ENTHUSIASTIC
INTERNATIONAL JOURNAL OF APPLIED STATISTICS AND DATA SCIENCE
Volume 3, Issue 1, April 2023, pp. 97-110

Marketability Study of Mathematical Sciences Students in Universiti Kebangsaan Malaysia (UKM)

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ARTICLE INFO

Keywords
Higher Education Institute (HEI)
Marketability
Satisfaction level
Importance level
Performance

ABSTRACT

Higher Education Institute (HEI) has a vital role in developing human capital of a country. Measuring the quality of teaching and learning system in HEI and also industry's satisfaction level is important to ensure the marketability of HEI graduates. This study examined Universiti Kebangsaan Malaysia (UKM) Mathematical Sciences students' marketability by determining industry's satisfaction level on students' skills and abilities during industrial training and identifies factors that affect students' marketability. There were 22 student attributes that were categorized into four factors. Mean scores and Relative Importance Analysis determined the satisfaction and importance level of each attribute studied respectively. Besides, Penalty-Reward Contrast Analysis (PRCA) showed that affective factor was categorized as a basic factor where its existence did not increase but its absence decreased the industry's satisfaction level. For Importance Performance Analysis (IPA), cognitive, affective, and cognitive & psychomotor factors were observed in the first quadrant which had high importance level but low performance level. Lastly, all four factors were found in the loyal customer zone and at an excellent level through Customer Satisfaction Index (CSI) analysis. In conclusion, UKM Mathematical Sciences students have high marketability in general, but preservation and improvement should be implemented on important attributes to enhance their marketability.

1. Introduction

The emphasis on developing human capital for the success of the next generation was initiated by the 5th Prime Minister of Malaysia, Dato' Seri Abdullah Haji Ahmad Badawi by including the human capital agenda as one of the key components in the 9th Malaysia Plan (RMK9) in 2006. In order to form a competitive and big-hearted generation, education should act as the basis for the formation of human capital. Not only does education build one's thinking and intellectual level, but it also shapes one's personality and morals [1]. Since the economic and social aspects depend on the education acquired, a person's ability in managing the quality of life can be explained by education. With a high level of education, poverty can be fought, democracy can be built, and a prosperous society can be realized [2].

p-ISSN 2798-253X
e-ISSN 2798-3153

To achieve Malaysia's vision, Higher Education Institute (HEI) is one of the most critical education levels. Innovation-based economic activities can be transformed from the research results of academics in HEI. Furthermore, higher education can expand and transfer knowledge and expertise of various sectors through a 'university for society' approach [3]. The reestablishment of the Ministry of Higher Education (MoHE) on 9 March 2020 also has proven that the government has emphasized the importance of the higher education sector by creating specialized ministry that sustains the higher education ecosystem to develop individuals that are capable of meeting national aspirations [4].

Based on a report from The British Council, tertiary education has proven to contribute positively to the improvement of life quality with economic and non-economic development as compulsory education in HEI can create positive change for individuals, communities, and nations. In addition, the study has shown that not only involvement in tertiary education can contribute to development, but the 'space' provided in HEI also enables the building of relationships with each other that helps create an intelligent and engaged civil society. Moreover, HEI has a role to communicate and collaborate with higher education programs to produce graduates who meet the industry and local community needs by taking into account of local contextual factors. Furthermore, the development of research ecology can be improved through collaboration with local, national, and international partners. Effective communication with policy implementers can also translate research results and knowledge to local needs. In short, higher education is critical to the long-term development of individuals, society, and country. Affected communities in low-income countries can also be protected through higher education following the ongoing effects of COVID-19 [5].

In 2020, the total unemployment among new graduates in Malaysia was estimated at 11616 people or 20 percent of the total population of Malaysia. A study conducted by the MoHE has shown that 1 in 5 new graduates face unemployment despite having invested a lot of money and time to get a degree [6]. Degree holders are now no longer guaranteed to get a job immediately upon graduation. Information from employers and industry said that there was a widening gap between what was learned in local HEI and what was expected by the industry or the job market which caused the unemployment rate to rise among Malaysian graduates. Feedback also showed that graduates from public universities did not have sufficient soft skills and technical level to compete in the market. Employers, particularly those in the Small and Medium Enterprise (SME) sector, had a poor impression of local graduates because they believed that they lacked the knowledge and skills required by employers, especially English proficiency, technical skills and analytical skills [7]. Graduates from overseas universities are expected to have a higher marketability than graduates from domestic universities. Therefore, the factors that influence the marketability of local HEI graduates should be identified to address the growing unemployment problem in Malaysia.

This study uses primary data obtained from a survey of the satisfaction level of the industry towards the level of skills and abilities of Universiti Kebangsaan Malaysia (UKM) Mathematical Science students who underwent industrial training programs. The objective of this study is to determine the satisfaction level and importance level of the industry towards the level of UKM students' skills and abilities based on the mean score and Relative Importance Analysis respectively. Besides, factors that influence the marketability of UKM students are identified through Penalty-Reward Contrast Analysis (PCRA), Importance-Performance Analysis (IPA) and Customer Satisfaction Index Analysis (CSI).

The rest of the paper is arranged as follow. In Section 2, we describe the data used and methods that are applied to carry out this study. Next, we discuss about the results of analysis conducted to fulfil the study objectives in Section 3. Finally, we conclude the study and provide opinions for future work in Section 4.

2. Material and Methodology

2.1. Data

The data for this research was a primary data obtained from a questionnaire to study the marketability of Mathematical Science students in UKM. The data contained feedback from 136 agencies on the satisfaction level towards the skills and abilities of UKM Mathematical Science students who underwent industrial training programs at the organization. Industrial training is students' placement in an organization in a chosen industry to take on supervised practical training for a specified period of time either abroad or within the country before they are awarded a Certificate, Diploma or bachelor's degree [8]. Industrial training data was used because it is an exposure of the real world of work for the first time to the students. Thus, this data could represent the actual level of skills and abilities possessed and learned by students from HEI.

There were 22 specific skills and abilities attributes included in the data and they have been classified into four factors namely cognitive factor, psychomotor factor, affective factor, and psychomotor and cognitive factor as shown in Table 1. Cognitive factors aim to develop individual mental skills and knowledge acquisition. Individual mental abilities and knowledge gain are highlighted by cognitive factors. Knowledge, application, understanding, analysis, assessment, and synthesis are six types of cognitive factors [9]. On the other hand, the utilization of motor skills and the capacity to coordinate them are categorized under psychomotor factors. Perception, set, directed response, mechanism, complicated overt reaction, adaptability, and origination are all psychomotor sub-domains [10]. Nevertheless, individual feelings, emotions, and attitudes are examples of affective elements. Receiving, responding, valuing, organizing, and characterization are few categories that fall under affective factors [9].

Table 1. Skills and Abilities Attributes According to Their Respective Factors

Factor	Attributes	
Cognitive	D4	Readiness to take on obligation
	D5	Passion in a given task/project
	D6	Dedication to the assigned task/project
	D13	Problem solving
	D15	Problem analysing
	D19	Decision making
	D21	Application of skills and knowledge learned at UKM
Psychomotor	D1	Being on time
	D9	Obey rules and regulations
	D10	Dress appropriately and neatly
	D11	Able to understand instructions from supervisor/employer
Affective	D2	Able to execute task/project
	D7	Have positive workplace relationships with other co-workers in your organization
	D12	Teamwork
	D14	Leadership
	D18	Able to coordinate and carry out assigned task
Psychomotor & Cognitive	D3	Eager/Ready to learn
	D8	Able to communicate/deliver information
	D16	Able to interpret the analysis/project results
	D17	Creative thinking
	D20	Able to convey thought related to assigned task
	D22	Make use of the newest technologies

According to Table 2, a 5-level Likert scale was used to determine the satisfaction level of the industry towards specific skills and abilities attribute when answering the questionnaire.

Table 2. Scale for the Satisfaction Level of The Industry towards Specific Skills and Abilities Attribute

Scale	The Satisfaction Level of the Industry towards the Skills and Abilities Attribute
1	Very dissatisfied
2	Dissatisfied
3	Neutral
4	Satisfied
5	Very satisfied

2.2. Mean Score Generation

Mean scores were used to determine the satisfaction level of the industry towards each attribute of skills and abilities of UKM Mathematical Science students. The mean score results from the division of the total score by the number of respondents.

$$Mean\ Score = \frac{Overall\ total\ score}{Total\ respondent} \quad (1)$$

where total score is the sum of all total scores for each level for each attribute,

$$Mean\ Score = \sum Total\ score\ for\ each\ level \quad (2)$$

and the total score for each level is obtained by multiplying the frequency of respondents who choose that level with the score value that represents that level for each attribute.

$$Total\ score\ for\ each\ level = frequency\ * score \quad (3)$$

The score value that represents the satisfaction level of the industry towards the specific skills and abilities of UKM students is as shown in Table 2.

The satisfaction level of the industry towards each attribute of skills and abilities of UKM Mathematical Science students generated was used in the analysis as conducted in Section 2.4, Section 2.5, and Section 2.6.

2.3. Relative Importance Analysis

Relative importance analysis was conducted to determine the importance level of the industry towards the level of skills and abilities of UKM Mathematical Science students. This analysis was carried out through R programming using *relaimpo* package. According to Gromping, the calculations performed in the *relaimpo* package are as follows [11].

Variance and covariance are defined as in (4).

$$s_{yy} = \frac{1}{n-1}\sum_{i=1}^{n}(y_i - \bar{y})^2 \quad (4)$$

$$s_{jk} = \frac{1}{n-1}\sum_{i=1}^{n}(x_{ij} - \bar{x}_{\cdot j})(x_{ik} - \bar{x}_{\cdot k})$$

and

$$s_{yk} = s_{jk} = \frac{1}{n-1}\sum_{i=1}^{n}(x_{ik} - \bar{x}_{\cdot k})(y_i - \bar{y})$$

which $\bar{x}_{\cdot j}$ indicates the arithmetic mean of the *j*-th regressor, the corresponding variance-covariance matrices can be defined as in (5).

$$s_{xx} = (s_{jk})\ j,k = 1,2,\dots,p \quad (5)$$

$$s_{xy} = (s_{ky})\ k = 1,2,\dots,p$$

$$s_{yx} = s_{xy}^T$$

and can be integrated into the overall variance-covariance matrix as in (6).

$$S = \begin{bmatrix} s_{yy} & s_{yx} \\ s_{xy} & s_{xx} \end{bmatrix} \quad (6)$$

The estimated coefficients for regressors $x_1, \dots, x_p$ in a linear model can be computed as in (7).

$$\hat{\beta}_{1,\dots,p} = s_{xx}^{-1}s_{xy} \quad (7)$$

the coefficient is irrelevant for relative importance and the unexplained variance of the response is obtained as in (8).

$$s_{yy} - S_{yx}S_{xx}^{-1}S_{xy} \quad (8)$$

The coefficient of determination R^2 from regressing *y* on *x* can be found as in (9).

$$R^2 = \frac{S_{yx}S_{xx}^{-1}S_{xy}}{s_{yy}} \quad (9)$$

p-ISSN 2798-253X
e-ISSN 2798-3153

If the regressors in x are divided into two groups x_1 and x_2, the variance-covariance matrix is divided as in (10).

$$S = \begin{bmatrix} s_{yy} & s_{yx_2} & s_{yx_1} \\ s_{x_2y} & s_{x_2x_2} & s_{x_2x_1} \\ s_{x_1y} & s_{x_1x_2} & s_{x_1x_1} \end{bmatrix} \tag{10}$$

the unexplained variance-covariance matrix of y and x_2 after adjusting for x_1 can be computed as in (11).

$$\begin{bmatrix} s_{yy} & S_{yx_2} \\ S_{x_2y} & S_{x_2x_2} \end{bmatrix} - \begin{pmatrix} s_{yx_1} \\ s_{x_2x_1} \end{pmatrix} S^{-1}_{x_1x_1} \begin{pmatrix} s_{x_1y} \\ s_{x_1x_2} \end{pmatrix}^T \tag{11}$$

The inverse of the appropriately sized upper left block of S^{-1} can be found in Equation (11) with division of S as shown in (10). The upper left element of (11) is the unexplained variance of the response y after regressing y against x_1. Therefore, the difference between the upper left element (11) and the unexplained variance (8) forms the full model divided by s_{yy} is the sequential R^2 when adding the regressor in x_2 to the model in addition to the regressors in x_1 ($seqR^2(x_2|x_1)$) when identifying x_1 and x_2 with the set of regressors contained in them, (13). Notice that all relevant calculations for sequential linear models can be based on the variance-covariance matrix and its conditional form according to the formula given in this section, i.e., no further calculations with all observations are required after calculations of the variance-covariance matrix.

LMG metrics were selected in conducting the relative importance analysis. To describe the metric, the following notations are useful: R^2 for a model with regressors in set S is given as

$$R^2(S) = \frac{Model\ SS\ (model\ with\ regressors\ in\ S)}{Total\ SS} \tag{12}$$

Additional R^2 when adding regressors in set M to a model with regressors in set S is given as

$$seqR^2(M|S) = R^2(M \cup S) - R^2(S) \tag{13}$$

The order of regressors in any model is a permutation of the available regressor $x_1, \ldots, x_p$ and is denoted by the tuple of indices $r = (r_1, \ldots, r_p)$. Suppose $S_k(r)$ denotes the set of regressors entered into the model before regressor x_k in the order r. Then the portion of R^2 allocated to regressor x_k in the order r can be written as

$$seqR^2(\{x_k\}|S_k(r)) = R^2(\{x_k\} \cup S_k(r)) - R^2(S_k(r)) \tag{14}$$

The LMG metric for regressing k-th x_k regression is based on the sum of the squares of the sequence from the linear model but relies on the arrangement by averaging all possible sequences $(p!)$ for p regression with (14). It can be written as

$$LMG(x_k) = \frac{1}{p!}\sum_{r-permutation} seqR^2(\{x_k\}|r) \tag{15}$$

which r denotes r-permutation, $r = 1, 2, \ldots, p!$, $seqR^2(\{x_r\}|r)$ denotes the sum of the squares of the sequence for regressing x_k in the order of the regression for the r-th permutation.

The level of importance of the industry towards the level of skills and abilities of UKM Mathematical Science students generated was used in the analysis as conducted in sections 2.5 and 2.6.

2.4. Penalty-Reward Contrast Analysis (PCRA)

Brandt [12] has introduced the Penalty-Reward Contrast Analysis (PRCA). This method is applied to determine the performance impact of an attribute either low or high on the level of customer satisfaction. The performance level for each attribute and the overall satisfaction level are required to conduct this analysis through multiple regression analysis with dummy variables. The factors containing the respective attributes are independent variables while the overall satisfaction level is a dependent variable.

p-ISSN 2798-253X
e-ISSN 2798-3153

There were four factors studied including cognitive factor, psychomotor factor, affective factor and psychomotor & cognitive factor in this study. From the PRCA results generated, the factors were categorized into four factors, namely the basic factor, one-dimensional factor, attractive factor and indifferent factor. Factors were identified by comparing the relationship between the performance of factors with the level of customer satisfaction on those factors as shown in Table 3.

Table 3. Classification of Factor on Overall Satisfaction at Low-Medium and High-Medium Performance

Factor	**Performance**	
	Low-Medium	***High-Medium***
Basic factor	Significant	Not significant
One-dimensional factor	Significant	Significant
Attractive factor	Not significant	Significant
Indifferent factor	Not significant	Not significant

Based on Albayrak and Caber, the calculations for the Penalty-Reward Contrast (PRCA) analysis in this study were as follows [13].

Step 1: Obtain the mean level of satisfaction for each factor that contains the attributes of their respective skills and abilities.

Step 2: Obtain the mean of satisfaction for each factor according to the percentages of 25%, 50% and 75%.

Step 3: Coding the data collected from the survey into low performance, medium performance and high performance based on 25%, 50%, and 75% for the mean satisfaction of each factor through multiple regression analysis with dummy variables of low performance and high performance.

Step 4: Conduct ANOVA test with the mean of satisfaction of each factor as the independent variable while the mean of overall satisfaction as the dependent variable to obtain the p-value for each factor to determine the significance level of the factor using the criteria stated in Table 3.

2.5. Importance-Performance Analysis (IPA)

Martilla and James introduced Importance-Performance Analysis (IPA) in 1977 [14]. There are two main components in IPA analysis including quadrant analysis and gap analysis. In this study, quadrant analysis was used, and it was conducted by generating a four-quadrant matrix from respondents' responses on the level of importance and level of satisfaction of specific attributes. It identified factors that need to be observed by the Department of Mathematical Sciences (JSM) for the improvement of attribute performance aiming to increase the satisfaction level of the industry.

An IPA is made up of a pair of coordinate axes where y-axis is the value of importance and the x-axis is the value of performance for a specific attribute. Each quadrant relates the importance and performance given by the industry to a specific attribute [15].

According to Martilla and James, four quadrants in IPA analysis were characterized as demonstrated in Table 4 [14].

Table 4. Quadrant in Importance-Performance analysis

Quadrant	**Quadrant Characteristics**
I	Focus here - low performance, high importance: prompt action is needed for improvement and is a main drawback.
II	Continue the good effort - high performance, high importance: the chance to attain or sustain a competitive advantage and is a key strength.
III	Low precedence - low performance, low importance: small drawback and additional effort is unnecessary.
IV	Possibility of redundancy - high performance, low importance: resources allocated on these attributes may be redundant and should be utilized somewhere else.

p-ISSN 2798-253X
e-ISSN 2798-3153

The calculations for the Importance-Performance analysis (IPA) in this study were as follows.

Step 1: Obtain the mean importance level and satisfaction level for each factor and attribute of skills and abilities.

Step 2: Plot the mean importance level and satisfaction level for each factor and attribute on a two-dimensional matrix.

Step 3: Obtain the limit to separate the matrix into four quadrants using the overall mean of the importance level and the performance level obtained. Each factor and attribute can be identified whether it is in a quadrant that has a high or low importance level and performance level. Based on the position on the matrix, decision to place emphasis on improving the performance of specific factors and attributes can be taken.

2.6. Customer Satisfaction Index (CSI)

The Customer Satisfaction Index (CSI) is a universal analytical instrument for determining customer satisfaction towards a product, service, or company as a whole. Through CSI, the cause of customer satisfaction or dissatisfaction can be identified. CSI is used to retain customers, plan better sales of products and services, improve the quality and value of recommendations as well as ensure more efficient and economical functionality.

The objective of CSI is to help an organization to establish and maintain long-term relationships with its customers. In addition, CSI allows an organization to better understand the needs and behaviors of its customers. In this study, CSI was used to determine the overall satisfaction level of the industry by combining all factors' performance examined.

According to New York: Free Press in his book The Service Profit Chain, the percentage of Customer Satisfaction Index (CSI) can be categorized into customer zones and levels of excellence as shown in Table 5 [16].

Table 5. Type of Customer Zone and Level of Excellence Based on Customer Satisfaction Index (CSI) Percentage

Percentage (%)	Zone	Level
0–40	Conservative customer	Poor
41–80	Indifferent customer	Good
81–100	Loyal customer	Excellent

According to Yanova, the calculations for Customer Satisfaction Index (CSI) analysis in this study were as follows [17].

Step 1: Find the mean weighted importance for each attribute,

$$W_i = \frac{\mu_i}{\Sigma \mu_i} \tag{16}$$

which μ_i is the mean level of importance of the *i*-th attribute.

Step 2: Obtain a satisfaction weighted score for each attribute,

$$P_i = W_i \times \mu_j \tag{17}$$

where μ_j is the mean satisfaction level of the j-th attribute.

Step 3: Calculating the total number of satisfaction weighting scores,

$$X = \Sigma P_i \tag{18}$$

Step 4: Get the percentage of Customer Satisfaction Index,

$$CSI = \frac{X}{5} \times 100\% \tag{19}$$

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e-ISSN 2798-3153

3. Results and Discussion

3.1. Demographic Analysis

Out of the 136 survey responses, 47 industry parties who involved in this study came from organizations with a size of less than 50 employees (35%), 23 industry parties with an organization size of 51 to 150 employees (17%) and 66 industry parties that came from organizations with a size of more than 150 employees (49%). Most of the industry parties involved in this study were from private organizations which is 77 people (57%), followed by government organizations which is 29 people (21%), statutory bodies which is 27 people (20%) and finally other organizations which is 3 people (2%). The number of industry parties from the financial sector was the highest with 37 people (27%), followed by 26 people from other sectors (19%) and 24 people from the service sector (18%).

Table 6. Respondents Profile

Respondents profile	Number	Percentage (%)
Size of organization		
<50 employers	47	35
51-150 employers	23	17
>150 employers	66	49
Type of organizations		
Government	29	21
Private	77	57
Statutory body	27	20
Others	3	2
Organization sectors		
Communication and IT	8	6
Finance	37	27
Consultation	5	4
Agriculture and food	1	1
Services	24	18
Defence and security	1	1
Industry	4	3
Transportation	1	1
Education	14	10
Manufacturing	13	10
Property development and construction	2	1
Others	26	19

3.2. Satisfaction and Relative Importance Analysis

The satisfaction and importance level of the industry towards each skills and abilities attribute of UKM Mathematical Science students was determined through mean score generation and relative importance analysis. There were 22 attributes studied in this study as shown in Table 1.

Table 7. The Importance Level and the Satisfaction Level of Each Skills and Abilities Attribute

Factor	Importance Level	Satisfaction Level
Cognitive	**0.049660**	**4.2920**
D4	0.039881	4.6029
D5	0.038525	4.4412
D6	0.044815	4.5956
D13	0.055805	4.1985
D15	0.053013	4.0809
D19	0.060112	4.0221
D21	0.055470	4.1029
Psychomotor	**0.031359**	**4.6452**
D1	0.013042	4.7720
D9	0.037956	4.6618
D10	0.028408	4.6324
D11	0.046030	4.5147
Affective	**0.046075**	**4.3330**
D2	0.051935	4.4519
D7	0.030763	4.5662

Factor	Importance Level	Satisfaction Level
D12	0.039719	4.4632
D14	0.065983	3.8676
D18	0.041976	4.3162
Psychomotor & Cognitive	**0.049428**	**4.2426**
D3	0.050618	4.6029
D8	0.048298	4.2574
D16	0.053619	4.0368
D17	0.056033	4.1029
D20	0.059119	4.1324
D22	0.028879	4.3235
Overall mean	**0.045455**	**4.3521**

According to Table 7, attribute D1 which is being on time had the highest mean satisfaction level (4.7720), followed by attribute D9 which is obey rules and regulations (4.6618) and attribute D10 which is dress appropriately and neatly (4.6324). All three attributes were classified as affective factors. On the other hand, the attribute with the lowest satisfaction level was attribute D14 which is leadership with a mean value of 3.8676, followed by attribute D19 which is decision making (4.0221) and D16 attribute which is the able to interpret analysis or project results (4.0368). Based on the feedback from the industry, the overall mean for the satisfaction level for all the attributes studied was 4.3521 out of a scale of 5. The performance of all attributes of skills and abilities of students studied was high with a mean value of satisfaction level 4 and above except for attribute D14 which is leadership. Therefore, efforts in maintaining satisfactory attribute performance should be made and at the same time measures to improve unsatisfactory attributes should also be planned and implemented so that the overall satisfaction level of the industry can be maintained at a high level.

Next, attribute with the highest level of importance was attribute D14 which is leadership (0.06598), followed by attribute D19 which is decision making (0.06011), attribute D20 which is the able to convey thought related to assigned task (0.05912), attribute D17 which is creative thinking (0.05603) and attribute D13 which is problem solving (0.05581). Thus, high importance attributes should be given priority to maintain their performance and efforts to increase the importance level of less important attributes can also be implemented to meet the expectations of the industry.

3.3. Penalty-Reward Contrast Analysis (PRCA), Importance-Performance Analysis (IPA) and Customer Satisfaction Index Analysis (CSI)

The mean value of satisfaction level and importance level of the industry towards the skills and abilities of students generated were used in the Penalty-Reward Contrast Analysis (PRCA), Importance-Performance Analysis (IPA) and Customer Satisfaction Index Analysis (CSI). 22 students' skills and abilities attributes studied were classified into 4 factors namely cognitive factors, psychomotor factors, affective factors and psychomotor & cognitive factors.

Firstly, Penalty-Reward Contrast Analysis was conducted to examine the impact of factor's performance on the satisfaction level of the industry whether it is low or high. The mean satisfaction for each factor containing the respective attributes was coded according to the mean of each factor with percentages of 25%, 50% and 75% as shown in Table 8.

Table 8. Mean satisfaction for each factor according to 25%, 50% and 75% percentage

Percentage (%)	Mean Factor Cognitive	Mean Factor Psychomotor	Mean Factor Affective	Mean Factor Psychomotor and Cognitive
25	4.00	4.25	4.00	4.00
50	4.36	4.75	4.40	4.33
75	4.71	5.00	4.60	4.50

From Table 8, factors are in the low performance category when the mean satisfaction is smaller or equal to the mean factor of 25%, factors are in the medium performance category when the mean

p-ISSN 2798-253X
e-ISSN 2798-3153

satisfaction ranges from mean factor of 25% to mean factor of 75% and factors are in the high-performance category when the mean satisfaction is equal or more than the mean factor of 75%.

Table 9. ANOVA Test for Each Factor

Factor	Low-Medium Performance		High-Medium Performance		Category of Factor
	p-value	*Coefficient*	*p-value*	*Coefficient*	
Cognitive	0.0000	-0.1919	0.0000	0.1936	One-dimensional
Psychomotor	0.0019	-0.1121	0.0035	0.0955	One-dimensional
Affective	0.0002	-0.1373	0.0177	0.0927	Basic
Psychomotor and Cognitive	0.0001	-0.1597	0.0002	0.1317	One-dimensional

Significance level of 0.01

Based on Table 9, cognitive factor, psychomotor factor, and psychomotor & cognitive factor had significant *p*-values for both low-medium performance and high-medium performance at the 0.01 significance level. Therefore, all three factors were categorized as one-dimensional factors that increase the satisfaction level of the industry linearly with the improvement of these factors' performance. For affective factor, the *p*-value was significant at low-medium performance but not significant at high-medium performance at the 0.01 significance level, so it was categorized as a basic factor. The basic factor is the factor that causes the dissatisfaction of the industry when it is absent but does not bring any impact to the satisfaction of the industry if it is achieved. The analysis results also showed that none of the factors was categorized as indifferent factors or attractive factors at the 0.01 significance level. The indifference factor is a factor that should not be given priority during improvement as it will not have an impact on the satisfaction of the industry whether it is achieved or not. As for the attractive factor, it is a factor that will not have an impact on the satisfaction of the industry if it is not achieved but will increase the satisfaction of the industry if it is achieved. The change in the overall satisfaction level can be determined by referring to the positive and negative signs of the coefficient values. An increase in overall satisfaction will occur with an increase in factor satisfaction for coefficients of positive value while an increase in overall satisfaction will occur with a decrease in factor satisfaction for coefficients of negative value.

Secondly, in the Importance-Performance Analysis, quadrant analysis was carried out to identify factors that need to be monitored by JSM in order for attribute performance to improve and the industry's satisfaction level to increase. The factors studied were observed either in the quadrant of high or low level of importance and performance.

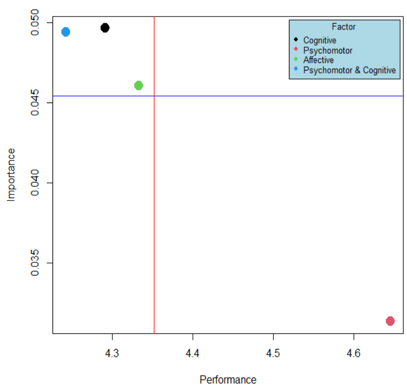

Fig. 1 Importance-Performance analysis for each factor.

According to Fig. 1, cognitive factor, affective factor and psychomotor & cognitive factor were in quadrant I where factor had a high importance level but low in performance level. Therefore, these factors should be given priority for improvement in order to improve the level of performance. Besides, psychomotor factor was in quadrant IV where factor had a low importance level but high performance level. Nonetheless, initiatives should be taken to increase its importance level.

p-ISSN 2798-253X
e-ISSN 2798-3153

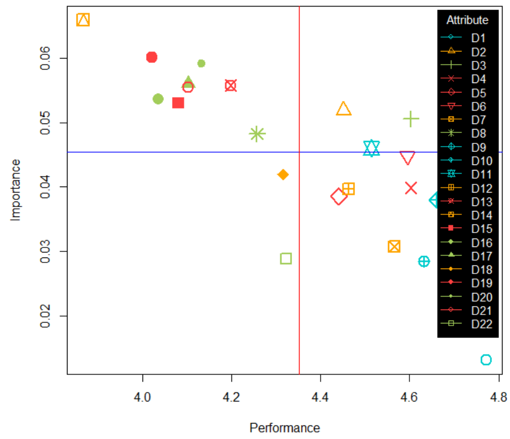

Fig. 2 Importance-Performance analysis for each attribute.

Fig. 2 has shown the Importance-Performance analysis for each attribute studied. Among the attributes for cognitive factor that were located in quadrant I are attribute D13 which is problem solving, attribute D15 which is problem analysing, attribute D19 which is decision making and attribute D21 which is the application of skills and knowledge learned at UKM. Other than that, attribute D1 which is being on time, attribute D9 which is obey rules and regulations and attribute D10 which is dress appropriately and neatly were among the attributes for affective factors in quadrant IV and only attribute D11 which is the able to understand instructions from supervisors or employers falls in quadrant II where it was also high-performing but important. However, only D14 attribute, namely leadership was in quadrant I for affective factors. Moreover, attribute D8 which is able to communicate and deliver information, attribute D16 which is able to interpret the analysis or project results, attribute D17 which is creative thinking and attribute D20 which is able to convey thought related to assigned task were among the attributes for psychomotor & cognitive factor which are in quadrant I.

Lastly, Customer Satisfaction Index analysis was conducted to determine the satisfaction level of the industry towards the skills and abilities of UKM Mathematical Science students depending on the mean importance and mean satisfaction of each attribute studied as a whole.

$$Overall\ CSI = \frac{4.29866}{5} \times 100\% = 85.97\%$$

$$Cognitive\ factor\ CSI = \frac{4.25930}{5} \times 100\% = 85.19\%$$

$$Psychomotor\ factor\ CSI = \frac{4.61261}{5} \times 100\% = 92.25\%$$

$$Affective\ factor\ CSI = \frac{4.27704}{5} \times 100\% = 85.54\%$$

$$Psychomotor\ \&\ cognitive\ factor\ CSI = \frac{4.22881}{5} \times 100\% = 84.58\%$$

The overall CSI value for the four factors studied has been recorded at a very high percentage of 85.97%. The analysis results according to factor showed that psychomotor factor had the highest customer satisfaction index which was 92.25%, followed by customer satisfaction index for affective factor which was 85.54%, then customer satisfaction index for cognitive factor which was 85.19% and lastly customer satisfaction index for psychomotor & cognitive factor which was 84.58 %. This indicated that the factors were at an excellent level and were categorized in the loyal customer zone. Thus, it was found that the industry was very satisfied with the level of skills and abilities of UKM Mathematical Science students based on the CSI value. However, improvement measures could be given priority to psychomotor & cognitive factor as it had the lowest CSI values when compared to other factors, followed by cognitive factors. A summary of the analysis results of the study is displayed in Table 10.

p-ISSN 2798-253X
e-ISSN 2798-3153

Table 10. Summary of Analysis Results

	PCRA	IPA	CSI
Cognitive factor	**One-dimensional**	**Quadrant I**	**85.19%**
Attribute D4		Quadrant IV	
Attribute D5		Quadrant IV	
Attribute D6		Quadrant IV	
Attribute D13		Quadrant I	
Attribute D15		Quadrant I	
Attribute D19		Quadrant I	
Attribute D21		Quadrant I	
Psychomotor factor	**One-dimensional**	Quadrant IV	**92.25%**
Attribute D1		Quadrant IV	
Attribute D9		Quadrant IV	
Attribute D10		Quadrant IV	
Attribute D11		Quadrant II	
Affective factor	**Basic**	**Quadrant I**	**85.54%**
Attribute D2		Quadrant II	
Attribute D7		Quadrant IV	
Attribute D12		Quadrant IV	
Attribute D14		Quadrant I	
Attribute D18		Quadrant III	
Psychomotor & Cognitive factor	**One-dimensional**	**Quadrant I**	**84.58%**
Attribute D3		Quadrant II	
Attribute D8		Quadrant I	
Attribute D16		Quadrant I	
Attribute D17		Quadrant I	
Attribute D20		Quadrant I	
Attribute D22		Quadrant III	
Overall	-	-	**85.97%**

4. Conclusion

The issue of unemployment is a hot topic that is always discussed and given attention by Malaysians. The main cause of unemployment in Malaysia is due to local HEI graduates who have skills and abilities level that are low or not in line with current market demand. HEI take a leading role in producing graduates who are not only excellent in academic achievement but also competent enough to meet the industry expectation. So, HEI should constantly monitor the quality of teaching and learning system as well as the satisfaction level of the industry towards the skills and abilities of its graduates. Therefore, the analysis results of this study can act as a reference to JSM on the factors that affect the marketability of UKM Mathematical Science students and ensure whether the current teaching and learning system implemented is in line with the expectations of the industry or not. From this study, we can conclude that the industry is satisfied with the level of skills and abilities of UKM Mathematical Science students. It depicts that UKM Mathematical Science students have high marketability because they can meet the requirements of the industry. However, preservation and improvement on the quality of education should be implemented so that the satisfaction level and the importance level of the industry towards the skills and abilities of students can increase. All the objectives of this study have also been achieved. Hopefully, the findings of this study can be utilized by JSM as a guide to improve teaching performance and syllabus quality, resulting in more competitive graduates.

There are a few recommended suggestions for further studies. Data at a different period can be used when conducting further studies. For example, industry satisfaction level data towards the students' skills and abilities in following years can be collected and analysed to compare with the results of this study to identify whether the marketability of UKM Mathematical Science students remains the same or not and also ensure that the teaching and learning curriculum at JSM always meets the market demand. Furthermore, data on the level of importance of the industry towards the students' skills and abilities level is proposed to be collected directly through questionnaires. In this study, the level of importance is generated by coding for each attribute through one of the Driver

Analysis, which is relative importance analysis. Although the derived importance level from coding has more benefits than the stated importance level from their own clients, there is still an unavoidable lack of analysis to obtain the value of derived importance. Therefore, comparisons can be made on the stated importance value with the derived importance value so that the actual industry demand can be reflected more clearly. In addition, the methodology of this study can be widely used in the education sector. In particular, HEI can use these three methods to evaluate and modify the program syllabus from time to time such as changing the way a subject is evaluated and adding subjects to produce graduates who can follow the trend of the current market. Not only that, views from users of HEI such as students and staff of HEI can also be collected and analysed with these methods to ensure the quality of service systems and teaching and learning curriculum are always at a satisfactory level.

Acknowledgment

This research is fully supported by UKM. We truly thank UKM in providing grant for this research.

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 p-ISSN 2798-253X
e-ISSN 2798-3153