



## Fuzzy Delphi Approach Determining Element in Competence Development Among Vocational College Business Graduates

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### Abstract

*The purpose of this study is to identify the elements in the competence development required by the Vocational College Business Department to meet the requirements of employability skills based on expert consensus. A total of 20 experts were selected to analyze the fuzziness consensus of experts. All collected data were analyzed using the Fuzzy Delphi Method. The findings show that there are 13 elements participation in competency development and 12 elements perceived support for competency development elements required by graduates of the Vocational College Business Department based on a qualified expert consensus, the threshold value (d construct) is less than 0.2 and the percentage of the expert group is more than 75%.*

**Keyword:** Employability skills, cognitive apprenticeship, vocational college business graduates, Fuzzy Delphi method, competency development

### Introduction

The development of highly competent and knowledgeable human capital is crucial in helping Malaysia to become a high-income nation. The technical knowledge gained by students from their business courses creates an added value sought by employers seeking for employees with experience (Jackson, 2011). In this regard, most employers seem to value and put more weight on experience compared to academic achievements when hiring new employees (Chronicle of Higher Education, 2012).

Over the years, there are many initiatives highlighted through various government policies. These include the New Economic Model (EBM), the Economic Transformation Program (PTE) and the 10th Malaysia Plan (10MP) which are aimed to develop highly competent manpower which in turn, could reduce Malaysia's dependence on foreign workforce (Majlis Penasihat Ekonomi Negara, 2010). This shows that there is a need for employers, students and training providers to increase the number of highly skilled workers [4], and to promote the Technical Vocational Education and Training (TVET) to raise awareness among students and employers (Unit Perancang Ekonomi, 2016).

This is in line with the aspiration of the competent workforce development which is shaped by the 2050 vision of National Transformation towards "Being the top 20 countries in economic development, social progress and innovation". This is also in line with UNESCO (2016) goal that by 2030, all students should possess the knowledge, skills, values sought by employers (Jackson & Chapman, 2012). Therefore, workmanship skills must be included in the curriculum to produce graduates who are competent to work in real business environment (Sangwan & Garg, 2017).

However, there is a lack of research on workmanship skills related to work experience in industrial training as reported by Jackling & Ricardo, (2015). This study explains the need for further research learning during industrial training to improve workability skills. Furthermore, Kagaari (2007) argued that there should be more studies related to factors involving the involvement of graduates in industrial training while (Gbadamosi et.al,(2015) stated that further research is needed on the effect of employers' support during industrial training on the development of employability skills. Moreover, Tomlinson & Holmes, (2017) posited that the issue on the employability skills of Higher Education Institutions' graduates could be considered as an economic and policy agenda where the focus is on exploring how graduates transfer their knowledge and skills they gained during their study to the work environment. Hence employability is a very important and critical field of study, specifically in light of the high rate of graduate unemployment due to the global economic downturn (Onyishi, Enwereuzor, Ituma, & Omenma, 2015).

This study will contribute to the existing body of research by focusing on business skills, specifically in the aspects of competency development. There are several studies that have attempted to combine the opinions of both stakeholders, specifically the employees and supervisors (Quality Assurance Agency, 2009), but there is limited research to address this problem by considering the different views of stakeholders including the employers, higher learning institutions, and graduates/ employees as these parties contribute to the development of business graduates' competencies. The respondents of this study include lecturers from the Vocational Colleges' Department of Business, field supervisors of the graduate industrial training programme, lecturers from the Department of Business and subject experts from the public and private universities and Malaysia teacher education institute.

## Literature Review

This efficiency-based approach enables a more flexible work organization compared to the traditional job-based approaches which are deemed as bureaucratic. It has been argued that these approaches hinder an organization's quick response to the changes in organizational needs (A.Campion et al., 2011)

### a. Employability Skills

'*Employability skills*' comprise of marketability, workability and employability. Marketability refers to the skills, quality and merit of graduates that could be used to market themselves for work (Hansson, 2002; Mohd As'ri Chik, 2009; Muhammad Hazrul, 2012). Meanwhile, workability is the ability to work and solve different tasks (Lees D, 2002), and employability is the ability to be employed by employers (Cleary et al., 2006; Hillage & Pollard, 1998; Yorke & Knight,

2006). In this light, marketability, workability and employability are aimed to provide benefits to individuals, the workplace, the community and the (BPTV KPM, 2014; CBI, 2009, 2011; Kementerian Pengajian Tinggi, 2012; Knight & Yorke, 2002; Lees D, 2002; Mason, Williams, & Cranmer, 2009; Moreland, 2006; Overtoom, 2000; Quality Assurance Agency, 2009; Yorke & Knight, 2006).

In this study, 'employability skills' reflect the essential elements needed by every employee to produce a flexible, innovative and able workers that can complete different tasks (BPTV KPM, 2014). In the meantime, business skills comprise of the knowledge, skills and abilities needed by every business graduates to become flexible, initiative and capable employees that can complete different tasks and fulfil employers' demand in the industry, particularly those related to the technical aspects of business (Jackson, 2011).

### **b. Competency Development**

Competency development is an activity undertaken by organizations to maintain and enhance the efficacy, knowledge and competency of their employees' (Forrier & Sels, 2003). It encompasses an integrative approach towards development activities which involve both an organization and its employees (Sandberg, 2000; Van Der Heijde & Van Der Heijden, 2006). In this regard, this study is focused on the development of competency, specifically the employability of skills vocational college business graduates.

### **c. Cognitive Apprenticeship Theory**

This study is focused on the apprenticeship approach. This approach is based on the cognitive apprenticeship theory, which uses simple constructivism (Collins, Brown, & Newman, 1989). At the early stage, this approach was initiated by conducting demonstration sessions to the students. These sessions were delivered by industry training supervisors to equip the students with the relevant skills. The students were given the opportunity to trying out these skills either individually or in groups under the guidance of industry training supervisors. The support of the industrial training supervisor was gradually reduced to increase the students' independence as they complete the assignment.

## **Methodology**

This study used Fuzzy Delphi Method (FDM) in obtaining expert consensus on the elements of the jungle school model for native students.

### **a. Sample**

This study is a quantitative study. This research involves 20 field experts as samples (Hsu & Sandford, 2007). Each selected experts have more than 5 years experience in the related field (Akbari & Yazdanmehr, 2014). This study used a set of questionnaire for competence development as its research instrument. The sets of questionnaire contain 25 items and were distributed to experts. The criteria for the selection of experts for the study include:

- i. Public university, private university, Malaysia teacher education institute and Vocational Colleges lecturers who graduated with Doctor of Philosophy and are experts in related fields
- ii. Lecturers who are working in the Business Department of vocational colleges and have served for more than 5 years
- iii. Employers supervising the industrial training of vocational colleges business students and have served for more than 5 years in industries.

For this study, to implement the Fuzzy Delphi technique, the researcher has approached group of experts who have agreed to contribute their expertise. In this regard, the experts have helped improve the items in the questionnaire through expressing ideas and providing critiques. Consequently, after indicating their level of agreement, the experts were asked to share their views on each item. The data obtained from the Likert Scale were then translated into Fuzzy number data and analyzed using Microsoft Excel software. This data analysis technique is known as the Fuzzy Delphi technique or Fuzzy Delphi Method (FDM) where expert comments and suggestions are considered to improve specific items. The researcher has also selected a five-point linguistic scale. as shown in Table 1 .

**Table 1 – Research Scale**

Level of agreement	Fuzzy Scale	Fuzzy Scale
Extremely disagree	0.0, 0.0,0.2	1
Disagree	0.0, 0.2,0.4	2
Somewhat agree	0.2, 0.4,0.6	3
Agree	0.4, 0.6,0.8	4
Extremely agree	0.6, 0.8,1.0	5

The data were then tabled to obtain the Fuzzy values (n1, n2, n3) and Fuzzy average values (m1, m2, m3). These values were then used to obtain the threshold value, percentage of expert consensus, defuzzication and item ranking. For the purpose of obtaining an expert agreement for each item, it was determined that the threshold value should not exceed 0.2(Chang, Hsu, & Chang, 2011; Cheng & Lin, 2002). The percentage of experts approval should exceed 75% (Hui-Chun & Gwo-Jen, 2008) meanwhile defuzzication value for each item should exceed  $\alpha$ -cut = 0.5(Bodjanova, 2006; Tang & Wu, 2010). The average value was determined according to the prescribed formula. The formula used to obtain the average value is as follow in Fig. 1;

$$d(\tilde{m}, \tilde{n}) = \sqrt{\frac{1}{3} [(m_1 - n_1)^2 + (m_2 - n_2)^2 + (m_3 - n_3)^2]}$$

Fig. 1: Formula to obtain the average value

Based on the formula in Fig. 1 , d depicts the threshold value. If the value of d is  $d > 0.2$ , then all the experts have reached an agreement. However, if the value of d is  $d \leq 0.2$ , the researchers have to repeat the procedure (Chen, 2000; Cheng & Lin, 2002). The Delphi's Fuzzy Technique also involves the process of determining the expert's agreement, which should either exceed or equal to 75% for the whole construct or for each item. At this point, the researchers have to obtain the decision or agreement of the expert group, which is also known as the consensus group. It was decided that a 75% consensus would be necessary to show agreement among the experts. If the consensus was less than 75%, then, the researchers would have to repeat the procedure to ensure that at least 75% consensus was reached among the experts.

The value of  $\alpha$ -cut equals to the median value for '0' and '1', where  $\alpha$ -cut =  $(0 + 1) / 2 = 0.5$ . Hence, if the value of A is less than the value of  $\alpha$ -cut = 0.5, the item would be rejected as it indicates the agreement of the specialist in rejecting the item but if the resulting value A exceeds the value of  $\alpha$ -cut = 0.5, the item will be accepted as it shows the expert consensus the item concerned (Bodjanova, 2006).

## Results and Discussion

As mentioned this study used the Fuzzy Delphi's expert agreement to determine the elements of competency development among vocational college business students. The next phase focused on the development of competencies (involvement) by testing thirteen (13) items which will specifically answer the question of the first study. Meanwhile, the development of competence (support) will be tested through twelve (12) items which will specifically answer the question of the second study.

The main objective of this study is to identify the elements in the development of competencies among business students of vocational colleges to fulfil the need of employability. In this regard, competency development is determined based on expert consensus, what is required by the employer and the requirements of a particular field. The results were presented according to the research questions:

*Research Question 1: What aspects should be included in the involvement competence development element for vocational college business students based on priorities?*

*Research Question 2: What aspects should be included in the support competence development element for vocational college business students based on priorities?*

*Research Question 1* : Based on the expert consensus, what aspects should be included in the involvement competence development element for vocational college business students based on priorities? Based on Table 2 for the development of competence (involvement), only items A1, A3, A7 and A12 have the threshold value of  $d \leq 0.2$ . In this regard, item has reached a good expert agreement if the average threshold ( $d$ ) value is less than 0.2 n (Chang et al., 2011; Cheng & Lin, 2002). In this light, although the findings show that only items A2, A4, A5, A6, A8, A9, A10, A11 and A13 have exceeded the threshold value ( $d > 0.2$ ), however, the percentage of expert consent indicates that all items have exceeded the value of 75% Chang et al.,(2011). Meanwhile, the highest value of *defuzzication* evaluation is 15.80, and the lowest is 12.40. All Alpha-Cut defuzzication (average of fuzzy response) exceeds  $\alpha$ -cut  $> 0.5$ ; according to (Bodjanova, 2006; Tang & Wu, 2010) the alpha cut value should exceed 0.5 and if less than 0.5 the item should be eliminated. This shows that the constructs of the Comprehensive Development Involvement item have been agreed upon by the experts involved in the assessment of this item. The items with experts' agreement are ordered based on *priority*.

*Research Question 2* : Based on the expert consensus, what aspects should be included in the Support competence development element for vocational college business students based on priorities? Based on Table 3 for the development of competence (support)below, only items B8 and B12 have the threshold value is  $d \leq 0.2$ . As mentioned, an item has reached a good expert agreement if the average value of the threshold ( $d$ ) is less than 0.2, (Chang et al., 2011; Cheng & Lin, 2002). In this light, although the findings show the items B1, B2, B3, B4, B5, B6, B7, B9, B10 and B11 have exceeded the threshold value ( $d > 0.2$ ), but the percentage of expert consent indicates that all items exceed the value of 75% (Chang et al.,2011). The highest value of defuzzication evaluation is 15.80 and the lowest is 11.40 while all Alpha-Cut defuzzication (average of fuzzy response) exceed the  $\alpha$ -cut $> 0.5$ . According to (Bodjanova, 2006; Tang & Wu, 2010) the alpha cut value should exceed 0.5 and items with less than 0.5 should be eliminated. This shows that the support construct items for Competency Development have been agreed upon by the experts involved in the assessment of this item. The items with experts' agreement were arranged according to *ranking*.

## Conclusion

The findings clearly show that based on the expert consensus, there are 13 elements of competency development for involvement and 12 elements of competency development for support required by business management students. In light of the 13 elements for involvement, the experts' most preferred choice for competency development item "There is a training session held in the classroom that focuses on acquiring knowledge" and while the least preferred item is "There is an application for the student to fill vacancies in the organization for a new appointment". Meanwhile, for the 12 elements of support, the most preferred by the competence development experts is the need for "Students to easily obtain all information about career opportunities in the organization" and the least preferred statement (12) is "Employers give students clarification regarding work processes using NOSS based KSKV".

Based on these finding, this study has allow the identification of the elements of competency development and the support of competency development of business management students. This information will help lecturers and industry training supervisors to conduct more appropriate training activities or programmes to help students effectively and efficiently master business related technical skills to fulfil the current and future needs of the industry.

Moreover, the information and feedback from the experts involved in the study can help develop some models or frameworks of competency development elements (involvement) and the development of competencies (support) among students. This could be in forms of documents and references such as guidebooks. This will facilitate the training of the student industry that will improve their employability skills. Furthermore, this will help develop vocational college business management students who well prepared to work in the industry, which in turn could reduce the unemployment rate among graduates.

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APPENDIX 1 (LAMPIRAN 1)

Table 2: Threshold value, expert consensus percentage , defuzzification,  $\alpha$ -cut and the ranking of competency development elements (involvement )

EXPERT / ITEM	Competency Development Elements (Involvement )												
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13
Expert 1	0.168	0.046	0.183	0.015	0.046	0.092	0.153	0.031	0.183	0.061	0.107	0.107	0.031
Expert 2	0.137	0.046	0.122	0.015	0.046	0.092	0.153	0.031	0.122	0.061	0.107	0.107	0.275
Expert 3	0.168	0.046	0.183	0.015	0.046	0.092	0.153	0.031	0.183	0.061	0.107	0.107	0.031
Expert 4	0.137	0.046	0.122	0.015	0.046	0.092	0.153	0.275	0.122	0.061	0.199	0.107	0.031
Expert 5	0.137	0.046	0.122	0.015	0.260	0.092	0.153	0.031	0.122	0.244	0.107	0.199	0.031
Expert 6	0.168	0.046	0.183	0.015	0.046	0.092	0.153	0.031	0.183	0.061	0.107	0.107	0.031
Expert 7	0.137	0.046	0.122	0.015	0.046	0.092	0.153	0.031	0.183	0.061	0.107	0.107	0.031
Expert 8	0.168	0.260	0.183	0.290	0.046	0.092	0.153	0.031	0.183	0.061	0.107	0.107	0.031
Expert 9	0.168	0.046	0.183	0.015	0.046	0.092	0.153	0.275	0.183	0.061	0.199	0.107	0.031
Expert 10	0.137	0.046	0.122	0.015	0.046	0.092	0.153	0.031	0.122	0.061	0.107	0.107	0.031
Expert 11	0.137	0.046	0.183	0.015	0.046	0.092	0.153	0.031	0.122	0.244	0.107	0.199	0.031
Expert 12	0.137	0.260	0.122	0.015	0.046	0.214	0.153	0.031	0.122	0.061	0.199	0.199	0.031
Expert 13	0.137	0.046	0.122	0.015	0.046	0.092	0.153	0.031	0.183	0.061	0.107	0.107	0.031
Expert 14	0.168	0.260	0.122	0.015	0.046	0.519	0.153	0.031	0.122	0.061	0.810	0.107	0.031
Expert 15	0.137	0.046	0.183	0.015	0.046	0.519	0.153	0.031	0.122	0.061	0.107	0.199	0.031
Expert 16	0.168	0.046	0.183	0.015	0.046	0.092	0.153	0.031	0.122	0.061	0.107	0.199	0.031
Expert 17	0.137	0.046	0.122	0.015	0.046	0.092	0.153	0.031	0.122	0.061	0.199	0.107	0.031
Expert 18	0.137	0.046	0.122	0.015	0.046	0.092	0.153	0.031	0.122	0.061	0.107	0.107	0.031
Expert 19	0.168	0.046	0.122	0.015	0.260	0.092	0.153	0.031	0.183	0.244	0.107	0.199	0.275
Expert 20	0.168	0.046	0.122	0.015	0.260	0.214	0.153	0.031	0.122	0.244	0.107	0.199	0.031
Threshold value item	0.151	0.078	0.147	0.029	0.078	0.147	0.153	0.055	0.147	0.098	0.160	0.139	0.055
Expert concensus (%)	100%	85%	100%	95%	85%	80%	100%	90%	100%	80%	95%	100%	90%
Defuzzication	14.20	15.40	14.40	15.80	12.60	14.80	14.00	15.60	13.60	12.80	14.60	13.40	12.40
$\alpha$ -cut	0.710	0.770	0.720	0.790	0.630	0.740	0.700	0.780	0.680	0.640	0.730	0.670	0.620
Ranking	7	3	6	1	12	4	8	2	9	11	5	10	13

**APPENDIX 2 (LAMPIRAN 2 )**

**Table 3: Threshold value (item d), expert concensus percentage , defuzzification,  $\alpha$ -cut and the ranking of competency development elements (support )**

EXPERT / ITEM	Competency Development Elements (Support )											
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
Expert 1	0.153	0.015	0.061	0.107	0.137	0.031	0.046	0.168	0.015	0.122	0.046	0.183
Expert 2	0.153	0.015	0.061	0.107	0.168	0.031	0.046	0.137	0.015	0.183	0.046	0.122
Expert 3	0.153	0.015	0.061	0.107	0.137	0.336	0.046	0.137	0.015	0.489	0.046	0.122
Expert 4	0.458	0.015	0.061	0.199	0.137	0.031	0.046	0.168	0.015	0.183	0.046	0.122
Expert 5	0.153	0.290	0.061	0.107	0.168	0.275	0.046	0.168	0.015	0.122	0.046	0.183
Expert 6	0.153	0.015	0.061	0.107	0.137	0.031	0.046	0.168	0.015	0.122	0.046	0.183
Expert 7	0.153	0.015	0.244	0.107	0.137	0.275	0.260	0.168	0.015	0.122	0.046	0.183
Expert 8	0.153	0.015	0.061	0.107	0.137	0.031	0.046	0.137	0.015	0.122	0.046	0.183
Expert 9	0.153	0.015	0.061	0.199	0.168	0.031	0.046	0.137	0.015	0.183	0.260	0.183
Expert 10	0.153	0.015	0.061	0.504	0.474	0.031	0.046	0.137	0.015	0.122	0.046	0.122
Expert 11	0.153	0.015	0.061	0.199	0.168	0.031	0.260	0.137	0.015	0.122	0.046	0.122
Expert 12	0.153	0.015	0.244	0.107	0.137	0.031	0.046	0.168	0.290	0.183	0.260	0.122
Expert 13	0.153	0.290	0.061	0.107	0.137	0.031	0.046	0.168	0.015	0.122	0.046	0.122
Expert 14	0.153	0.015	0.061	0.199	0.137	0.031	0.046	0.168	0.015	0.183	0.046	0.183
Expert 15	0.153	0.015	0.061	0.107	0.137	0.275	0.046	0.137	0.015	0.122	0.046	0.122
Expert 16	0.153	0.015	0.244	0.107	0.168	0.031	0.046	0.137	0.015	0.122	0.046	0.122
Expert 17	0.153	0.015	0.244	0.107	0.137	0.031	0.260	0.137	0.015	0.183	0.260	0.122
Expert 18	0.153	0.015	0.061	0.199	0.168	0.031	0.046	0.137	0.015	0.122	0.046	0.122
Expert 19	0.153	0.015	0.061	0.107	0.137	0.031	0.046	0.168	0.015	0.122	0.046	0.183
Expert 20	0.153	0.321	0.061	0.107	0.168	0.031	0.046	0.137	0.015	0.122	0.046	0.122
Threshold value item	0.168	0.058	0.098	0.150	0.165	0.082	0.078	0.151	0.029	0.159	0.078	0.147
Expert concensus (%)	95%	85%	80%	95%	95%	80%	85%	100%	95%	95%	85%	100%
Defuzzication	14.00	12.20	15.20	14.60	14.20	12.40	11.40	13.80	15.80	14.40	15.40	13.60
$\alpha$ -cut	0.700	0.610	0.760	0.730	0.710	0.620	0.570	0.690	0.790	0.720	0.770	0.680
Ranking	7	11	3	4	6	10	12	8	1	5	2	9