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Modified delphi technique: the future of vocational learning skills

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ABSTRACT

This article explains the development of checklist which is related with future of vocational learning skills by using the Modified Delphi techniques. The Modified Delphi technique provides the opportunity for researchers to gather input from participants in the first round of collecting data and then distributed that checklist to the expertise until consensus achieved. Often, the process is used to find consensus among experts who have different views and perspectives. The Modified Delphi technique enables group problem-solving using an iterative process of problem definition, discussion, feedback, and revisions. This paper will discuss the basics of the Modified Delphi techniques, its application potential, the selection of expert panels and the means on how consensus can be reached among the participants using examples of our past research using the technique. The 13 out of 15 domain of the future learning skills have found in this research.

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Introduction

Tomorrow belongs to those who can hear it coming, said David Bowie forty years ago. Jobs, labour markets and economics are rapidly changing: globalisation, technology and growing services sector are both causes and symptoms. The education in today's modern world must transform and in line with the needs of Industrial Revolution. To change one's education curriculum may seem difficult, but it is applicable with the elements of Industrial Revolution. Peter (2017) and Mustapha et. al (2020) opined that curriculum must be revised triennially to ensure it is in line with the objectives of curriculum needs, to date. However, the curriculum that needs to be revised must involve theory syllabus solely without emphasising skills at workshop or laboratory. It is also supported by Grewall et. al. (2018) said that in order to develop a technical and vocational education – based curriculum, a particular guideline focusses on the future learning skills that must be developed and applied. Other than Grewal's and others, World Economic Forum (2017) and Haron et. al. (2019) also asserted that skilled labours should be developed early since college days, so they could seize as many as

opportunities at educational institutions and make use of them, in preparation for their careers in future. Thus, hoping that authorities such as the government, curriculum makers, educators and those who involve can intensify our current curriculum and the one that will be developed soon with the elements of future learning skills. So, it could help to increase the percentage of graduates' marketability from any technical and vocational schools, soon.

Moving Forward – Towards Effective Education

In 19th century, only a small number of children who could enrol in pre-primary education compared to those who could not. Then, they worked at factories and farm sector. Yet, the timeline changes had empowered the educational system in the world including the Industrial Revolution which started begun. The Industrial Revolution happened when the industry needed huge number of skilled labours to execute activities such as data control and software development. Hence, securing jobs became very competitive among the graduates intensely. While, the employers sought for potential labours to fulfil the needs and targets of the industry at that time. The point also seconded by Crittended and Peterson (2019) that the rivalry in future will become more competitive, cohesive and resilient by emphasizing investment on human beings, education and training, skills, creativity and innovative capacity. Many aspects should be taken into consideration while surpassing the policy such as: (i) the content of policy and implications for those in Technical and Vocational Education, (ii) define the vision of Technical and Vocational Education in year 2030 (iii) the cooperation with industries (Cyert, 2017). Thus, researcher decided to take into account the factor of graduate's marketability, needs and demands of the industry by developing a checklist which contains domains of learning skills focus on technical and vocational which must be mastered by every graduate at the very end soon. So, the authorities could take the effective ways to enhance the capability and increase the added values in themselves to meet the demand of industry later.

Method

Researcher has developed a preliminary checklist of future vocational learning skills domains to explore the criteria of learning skills in the future vocational and technical area among the experienced experts, who knowledgeable in teaching and learning studies. The checklist has 15 domains that measured and validated to obtain the validity and reliability each of them. The checklist was distributed to 35 respondents in Malaysia during the pilot test prior to performance of actual research. The data gathered was analysed using SPSS software to get the value of domains consensus.

Instrument Development

Davis et al. (2002) contend that a central challenge of studying core vocational knowledge and skills is about operationalizing and defining the scope of the discipline. Defined as the "the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large" (American Marketing Association, 2007), marketing is a complex field requiring industry practitioners with a varied set of competencies. As a result, the starting point for a study of this nature is to deconstruct and rank the specific conceptual knowledge areas and skills among industry practitioners.

The process undertaken began with a literature review of existing studies on meta-skills and knowledge areas central to vocational learning. Next, we conducted a future vocational learning skills of the top 20 expert panels by using the Modified Delphi Technique. This analysis included coding key outcomes, skills, and knowledge areas at both program and course levels. We then established an expert industry panel to support checklist development based on purposeful sampling to ensure a diverse representation of vocational learning expertise. The four criteria used to select the panel involved (a) experienced in technical and vocational education (b) writing books and journals which focus on technical and vocational education, (c) leaders in technical and vocational education, and (d) representatives from diverse industries. Based on these criteria, a pool of candidates was identified via the researchers' professional networks. The technique used in developing the checklist is the Modified Delphi Technique. There were 3 rounds of procedure and conducted with 20 expert panels who were chosen based on their knowledge and experience.

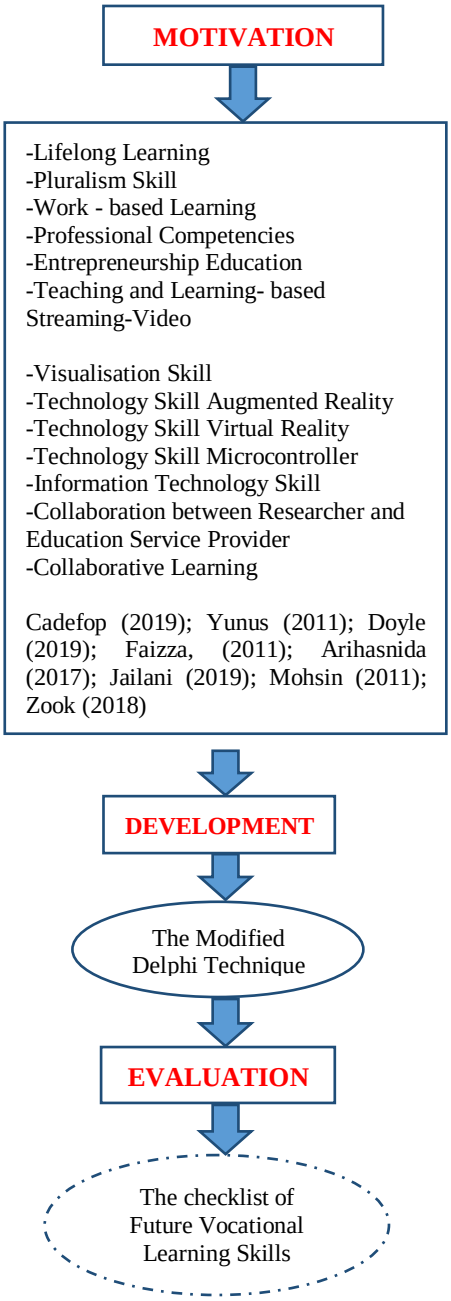

Diagram 1 <Flow the Development of Future Vocational Learning Skills>

A preliminary checklist or motivation phase was developed based on the 15 identified domains within the literature and the curriculum analysis. The flow of the checklist followed the structure of the most important and unimportant of vocational learning domain analyses, where the respondent was asked to assess each item on a 3-point rating scale to enable analysis of variance (Bacon, 2003). A 3-point scale is considered more appropriate for surveys (see Finstad, 2010). The important scale is anchored at (1) needs only a basic understanding (2) and (3) needs a deep comprehension. Similarly, the performance scale is anchored at (1) very weak and (3) very strong. The evaluation of meta-skills leveraged the item structure of the European Centre for the Development of Vocational Training (CEDEFOP) briefing note (Mayer, 2018). The CEDEFOP briefing note was selected since (a) it was designed as an instrument to measure meta-skills development of vocational learning and (b) the item structure of the CEDEFOP briefing note has demonstrated significant reliability and validity (Parks et al., 2001). A pre-test was conducted to examine the reliability of the checklist. A total of 35 respondents were specifically selected and asked to review the checklist. Each was asked to complete the checklist and provide feedback on the clarity of the checklist, as well as the relevancy of the

domain measured against the discipline. Based on the Cronbach's Alpha analysis, no domain was made redundant and nothing should be removed as all domains have good fit and strong which value of reliability is between 0.75 -0.87.

Sample

In order to determine the scale of the most important to the least one of the future learning skills domains in vocational education, each domain needs to be verified and examined by experts. The 20 panels were chosen as the validity experts and basic needs analysis during the motivation and development phase (Refer Table 1) of the checklist. The developed checklist was distributed to 35 respondents comprises five zones in Malaysia. After collected the checklist, the data was analysed using Scale analysis in SPSS to obtain the value of reliability. Majority of the respondents are male who have over 10 years of working experience.

Table 1 <Expertise and Respondents Sample>

Category	**Percent** *Expertise (N= 20)*	**Percent** *Respondents (N=35)*
Gender		
Male	37.3	63.2
Female	62.7	36.8
Experience		
Less than 1 year	-	-
1-5 years	11.6	15.5
6-10 years	40.6	25.5
More than 10 years	47.8	59
Age		
25 - 30	-	-
31 - 35	34.8	35.1
36 – 40	21.9	22.1
41 – 45	11.9	20.5
46 – 50	9.7	22.3
51 – 55	4.6	-
56 – 60	9.9	-
Above 60	7.2	-

Results and Discussions

The Modified Delphi Technique

Based on the literature research related to the vocational learning skills domains, a 15 of domains were suggested. Those domains were arranged in one checklist. The basic checklist must be developed as the guideline for the researcher during interviews. Thus, the checklist was examined and verified by 20 expertise obtain the validity of domain. Table 2 shows the experts' opinion and evaluation compared to curriculum analysis during the first round of the Modified Delphi Technique.

Table 2 <Delphi First Round>

No of Domain	**Domain**	**Expertise**	**Curriculum Analysis**	**Literature Review**
K1	Lifelong Learning	√	-	Cadefop (2019)
K2	Pluralism Skill	√	√	
K3	Work – based Learning	√	√	Yunus (2011)
K4	Accessing and Analysing Information	√	√	(Tony, 2011)
K5	Curiosity and Imagination	√	√	
K6	Professional Competencies	√	√	Doyle (2019)
K7	Entrepreneurship Education	√	√	Zook (2018)

No of Domain	Domain	Expertise	Curriculum Analysis	Literature Review
K8	Teaching and Learning- based Streaming-Video	√	√	
K9	Visualization Skill	√	√	Faizza, (2011)
K10	Technology Skill Augmented Reality	√	√	
K11	Technology Skill Virtual Reality	√	√	
K12	Technology Skill Microcontroller	√	√	Arihasnida (2017)
K13	Information Technology Skill	√	√	Jailani (2019)
K14	Collaboration between Researcher and Education Service Provider	√	√	Mohsin (2011)
K15	Collaborative Learning	√	√	

The Next Round of Delphi

After the 20 experts returned the checklist, the descriptive analysis statistics of Measures of Central Tendency obtained the values of median and interquartile range (IQR). The values of median are 4 and 5 which indicate the experts met the consensus on those items while the IQR shows the values of 0 and 1 which indicate a consensus between experts' opinion on those developed items (Nashir et. al, 2015; 2019; 2020). Table 3 shows the summary of domain findings in round 2 and 3. Based on Table 3, 15 items were recommended in the checklist development to be tested during the first round. However, during the third round, it had removed 2 items which are accessing skill & analysing information and curiosity & imaginative skills which did not get votes. Hence, at the final round, 13 domains in total were finalised. Then, based on the experts' consensus, these 13 domains obtained high consensus level which are median 4 and 5 while the high/ strong value of consensus; IQR is 0 and 1. This shows that all 13 domains are consensus and agreed by the 20 experts at the round 3.

Table 3 <Next Delphi Round>

No of Domain	Domain	Round 2		Round 3		Literature Review
		Median	IQR	Median	IQR	
K1	Lifelong Learning	4	0	4	0	Accepted
K2	Pluralism Skill	5	1	5	1	Accepted
K3	Work – based Learning	5	1	5	1	Accepted
K4	Accessing and Analysing Information	2	2	-	-	Rejected
K5	Curiosity and Imagination	1	2	-	-	Rejected
K6	Professional Competencies	4	1	4	1	Accepted
K7	Entrepreneurship Education	4	1	5	1	Accepted
K8	Teaching and Learning- based Streaming-Video	4	1	4	1	Accepted
K9	Visualization Skill	4	0	4	0	Accepted
K10	Technology Skill Augmented Reality	5	0	5	0	Accepted
K11	Technology Skill Virtual Reality	5	0	5	0	Accepted
K12	Technology Skill Microcontroller	4	1	5	1	Accepted
K13	Information Technology Skill	5	1	5	1	Accepted
K14	Collaboration between Researcher and Education Service Provider	5	1	5	1	Accepted
K15	Collaborative Learning	5	1	5	1	Accepted

Reliability Domain

In the study there are two types of reliability which is internal and external. In this study internal reliability was done where data was collected, analyzed and interpreted regarding to the rule of thumb (Table 4). Table 4 is the rule of thumb of the result of the Cronbach's Alpha using IBM SPSS software. Based on the Table 5, there are seven domain which is have internal consistency good out of 15 domain in this research.

Table 4 <Rule of Thumb for Results>

Cronbach's Alpha	Internal Consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Table 5 <Interpretation of Reliability>

No of Domain	Domain	Reliability Cronbach's Alpha	Interpretation
K1	Lifelong Learning	0.75	Acceptable
K2	Pluralism Skill	0.77	Acceptable
K3	Work – based Learning	0.81	Good
K4	Accessing and Analysing Information	0.83	Good
K5	Curiosity and Imagination	0.85	Good
K6	Professional Competencies	0.77	Acceptable
K7	Entrepreneurship Education	0.87	Good
K8	Teaching and Learning- based Streaming-Video	0.76	Acceptable
K9	Visualization Skill	0.76	Acceptable
K10	Technology Skill Augmented Reality	0.77	Acceptable
K11	Technology Skill Virtual Reality	0.78	Acceptable
K12	Technology Skill Microcontroller	0.75	Acceptable
K13	Information Technology Skill	0.80	Good
K14	Collaboration between Researcher and Education Service Provider	0.80	Good
K15	Collaborative Learning	0.87	Good

Conclusion

This paper presents the results on Delphi Technique to determine the domains of future vocational learning skills and to verify whether all the items in the checklist were statistically reliable and valid for further analysis, and if each item measured the specific objectivity within the analysis. The results are also supported by Cronbach's Alpha of item reliability at 0.75 -0.87 respectively. Based on the summary of statistic in this analysis, the validity and reliability for 15 domain of future vocational learning skills is reliable. It is recommended that future research should explore the effectiveness of the students in technical and vocational institutions after apply this future vocational learning skills domain. This would produce valuable information about the effectiveness of this domain. Another avenue for the future research should be to combine both quantitative and qualitative analysis and analyse the results with a view to minimizing the possibility of bias in understanding the measurement of instruments.

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