



## Evaluations of Interns' Performances after Intervention Program Using Hierarchical Fuzzy Conjoint Analysis Model

ZAKARIA Nora (1), SULAIMAN Nor Hashimah (2), YUNOS Siti Nur Sakinah (3)

Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA, Malaysia (1)

Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA, Malaysia (2)

Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA, Malaysia (3)

### Abstract

*Internship programs is a platform for the on-the-job training module that provide relevant hands-on or real work experiences for undergraduates within a specific period of time. In preparing the students with necessary skills prior to the students embarking the internship program, the Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA (UiTM) Malaysia has carried out an intervention program. The program is a special graduate employability program with industry collaborations focusing on effective employability skills such as Interpersonal Communication, Business Professional Communication, Public Communication, and Executive Skills Development that are important components for the students to excell in their internship. At the end of the internship program, the performance of interns' have undergone the intervention program prior to their internship were rated by their respective companies' employers based on seven employability attributes and twenty nine sub-attributes. As human preferences are rather fuzzy and uncertain in nature, a hierarchical fuzzy conjoint analysis model is proposed and employed in analysing the employers' ratings or preference levels on the interns' performance with respect to the attributes. The findings show that the employers were very satisfied with the interns on their Ethics and Values attribute and satisfied with other six attributes which are Communication Skills, Problem Solving, Practical Skills, Social Skills, Technological Skills, and Information Management Skills.*

**Keywords:** *conjoint analysis, employability skills, intervention program, performance, internship;*

### 1. Introduction

In today's highly competitive job market, managers are looking for individuals that have proper scholarly proficiencies and are exceptionally talented to fill positions in their organizations. Malaysian managers are searching for a more adaptable and versatile workforce as they themselves try to change their organizations into a more adaptable and versatile one [1]. However, graduates today face appalling challenges in meeting the market demand in terms of skills, quality and also qualification. Graduates with sound employability skills such as work ethics, self confidence, communication skills, leadership skills and good attitude are highly valued by employers would definitely succeed in paving their way into the labour market [2, p.2]. Many studies indicate that graduates who have trouble in finding a proper job are partly due to lacking of employability skills [3,4].

Some predictors of employability include English language proficiency, ethnicity, and the types of degree obtained [5]. According to [6], Malaysian graduates did not lack the skills and talent or competency to be employed. But they need proper direction and inputs to nurture their natural talent, interpersonal skills and abilities as stated by The National Education Blueprint 2015-2025: Higher Education [7]. Graduates must have the evidence to prove to the employers that they have the ability to deal with uncertainty, the ability to work under pressure, show action-planning skills, communication skills, information technology skill, team work, a readiness to explore and create opportunities, self-confidence, self-management skills and the enthusiasm to learn something new to gain their employer's interest [8]. In addition to that, graduates who have the traits to work within a team also can lead to team success and they will be hired by the employer. Employers are searching for graduates that can converse fluent English and good interpersonal skills since they have the ability to express ideas, explain about issues and resolve problems [9]. In 2012, Ministry of Higher Education Malaysia (MOHE) launched the Graduate Employability Blueprint [8] for 2012-2017 with the aim to increase the graduate employability as well as to fulfil the need for skilled and professional manpower towards nation building. Many of the programs suggested involved collaboration of industry with universities [8] and universities are encouraged to implement programs through Graduate Employability Grant from MOHE. To embed employability skills into students' activities, the Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA (UiTM) Malaysia proposed a model for graduate



employability [11] through Graduate Employability Grant. The aim is to prepare the students prior to their internship as shown in Figure 1.

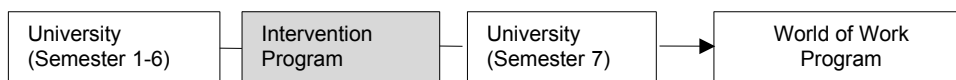


Fig. 1. An intervention program before internship.

This intervention program named as “Born to be a Diamond” involved industry participation. They found that after the intervention program, the actual performance of these interns is much higher than expectations of their employers. Twenty three students voluntarily participated in this program which was held for 22 days focuses on effective employability skills such as Interpersonal Communication, Business Professional Communication, Public Communication, and Executive Skills Development. Also sessions such as visioning, personal development, interpersonal communication, personal finance, personal grooming, etiquette and protocol are embedded in the program. Apart from that, some other modules such as business acumen, entrepreneurship skills to empower self or create a startup, design thinking and Business Model Canvas for a new economy and Internet of Things (IoT) skills, e-commerce is also being introduced to prepare them for the new world of work. Some of the modules were conducted by captains of industries. At the end of their internship, the questionnaires were given to their respective companies' employers to rate their performance. Some of the reputable companies (Multinational Companies and Government Linked Companies) were the American Insurance Association (AIA), Tune Protect Malaysia, Petronas, AmBank Group Malaysia, Bank Muamalat Malaysia Berhad, Commerce International Merchant Bankers Berhad (CIMB), Telekom Malaysia Berhad (TM) and Bank Islam Malaysia Berhad Securities (BIMB Securities).

## 2. Methods

In this paper, a Hierarchical Fuzzy Conjoint Analysis Method (HFCAM) which is an extension of the Fuzzy Conjoint Method (FCM) [12] and fuzzy set preference model [13] is proposed and employed in evaluating the interns' performance after intervention program, the application of HFCM enables the performance of the interns' to be studied by specific attribute as well as by the overall achievement across attributes as laid out in Table I. Basic theories and related operations on fuzzy sets used in the procedure can be found in [15,16]. Ratings of employers on the interns are extracted from questionnaires which are designed based on [3,12] with slight modification to suit with the intervention program involving 7 attributes and 29 sub-attributes as listed in Table 1.

Table 1. Attributes and Sub-attributes



The general procedure of the HFCM is presented as follows:

**Step 1:** Identify the set of attributes,  $X = \{X_i\}$ , sub-attributes,  $X_i = \{x_{ij}\}$  with  $i=1,2,\dots,m$ ,  $j=1,2,\dots,|X_i|$ , where  $|X_i|$  is the cardinality of the set  $X_i$ .

**Step 2:** Set the predefined linguistic rating defined by discrete fuzzy sets,  $L_k = \left\{ \frac{\mu_{L_k,p}}{p} \right\}$ ,  $p,k=1,2,\dots,t$ .

**Step 3:** Obtain the fuzzy sets representing:

- The aggregated linguistic ratings  $\tilde{X}_{ij}$  with respect to the sub-attributes  $x_{ij}$  where

$$\tilde{X}_{ij} = \sum_{k=1}^t \frac{r_{ijk}}{\sum_{k=1}^t r_{ijk}} L_k = \left\{ \frac{\mu_{ijp}}{p}, p=1,2,\dots,t \right\} \quad (1)$$

where  $r_{ijk}$  is the number of for each linguistic rating,  $L_k$ ,  $k=\{1,2,\dots,t\}$ .

- The aggregated linguistic ratings  $\tilde{X}_i$  for the  $i$ -th attributes  $X_i$ ,  $i=1,2,\dots,m$  such that

$$\tilde{X}_i = \sum_{j=1}^{|X_i|} w_{ij} \tilde{X}_{ij} = \left\{ \frac{\mu_{ip}}{p}, p=1,2,\dots,t \right\}, w_{ij} \in [0,1] \quad (2)$$

- The overall rating  $\tilde{X}$  across attributes such that

$$\tilde{X} = \sum_{i=1}^m \omega_i \tilde{X}_i = \left\{ \frac{\mu_p}{p}, p=1,2,\dots,t \right\}, \omega_i \in [0,1] \quad (3)$$

Note that the sub-attribute weights  $w_{ij}$  and the attribute weights  $\omega_i$  can be generated using any appropriate attribute weight determination methods available in the literature.

**Step 4:** Calculate the degree of similarities of the following pairs of fuzzy sets representing:

- The aggregated linguistic ratings for sub-attributes  $\tilde{X}_{ij}$  and the linguistic ratings  $L_k$  where

$$S_{ijk}(\tilde{X}_{ij}, L_k) = \frac{1}{1 + \sqrt{\sum_{p=1}^t (\mu_{ijp} - \mu_{L_k,p})^2}}, i=1,2,\dots,m, j=1,2,\dots,|X_i|, k=1,2,\dots,t \quad (4)$$

- The aggregated linguistic ratings  $\tilde{X}_i$  for the  $i$ -th attributes and the linguistic ratings  $L_k$ :

$$S_{ik}(\tilde{X}_i, L_k) = \frac{1}{1 + \sqrt{\sum_{p=1}^t (\mu_{ip} - \mu_{L_k,p})^2}}, i=1,2,\dots,m, k=1,2,\dots,t \quad (5)$$

- The overall rating  $\tilde{X}$  across attributes and  $L_k$  where

$$S_k(\tilde{X}, L_k) = \frac{1}{1 + \sqrt{\sum_{p=1}^t (\mu_p - \mu_{L_k,p})^2}}, k=1,2,\dots,t \quad (6)$$

**Step 5:** Identify the linguistic term that represent the performance with respect to the sub-attributes, attributes and overall evaluation (across attributes) based on the highest similarity degrees calculated in Step 4.



### 3. Results and Discussions

The number of responses based on the linguistic rating by 23 employers with respect to the sub-attributes based on the questionnaires are displayed in Table 2. Five predefined linguistic terms defined by discrete fuzzy sets used in rating the performance of the interns are:

$$\begin{aligned}
 \text{Not Satisfied, } L_1 &= \left( \frac{1}{1}, \frac{0.7}{2}, \frac{0.3}{3}, \frac{0}{4}, \frac{0}{5} \right) ; & \text{Less Satisfied, } L_2 &= \left( \frac{0.7}{1}, \frac{1}{2}, \frac{0.7}{3}, \frac{0.3}{4}, \frac{0}{5} \right) ; \\
 \text{Quite Satisfied } L_3 &= \left( \frac{0.3}{1}, \frac{0.7}{2}, \frac{1}{3}, \frac{0.7}{4}, \frac{0.3}{5} \right) ; & \text{Satisfied, } L_4 &= \left( \frac{0}{1}, \frac{0.3}{2}, \frac{0.7}{3}, \frac{1}{4}, \frac{0.7}{5} \right) ; \\
 \text{Very Satisfied, } L_5 &= \left( \frac{0}{1}, \frac{0}{2}, \frac{0.3}{3}, \frac{0.7}{4}, \frac{1}{5} \right) .
 \end{aligned}$$

Table 2. Number of Responses based on Linguistic Ratings

From Table 2, the fuzzy sets representing the aggregated linguistic ratings for each sub-attributes,  $\tilde{x}_{ij}$ , main attributes,  $\tilde{X}_i$ , and the overall performance,  $\tilde{X}$ , are derived using (1), (2) and (3), respectively. For  $x_{11}$ , the corresponding fuzzy set is obtained as

$$\tilde{x}_{ij} = \left( \frac{0.026}{1}, \frac{0.152}{2}, \frac{0.483}{3}, \frac{0.791}{4}, \frac{0.848}{5} \right).$$

Applying (4), the similarity degree between fuzzy sets  $\tilde{x}_{11}$  and  $L_k, k=1, \dots, 5$  is calculated as  $S_{11}(\tilde{x}_{11}, L_1)=0.38$ ,  $S_{12}(\tilde{x}_{11}, L_2)=0.4$ ,  $S_{13}(\tilde{x}_{11}, L_3)=0.51$ ,  $S_{14}(\tilde{x}_{11}, L_4)=0.73$  and  $S_{15}(\tilde{x}_{11}, L_5)=0.77$ . Note that the highest similarity degree  $S_{15}(\tilde{x}_{11}, L_5)=0.77$  is associated with the linguistic term  $L_5$  indicating that the employers are Very

Satisfied with interns on the attribute  $x_{11}$ . The respective degrees of similarity for the rest of the sub-attributes, main attributes and the overall performance with the predefined linguistic terms i.e.  $S_{ijk}(\tilde{x}_{ij}, L_k)$ ,  $S_{ik}(\tilde{X}_i, L_k)$  and  $S_k(\tilde{X}, L_k)$  are calculated accordingly using (4), (5) and (6). The results are displayed in Table 3.





Table 3. Employers' Preference Ratings towards interns' performance

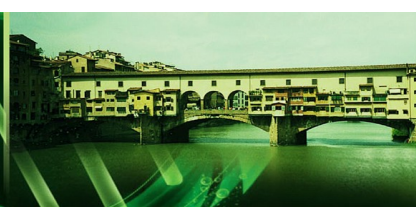
Based on Table 3, the employers are very satisfied with the interns' "Ethics and Values" skills. The employers are basically satisfied with the rest of the attributes, namely "Communication Skills", "Problem Solving", "Technological Skills" and "Information Management". The sub-attribute Entrepreneurial skills ( $x_{35}$ ) received the lowest linguistic preference rating by the employers i.e. 'Quite Satisfied' as compared to the rest of the sub-attributes. Overall, the respective employers are "Satisfied" with the interns' performance in the internship program of their company.

#### 4. Conclusions

This study focuses on the implementation of Hierarchical Fuzzy Conjoint Analysis Method (HFCAM) in analysing the level of preference or ratings of employers towards interns' performances on the employability attributes. The result showed employers were satisfied with the overall interns' performances, it can be concluded that the intervention program before the students enter the world of work can be served as an effective model for the future employability program.

#### References

- [1] Salina, D., Nurazariah, A., Mazuin, S. N., & Rajadurai, J. (2011). Enhancing university business curriculum using an importance-performance approach: A case study of the business management faculty of a university in Malaysia. *International Journal of Educational Management*, 25(6), 545-569.
- [2] Hillage, J. & Pollard, E. (1998) *Employability: Developing a Framework for Policy Analysis*. Department for Education and Employment, London.



- [3] Zaliza, H., & Safarin, N. M. (2014). Unemployment among Malaysia graduates: Graduates' attributes, lecturers' competency and quality of education. *International Conference on Education & Educational Psychology*, 112, 1056-1063.
- [4] Mustapha, Ramlee, Karim, F., R., M. Y., Azman, N., Yamat, H., et al. (2008). K-economy and globalisation: Are our students ready? *Jurnal Personalia Pelajar*, 11, 1-23.
- [5] Lim, H. (2010). Predicting low employability graduates: The case of Universiti Utara Malaysia. *Singapore Economic Review*, 55(3), 523-535.
- [6] Khoo, H. C. (2001). 'Graduating into the IT industry'. *Education Quarterly*, 19, 14-15.
- [7] NEB (2015). *The National Education Blueprint 2015 –2025: Higher Education*. Ministry of Education Malaysia.
- [8] GEB (2012). *The National Graduate Employability Blueprint for 2012-2017*. Ministry of Higher Education Malaysia.
- [9] Raybould, J., & Sheedy, V. (2005). Are graduates equipped with the right skills in the employability stakes? *Industrial and Commercial Training*, 37(5), 259-263.
- [10] Chang, M. (2004). Why some graduates are more marketable than others: Employers' perspective. *Workshop on Enhancing Graduate Employability in a Globalised Economy*, Economic Planning Unit.
- [11] Zakaria, N, Jalal, Z. A., & Yunos, S. N. S. (2018). Bridging the gap between employers' expectation and graduates' actual performances through communication strategies. *E-Proceeding LSP-GABC 2018*.
- [12] Hassan, S. N. H., Zamberi, M. M., Khalil, S. N. b., Sanusi, N. b., Wasbari, F., & Kamarolzaman, A. A. (2012). Company perception on the employability skills of industrial training students. *Journal of Technical Education and Training (JTET)*, 4(2).
- [13] Turksen, I.B. & Wilson, I.A. (1994). A Fuzzy Preference Model for Consumer Choice. *Fuzzy Sets and Systems*, 68, pp. 253-266.
- [14] Yahya, Y.H. & Mohamad, N. (2011) Designing Software Usability Measurement Using Fuzzy Set Conjoint Model. *Proc. of International Conference on Computer Communication and Management (CSIT)*, IACSIT Press, Singapore, pp. 582-586.
- [15] Kahraman, C. (2008). *MultiCriteria Decision Making Methods and Fuzzy Sets*, In Kahraman (Ed.). *Fuzzy Multi-Criteria Decision Making: Theory and Applications with Recent Developments*, Springer Science & Business Media, LLC, New York.
- [16] Wang, L.X. (1997). *A Course in Fuzzy Systems and Control*. New Jersey: Prentice Hall International, Inc.