to be its educational system. It serves as a tool to support and build the nation's economy and community, raising living standards and reducing unemployment (Gibb et al., 2012). According to Marques (2021), people who do not prioritize continuing their education enough in their own life are likely to be less happy or fulfilled since they spend less time engaging in personal development activities and exploring their interests. Besides, elderly people who learn less frequently than they should are more prone to degenerate cognitively more quickly. Furthermore, tertiary education can provide individuals from disadvantaged backgrounds with the necessary skills and qualifications to access higher-paying jobs and improve their socioeconomic status (OECD, 2015). Over the years, Malaysia has experienced a notable expansion in the education sector. The ministry of education is making much effort to make sure that the educational system can change to meet consumer demand (Ariffin et al., 2008). Since the beginning of the industrial period, technical advancements have unquestionably increased and had a significant impact on the workforce. Individuals must constantly expand their knowledge and abilities to keep up with technological innovation (Jones & Sallis, 2013).

However, the overall number of students enrolled in higher education has recently grown at slower rates. According to a report released by the Department of Statistics Malaysia (DOSM), in 2019, out of the 560,000 Sijil Pelajaran Malaysia (SPM) candidates, 390,000 were inclined towards immediate employment, while only 170,000 expressed interests in furthering their education. This trend persisted in subsequent years, with 271,270 out of 401,105 SPM candidates opting out of tertiary education in 2020. Similarly, in 2021 and 2022, a total of 277,262 out of 407,097 SPM candidates and 258,497 out of 373,974 SPM candidates, respectively, made similar decisions to forego tertiary studies. This shift in preferences has not only affected SPM candidates but has also impacted private higher educational institutions (IPTS). In 2018, statistics revealed that out of 1.32 million students in institutions of higher learning (IPT), approximately 670,000 were enrolled in IPTS. However, the number of students continuing their studies at IPTS in 2021 and 2022 failed to surpass 600,000 (Utusan, 2021). This emerging trend has raised concerns among various stakeholders, including the Ministry of Higher Education (KPT), educational institutions, stakeholders, and potential employers. Understanding the underlying causes and implications of this phenomenon is essential for addressing the challenges confronting the higher education sector and ensuring equitable access to learning opportunities for all. Thus, this study aims to identify and prioritize the factors and subfactors influencing the decision of former students from Sekolah Menengah Kebangsaan Sungai Layar to abstain from pursuing tertiary education studies.

Literature Review

Multi-Criteria Decision Making (MCDM) is a decision-making tool that integrates quantitative and qualitative considerations to address complex choices (Afolayan, 2021). MCDM

encompasses techniques such as Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), Fuzzy Delphi, ELECTRE and Analytic Hierarchy Process (AHP) to evaluate multiple alternatives with conflicting criteria (Saaty, 2008). These methods assist decision-makers in selecting the most desirable option, particularly in uncertain situations (Zhang et al., 2019).

Fuzzy Analytical Hierarchy Process (FAHP)

Fuzzy sets, introduced by Zadeh (1965), are a collection of elements characterized by membership degrees. This theory provides a methodology for decision-making by assigning degrees to elements using fuzzy set descriptions (Konstantinidis al., 2011). Fuzzy sets encompass various types of fuzzy numbers, such as triangular, trapezoidal, and Gaussian fuzzy numbers, which represent uncertain or imprecise linguistic values.

A triangular fuzzy number, M, denoted by a triple of real numbers (a,b,c) is shown in Figure 1 with parameter $a \leq b \leq c$ where a,b,c indicates the smallest to the largest possible value of membership function $\mu_M(x)$.
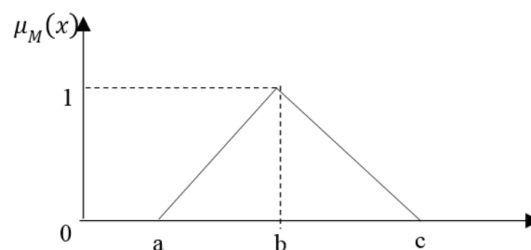

Figure 1: Triangular Fuzzy Number

The membership function, $\mu_M(x)$ is given as follows:

$$\mu_M(x) = \begin{cases} \dfrac{x-a}{b-a}, & a \leq x \leq b \\ \dfrac{c-x}{c-b}, & b \leq x \leq c \\ 0, & otherwise \end{cases}$$

By utilizing fuzzy set theory, decision-makers can handle situations where precise boundaries or crisp categorizations are inadequate. This allows for a more nuanced treatment of uncertainty and ambiguity in decision-making processes. The Fuzzy Analytic Hierarchy Process (FAHP) is a decision-making technique that integrates Fuzzy Logic Theory with the Analytic Hierarchy Process (AHP) (Saaty, 1980). FAHP combines AHP with Fuzzy set theory to provide decision-makers with a more systematic and realistic approach to decision-making. It considers appropriate criteria and alternatives while incorporating human logic (Buckley, 1985). The integration of Fuzzy set theory into AHP through FAHP enhances the flexibility and adaptability of the decision-making process, enabling decision-makers to handle situations where crisp boundaries may be inadequate (Wang & Luo, 2005). This study employs the Fuzzy Analytic Hierarchy Process (FAHP) due to its ability to offer a more realistic and effective approach to decision-making, particularly in situations characterized by uncertainties and

imprecisions in human judgment. FAHP is favoured for its capacity to translate linguistic decisions into numerical analyses, facilitating direct comparisons between factors and subfactors. Moreover, the flexibility inherent in FAHP is deemed crucial for this study, which relies on experts' opinions and perceptions. This flexibility allows decision-makers to articulate their preferences in a more adaptable and subjective manner, thereby enhancing the overall effectiveness of the decision-making process.

Factors and Subfactors

In this section, factors and subfactors influencing students' decisions after secondary school are discussed and listed in the following subsection. There are three main factors that have been considered in this paper which are financial constraints, social attributes, and social influence.

Financial Constraints

Financial constraints, refer to limitations or barriers that individuals face due to inadequate financial resources, which can significantly impact their decisions and choices, including the pursuit of tertiary education (Dynarski, 2003). Financial constraints play a crucial role in shaping educational opportunities in Malaysia, where the cost of higher education is a concern for many students and their families. One major financial constraint is the high cost of tuition fees and related expenses associated with tertiary education (Hossler et al., 1989). Malaysian students often face the challenge of affording the fees required for enrolment in universities or colleges. Meanwhile, scholarships, grants, and financial aid programs can alleviate the financial strain, but limited availability and stiff competition make it difficult for all students to secure such assistance (Dynarski, 2003). As a result, some students may be deterred from pursuing tertiary education altogether or may have to compromise on their preferred institutions or programs due to financial considerations. Furthermore, students from financially disadvantaged backgrounds may have to work part-time jobs or engage in other income-generating activities to support themselves. They may also need to contribute to their family's financial needs. Balancing work and study commitments can be challenging, potentially affecting academic performance and overall educational experience.

Student Attributes

Students' attributes, refer to the individual characteristics, traits, and qualities that influence their educational experiences, performance, and decision-making processes (Hossler et al., 1989). Academic preparedness refers to the level of knowledge, skills, and competencies that students possess prior to engaging in a specific educational program or course. It encompasses the foundation of academic abilities and content knowledge that students bring with them as they enter higher education or pursue further studies. Academic preparedness plays a crucial role in students' ability to comprehend, engage with, and succeed in their academic pursuits. Additionally, dissatisfaction with a course offered in an educational institution can arise when students feel that the course does not meet their expectations, needs, or align with their academic or career goals (Zahra, 2014). Students may feel that the course content or curriculum is not aligned with their academic interests or career aspirations. They may perceive a lack of relevance to their chosen field of study or future professional goals.

Social Influences

Social influence refers to the process through which individuals are influenced by the thoughts, attitudes, beliefs, and behaviours of others within their social environment (Hossler et al., 1989) Media and online platforms also play a role in social influence. Media portrayals of successful

individuals who have achieved educational milestones can shape students' perceptions and aspirations. Online platforms, such as social media, provide opportunities for information sharing, peer influence, and exposure to different educational opportunities, further impacting students' decisions. Additionally, peers and friends also exert considerable influence on students' decision-making processes. Peer discussions, sharing of experiences, and recommendations regarding specific institutions, programs, or career paths can impact students' decisions to pursue tertiary education (Solomon., 1955). One aspect of social influence is the impact of family and parental expectations. Parents often have strong aspirations for their children's education and future success. Their beliefs, values, and encouragement can shape students' attitudes towards higher education (Hossler et al., 1989).

Methodology
There are two stages that start with data collection, followed by data implementation that involves seven steps before each factor can be ranked.

Data Collection

Instrument
The questionnaires are developed by referring to Byun et al. (2012) and Scott (2011) which covered the same subject area. There are two sections to the questionnaire: Part A and Part B. Demographic questions in Part A concentrate on the respondents' backgrounds. The subjects covered in Part B are related to the criteria and sub criteria of this study. Part B focuses on the factors and subfactors involved. A hierarchical structure is created to represents the problem and each question in Part B will be presented in a pair of factors or subfactors and the decision makers will express their opinion using the chosen scale according to AHP. Fundamentally, questions in Part B are a series of comparisons between factors and subfactors with the concepts are similar to past studies and this research has adopted from Lyu et al. (2020) and Razi et al. (2020).

Participants
The respondents are from SMK Sungai Layar, Sungai Petani, Kedah, which includes 60 former students from SMK Sungai Layar aged 18 years old who do not pursue studies in tertiary education. Participants are identified with the help of school administration after their consent to participate. The questionnaire is distributed physically, and they are given a couple days to complete the task.

Data Analysis
After the data collection process, Part B of the questionnaire are analysed in a series of steps in FAHP. The comparisons made between factors and subfactors are first translated into fuzzy number before further calculated. The following steps shows how FAHP treat and interpret the questionnaire to obtain the objective which is to identify the influential factors and subfactors.

Step 1: Comparing the factors and subfactors via linguistic terms.
The decision makers compare the factors and subfactors using the linguistic terms in Table 1.

Table 1: Triangular Fuzzy Number with Linguistic Variables

Saaty Scale	Definition	Fuzzy Triangular Scale
1	Equally importance (EI)	(1,1,1)
3	Weakly importance (WI)	(2,3,4)
5	Fairly importance (FI)	(4,5,6)
7	Strongly importance (SI)	(6,7,8)
9	Absolutely importance (AI)	(9,9,9)
2		(1,2,3)
4	The intermittent values	(3,4,5)
6		(5,6,7)
8		(7,8,9)

The pairwise comparison matrix denoted as Q_k is shown as follows. How many of the kth decision-makers chose the ith criteria over the jth criteria are shown by the triangular numbers p_{ij}^k.

$$Q_k = \begin{bmatrix} p_{11}^k & p_{12}^k & \cdots & p_{1n}^k \\ p_{21}^k & \cdots & \cdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ p_{n1}^k & p_{n2}^k & \cdots & p_{nn}^k \end{bmatrix}$$

Step 2: Determining the average fuzzy number of preferences.

If there are many decision-makers, the preferences of each are averaged, and p_{ij} is determined by the following equation:

$$p_{ij} = \frac{\sum_{k=1}^{k} p_{ij}^k}{k}$$

Then, the pairwise contribution matrix is update in accordance with the averaged preferences, as shown below.

$$Q = \begin{bmatrix} p_{11} & \cdots & p_{1n} \\ \vdots & \ddots & \vdots \\ p_{n1} & \cdots & p_{nn} \end{bmatrix}$$

Step 3: Calculating the geometric mean of fuzzy comparison value.

The following equation are then used to calculate the geometric mean of the fuzzy comparison values for each factor where the number of factors in the study is n.

$$s_i = \left(\prod_{j=1}^{n} p_{ij} \right)^{\frac{1}{n}}, i = 1, 2, ..., n$$

Step 4: Determining the fuzzy weight of each factor.

The fuzzy weight of each factor is determined by finding the vector summation of each s_i first. Then the inverse of summation vectors is calculated. To make it in ascending order, remove

the fuzzy triangular number. Lastly, the fuzzy weight of criteria z_i is multiplied each s_i with the reverse vector. Equation below incorporated all the steps used to determine the fuzzy weight of each factor.

$$z_i = s_i \left(s_1 + s_2 + s_3 + \cdots + s_n \right)^{-1}$$
$$= \left(lz_i, mz_i, uz_i \right)$$

Step 5: De-fuzzifying the fuzzy weight of factor.
The fuzzy weights of each factor need to be de-fuzzified by using Centre of Area method that was introduced by Chou and Chang (2008) because are still fuzzy triangular numbers. The calculation is shown as follows.

$$A_i = \frac{\left(lz_i, mz_i, uz_i \right)}{3}$$

Step 6: Normalising the de-fuzzified weight of factor.
The normalization of the de-fuzzified weight of factor is required as A_i is a non-fuzzy number. The equation below shows how the normalization is done.

$$B_i = \frac{A_i}{\sum_{i=1}^{n} A_i}$$

Result and Discussion
To illustrate the prior methods, we consider three factors namely financial constraints, students attributes and social influence and eight subfactors. Figure 2 below depicts the hierarchy structure of this study.
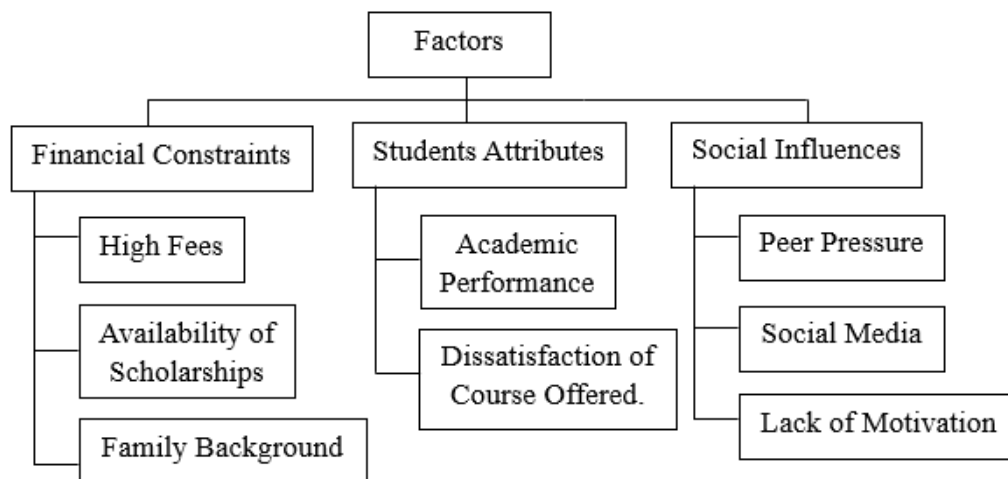

Figure 2: Hierarchy Structure of Factors and Subfactors

Evaluation of Factors and Subfactors
Evaluation is carried out based on the sixty respondents of former SMK Sungai Layar students. Decision makers were asked to assess the relative importance of the factor using the linguistic term represented in the form of Triangular Fuzzy Number through pairwise comparisons. Next, the average fuzzy number are calculated, and the results are shown in Table 2.

Table 2: Updated Pairwise Comparison for Factors

Factors	Financial Constraints	Student Attributes	Social Influence
Financial Constraints	(1,1,1)	(13/4,25 /6,5)	(22/3,23 /3,8)
Student Attributes	(2/3,3/4,1)	(1,1,1)	(3,23/6 ,14/3)
Social Influence	(1/4,1/3,3/7)	(1/2,5 /7,1)	(1,1,1)

The geometric mean of the fuzzy comparison for the factor is a crucial step in determining the fuzzy weight of the factor. Table 3 shows the geometric mean obtained for each factor.

Table 3: Geometric Mean for Each Factor

Factors	Geometric Mean		
Financial Constraints	2.8741	3.1725	3.4421
Student Attributes	1.2371	1.4313	1.6363
Social Influence	0.5138	0.6228	0.7348

The following step is to find the fuzzy weight of each factor. By implementing the formula used in previous section, the fuzzy weight is obtained and tabulated in Table 4.

Table 4: Fuzzy Weight of Factors

Factors	Fuzzy Weight		
Financial Constraints	0.4944	0.6070	0.7442
Student Attributes	0.2128	0.2738	0.3538
Social Influence	0.0884	0.1192	0.1589

In order to rank all the factors, the fuzzy weight of the factor is de-fuzzified first, before normalised and ranked. Table 5 shows the de-fuzzified weight of each factor.

Table 5: The De-fuzzified Fuzzy Weight of Factors

Factor	Weight
Financial Constraints	0.6152
Student Attributes	0.2802
Social Influence	0.1221
Total	1.0175

Table 6 shows the normalised fuzzy weight of each factor and their respective rank based on the normalised fuzzy weight value. The rank is determined based on the normalised fuzzy weight in which the higher value are ranked as number one.

Table 6: The Normalized Fuzzy Weight and Rank of Factors

Factor	Weight	Rank
Financial Constraints	0.6046	1
Student Attributes	0.2753	2
Social Influence	0.1200	3

The same methods are repeated to acquire the global weight of the subfactor by multiplying factors weight and subfactor weight. To calculate the result for each subfactor, the global

weight of the factor is multiplied by the weight of the subfactor, and the products are summed. Subsequently, these results are arranged in ascending order and presented in Table 7.

Table 7: Global Weight of Factor

	Financial Constraints	Student Attributes	Social Influence	Total	Rank
High Fees	0.1553	0.0932	0.0528	0.3012	1
Availability of Scholarships	0.1086	0.0669	0.0392	0.2146	2
Family Background	0.0548	0.0356	0.0222	0.1127	3
Academic Performances	0.0265	0.0165	0.0099	0.0529	5
Dissatisfaction of Course Offered	0.0371	0.0225	0.0131	0.0727	4
Peer Pressure	0.0195	0.0125	0.0079	0.0399	8
Lack of Motivation	0.0205	0.0129	0.0079	0.0413	7
Social Media	0.0246	0.0153	0.0092	0.0491	6

Lastly, Table 8 displays the final ranking of the factors and subfactors that influence the decisions of former SMK Sungai Layar students not to pursue higher education.

Table 8: Rank of Factors and Subfactors

Factor	Rank	Subfactor	Rank
Financial Constraints	1	High Fees	1
		Availability of Scholarships	2
		Family Background	3
Student Attributes	2	Academic Performances	5
		Dissatisfaction of Course Offered	4
Social Influence	3	Peer Pressure	8
		Lack of Motivation	7
		Social Media	6

The primary determinant influencing students' choice against pursuing higher education is the substantial cost associated with it. Additionally, the accessibility of scholarships holds considerable sway, as many students are disinclined to accumulate early-life student debt. Family background and socio-economic status also emerge as pivotal factors influencing students' decisions to forego further studies. Conversely, dissatisfaction with available courses ranks as a secondary concern. Moreover, peer pressure and motivational factors exert minimal influence on students' deliberations regarding higher education enrolment.

Conclusion

In order to understand and analyse the factors and subfactors that influence the decisions of former SMK Sungai Layar students not to pursue higher education better, this study implemented Fuzzy AHP approach. This approach translates linguistic variables and provides a clear indication of the most influential factors and subfactors in the study. In summary, the findings underscore the paramount importance of financial constraints, with students' individual characteristics and social influences also playing significant roles. Specifically, high fees and the availability of scholarships emerge as primary subfactors influencing students' decisions to forego higher education pursuits. These insights suggest that entities such as the Ministry of

Higher Education (KPT), higher education institutions, and schools could implement more effective interventions, particularly in the realm of financial assistance, to promote higher education enrolment among students. This research can be further studied by considering a wider range of specific factors and subfactors. The number of participating decision-makers could also be increased to generate more precise results.

References

Afolayan, A. H., Ojokoh, B. A., & Adetunmbi, A. O. (2020). Performance analysis of fuzzy analytic hierarchy process multi-criteria decision support models for contractor selection. *Scientific African*, *9*.

Ariffin, A. A. M., Ahmad, A. H., Ahmad, S., & Ibrahim, A. (2008). Determining decision-making styles and demographic differences in selecting higher education services among Malaysian. *International Journal of Business and Society*, *9*(1), 1.

Asch, S. E. (1955). Opinions and Social Pressure. *Scientific American*, *193*(5), 31–35. http://www.jstor.org/stable/24943779

Buckley, J. J. (1985). Fuzzy hierarchical analysis. *Fuzzy Sets and Systems*, *17*(3), 233247.

Byun, S. Y., Schofer, E., & Kim, K. K. (2012). Revisiting the role of cultural capital in East Asian educational systems: The case of South Korea. *Sociology of education*, *85*(3), 219-239.

Chou, S. Y., Chang, Y. H., & Shen, C. Y. (2008). A fuzzy simple additive weighting system under group decision-making for facility location selection with objective/subjective attributes. *European Journal of Operational Research*, *189*(1), 132-145.

Dynarski, S. M. (2003). Does aid matter? Measuring the effect of student aid on college attendance and completion. *American Economic Review, 93*(1), 279-288.

Gibb, A., Haskins, G., & Robertson, I. (2012). Leading the entrepreneurial university: Meeting the entrepreneurial development needs of higher education institutions. In Universities in change (pp. 9-45). Springer, New York, NY.

Hossler, D., Braxton, J., & Coopersmith, G. (1989). Understanding student college choice. In Higher education: *Handbook of theory and research* (*Vol. 5, pp.* 231288). Springer.

Jones, G., & Sallis, E. (2013). Knowledge management in education: Enhancing learning & education. *Routledge.*

Konstantinidis, C., Balodimos, D., & Georgopoulos, V. (2011). The application of fuzzy sets theory in natural hazard assessment. *In Natural Hazards and Earth System Sciences*, *11*(6), 1663-1674.

Lyu, H. M., Sun, W. J., Shen, S. L., & Zhou, A. N. (2020). Risk assessment using a new consulting process in fuzzy AHP. *Journal of Construction Engineering and Management*, *146*(3), 04019112.

Marques, V. C., & Berry, G. R. (2021). Enhancing work-life balance using a resilience framework. *Business and Society Review*, *126*(3), 263-281.

OECD. (2015). The Future of Productivity. OECD. Retrieved from https://www.oecd-ilibrary.org/docserver/3197152ben.pdf?expires=1683481274&id=id&accname=guest&checksum=614024C8E2A5312CF077B5BCDF38EE33

Rasberry, C. N., Lee, S. M., Robin, L., Laris, B. A., Russell, L. A., Coyle, K. K., & Nihiser, A. J. (2011). The association between school-based physical activity, including physical education, and academic performance: a systematic review of the literature. *Preventive medicine*, *52*, S10-S20.

Razi, P. Z., Ramli, N. I., Ali, M. I., & Ramadhansyah, P. J. (2020). Selection of best consultant by using analytical hierarchy Process (AHP). In *IOP Conference Series: Materials Science and Engineering* (Vol. 712, No. 1, p. 012016). IOP Publishing.

Saaty, T. L. (2008). Decision making with the analytic hierarchy process. *International Journal of Services Sciences*, *1*(1), 83-98.

Saaty, T. L. (1980). The Analytic Hierarchy Process. *New York, NY: McGraw-Hill.*

Salemi, Zahra. "Study of main reasons of the students dissatisfaction from educational services." *Advances in Environmental Biology*, Oct. 2014, pp. 1180+. *Gale Academic OneFile*, link.gale.com/apps/doc/A417895339/AONE?u=anon~c783eae3&sid=google Scholar&xid=1db04129. Accessed 3 May 2024.

Seal, C. R., Naumann, S. E., Scott, A. N., & Royce-Davis, J. (2011). Social emotional development: A new model of student learning in higher education. *Research in Higher Education Journal*, *10*, 1.

Utusan Malaysia, 376 IPTS Kritikal, May 24, 2021. https://www.utusan.com.my/nasional/2021/05/376-IPTS-kritikal/. [accessed on June 24, 2021]

Wang, Y. M., & Luo, Y. J. (2005). A fuzzy AHP approach to selecting multimedia projector. *International Journal of Production Economics*, *96*(3), 307-326.

Zadeh, L. A. (1965). Fuzzy sets. *Information and Control*, *8*(3), 338-353.

Zhang, X., Huang, J., Yu, D., & Li, Q. (2019). A hybrid multi-criteria decision-making approach for energy management in commercial buildings. *Energies*, *12*(13), 2560.