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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 Delphi techniques. The Delphi technique provides the opportunity for researchers to gather input from participants without requiring them to work face-to-face. Often, the process is used to find consensus among experts who have different views and perspectives. The 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 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. This article also provides Rasch analysis to find reliability in checklist. The value of realibility must achieve 0.71 – 0.99 in good fit. The 11 out of 13 domain of the future learning skills have found in this research.*

Keywords--- *Delphi technique, technical and vocational education, expert panels, future learning skills, checklist, instruments, Rasch analysis*

I. 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 [1] and Mustapha et al [2] 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 [3] 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 [4] and Haron et al [5] 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 [6].

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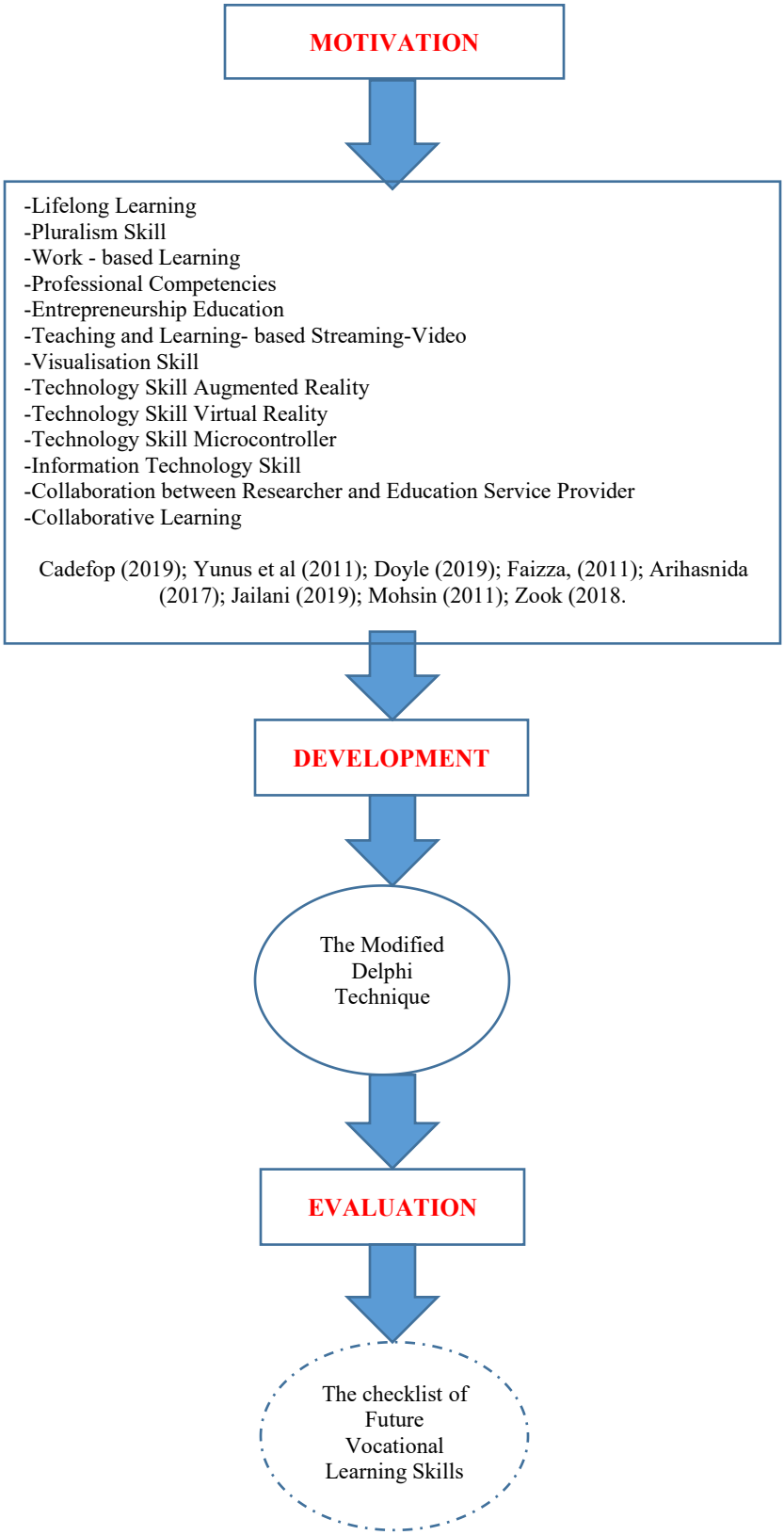
II. MOVING FORWARD – TOWARDS EFFECTIVE EDUCATION

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 Crittenden and Peterson [7] 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 [8]. 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.

III. METHODOLOGY

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 13 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 and Winsteps to get the value of domains reliability.

Diagram 1. Flow the Development of Future Vocational Learning Skills


MOTIVATION
-Lifelong Learning
-Pluralism Skill
-Work - based Learning
-Professional Competencies
-Entrepreneurship Education
-Teaching and Learning- based Streaming-Video
-Visualisation Skill
-Technology Skill Augmented Reality
-Technology Skill Virtual Reality
-Technology Skill Microcontroller
-Information Technology Skill
-Collaboration between Researcher and Education Service Provider
-Collaborative Learning
Cadefop (2019); Yunus et al (2011); Doyle (2019); Faizza, (2011); Arihasnida (2017); Jailani (2019); Mohsin (2011); Zook (2018.
DEVELOPMENT
The Modified Delphi Technique
EVALUATION
The checklist of Future Vocational Learning Skills

INSTRUMENT DEVELOPMENT

Davis et al [9] 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" [10], marketing is a complex field requiring industry practitioners with a varied set of competencies [11]. 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.

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 [12]. A 3-point scale is considered more appropriate for surveys (see Finstad) [13]. 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 [13]. 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 [14]. 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. Both the empirical results from Rasch analysis identified concerns associated with both redundancy and checklist length. Based on the Rasch analysis, no domain was made redundant and nothing should be removed as all domains have good fit/ strong which value of reliability is between 0.70 to 0.88.

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 Rasch analysis 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	-

IV. 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)
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 [16]; [17]; [18]. 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	
		Median	IQR	Median	IQR
K1	Lifelong Learning	4	0	4	0
K2	Pluralism Skill	5	1	5	1
K3	Work – based Learning	5	1	5	1
K4	Accessing and Analysing Information	2	2	-	-
K5	Curiosity and Imagination	1	2	-	-
K6	Professional Competencies	4	1	4	1
K7	Entrepreneurship Education	4	1	5	1
K8	Teaching and Learning- based Streaming-Video	4	1	4	1
K9	Visualisation Skill	4	0	4	0
K10	Technology Skill Augmented Reality	5	0	5	0
K11	Technology Skill Virtual Reality	5	0	5	0
K12	Technology Skill Microcontroller	4	1	5	1
K13	Information Technology Skill	5	1	5	1
K14	Collaboration between Researcher and Education Service Provider	5	1	5	1
K15	Collaborative Learning	5	1	5	1

RASCH ANALYSIS

Analysing data using Rasch Measurement Model gained (i) reliability and items separation between respondents; (ii) items polarity measure constructs based on PTMEA CORR and (iii) the suitability (fit) of domain measurement. Based on the Rasch Measurement Model, the reliability value of Alpha Cronbach is at (a) between 0.71 – 0.99 where the best value is at (71% - 99%). The data finding found that the value of reliability between domains is at its best; 0.72, however the reliability between respondents is at 0.87. The values obtained indicates the checklist is fit and at its best because the consistency value is high, strong and suitable (fit) between each domain.

Besides, the analysis on separation each domain between respondents also need to be shown. Table 4 shows the whole values of reliability and domain separation are at 0.72 and 1.61. The reliability value obtained indicates good and accepted [19]. While, the separation value, 1.61 indicates good and need to be separated into 2 parts at its measurement level. However, Linacre [20] opined that index value of separation is good if it closes to 2.0.

Table 4: Reliability of 13 Domains

No. of Domain	Domain	Reliability Domain		INFIT MNSQ		OUTFIT MNSQ	
		Domain	Separation	Max	Min	Max	Min
K1	Lifelong Learning	0.77	1.83	1.76	0.75	2.17	0.70
K2	Pluralism Skill	0.86	2.43	1.73	0.19	1.77	0.19
K3	Work Based Learning	0.71	1.58	1.74	0.66	1.51	0.54
K4	Professional Competencies	0.77	1.75	1.56	0.77	2.66	0.55
K5	Entrepreneurship Education	0.87	2.50	2.22	0.55	1.88	0.64
K6	Teaching and Leaning – based Streaming Video	0.75	3.14	3.11	0.67	2.45	0.75
K7	Visualisation Skill	0.80	2.23	2.42	0.88	3.45	0.82
K8	Technology Skill Augmented Reality	0.82	1.60	2.11	0.80	4.11	0.67
K9	Technology Skill Virtual Reality	0.78	2.23	1.45	0.74	2.66	0.54
K10	Technology Skill Microcontroller	0.88	3.12	2.54	0.56	3.45	0.78
K11	Information Technology Skill	0.76	2.45	2.86	0.67	2.32	0.66
K12	Collaboration between Researcher and Education Service Provider	0.75	2.31	2.74	0.76	3.11	0.53
K13	Collaborative Learning	0.70	1.89	2.77	0.82	1.45	0.58
	Total	**0.72**	**1.61**	**2.85**	**0.56**	**2.86**	**0.54**

Thus, regarding to the Table 5, the reliability value of each respondent is at 0.88 and separation value is at 3.43. It indicates the data obtained is good and acceptable. In fact, separation value exceeds 2.0 is considered fit and good. Linacre [20].

Table 5: Reliability of 35 Respondents

No. of Domain	Domain	Reliability of Respondents		INFIT MNSQ		OUTFIT MNSQ	
		Domain	Separation	Max	Min	Max	Min
K1	Lifelong Learning	0.86	2.21	1.66	0.77	2.65	0.89
K2	Pluralism Skill	0.75	1.43	1.45	0.21	1.87	0.23
K3	Work Based Learning	0.73	2.11	1.67	0.65	1.92	0.77
K4	Professional Competencies	0.67	1.75	1.43	0.77	2.65	0.54
K5	Entrepreneurship Education	0.87	1.67	2.21	0.55	1.76	0.68
K6	Teaching and Leaning – based Streaming Video	0.88	2.13	2.34	0.67	2.45	0.34
K7	Visualisation Skill	0.73	2.44	2.11	0.88	2.44	0.74
K8	Technology Skill Augmented Reality	0.82	1.71	2.56	0.80	3.11	0.44
K9	Technology Skill Virtual Reality	0.64	2.33	1.67	0.74	2.87	0.67
K10	Technology Skill Microcontroller	0.82	3.11	2.12	0.56	2.43	0.54
K11	Information Technology Skill	0.76	2.65	2.66	0.67	2.31	0.75
K12	Collaboration between Researcher and Education Service Provider	0.71	2.31	2.13	0.76	2.21	0.68
K13	Collaborative Learning	0.77	1.43	2.45	0.78	1.88	0.57
	Total	**0.88**	**3.43**	**3.02**	**0.66**	**2.65**	**0.76**

ITEM POLARITY BASED ON PTMEA CORR VALUE

PTMEA CORR value is used to indicate items for testing the relationship between domains to achieve the suitability (good fit). If the value of PTMEA CORR is positive, it shows the value of domain measured is good and vice versa [19]. Therefore, the negative value should be amended or removed because that particular domain has no effect in the developed checklist. Based on Table 6, no negative domain was found, so the whole domains meet their good fit. However, if there is any negative domain found, it shall be amended or removed. The most positive PTMEA CORR value is 0.65, domain K12 which is "The collaboration between Researcher and Education Service Provider". It indicates the whole PTMEA CORR value is high and there is a high positive correlation between each items or domain.

Table 6: Item Polarity

No. of Domain	Domain	PTMEA CORR
K11	Information Technology Skill	.33
K10	Technology Skill Microcontroller	.36
K6	Teaching and Learning- based Streaming Video	.42
K2	Pluralism Skill	.47
K4	Professional Competencies	.50
K9	Technology Skill Virtual Reality	.52
K8	Technology Skill Augmented Reality	.55
K1	Lifelong Learning	.55
K7	Visualisation Skill	.55
K13	Collaborative Learning	.57
K5	Entrepreneurship Education	.60
K3	Work based Learning	.64
K12	Collaboration between Researcher and Education Service Provider	.65

ITEM FIT MEASURE FOR DOMAIN

Items fit is measuring the constructs that can be seen through the infit and outfit Mean Square (MNSQ). According to Bond & Fox [19] the outfit and infit MNSQ should be in the range of 0.6 to 1.4 to ensure the items are suitable for measuring the constructs. But the outfit index MNSQ noteworthy in advance compared infit MNSQ for determining congruity of items that measure a construct or latent variable [20]. If the infit or outfit MNSQ value more than 1.4 logit, then it gives meaning confusing item. If the MNSQ value is less than 0.6 logit, it shows that the item is too easily anticipated by the respondents [20]. Beside that the outfit and infit ZSTD value should also be within -2 to +2 [19]. But if the outfit and infit MNSQ be accepted, the ZSTD index can be ignored [20]. Therefore, if this condition did not meet, then the item can be considered to be removed or having purified. Based on Table 7, found two items that are not in the specified range and it should be purified or dropped. Items that exceed the value of 0.6 until 1.4 in column outfit MNSQ are item K1 (0.23) and item K13 (1.48).

Table 7: Item Fit Measure based Outfit MNSQ

No. of Domain	Domain	Infit		Outfit	
		MNSQ	ZSTD	MNSQ	ZSTD
K1	Lifelong Learning	1.22	2.5	0.23	2.6
K2	Pluralism Skill	.99	-.1	.98	-.2
K3	Work Based Learning	.81	-2.4	.81	-2.4
K4	Professional Competencies	.81	-2.4	.81	-2.5
K5	Entrepreneurship Education	1.16	1.9	1.18	2.0
K6	Teaching and Leaning – based Streaming Video	.88	-1.4	.88	-1.4
K7	Visualisation Skill	1.36	3.8	1.34	3.7
K8	Technology Skill Augmented Reality	1.02	.3	1.03	.3
K9	Technology Skill Virtual Reality	1.11	1.3	1.11	1.3
K10	Technology Skill Microcontroller	1.05	.6	1.06	.7
K11	Information Technology Skill	.99	-.1	.99	-.1
K12	Collaboration between Researcher and Education Service Provider	.93	-.8	.93	-.8
K13	Collaborative Learning	1.89	1.9	1.48	9.9

ITEM MEASURE FOR CONSTRUCT

Based on Table 8, each item has been analysed and compiled in the order of Winstep software. The difficulties item is in the first position while the simplest item is in the bottom position. The K2 domain have a value of 0.66 while K12 domain with a value of 0.42, it can be conclude that the K2 domain have twice the difficulty level compared to K12 domain. Overall, the findings of the level difficulties for the domain based on Sumintono & Widhiarso [22].

- The value measure < -1 = item is very easy
- The Value of measures -1 to 0 = simple items
- The Value of measures 0 to 1 = difficult items
- The value of the measure > 1 = the item is very difficult

Table 8: Item Measure based Measure Term

Bil	Domain	Measure	Infit		Outfit	
			MNSQ	ZSTD	MNSQ	ZSTD
K2	Pluralism Skill	.66	.99	-.1	.98	-.2
K3	Work Based Learning	.65	.81	-2.4	.81	-2.4
K4	Professional Competencies	.65	.81	-2.4	.81	-2.5
K5	Entrepreneurship Education	.61	1.16	1.9	1.18	2.0
K6	Teaching and Leaning – based Streaming Video	.58	.88	-1.4	.88	-1.4
K7	Visualisation Skill	.56	1.36	3.8	1.34	3.7
K8	Technology Skill Augmented Reality	.54	1.02	.3	1.03	.3
K9	Technology Skill Virtual Reality	.49	1.11	1.3	1.11	1.3
K10	Technology Skill Microcontroller	.48	1.05	.6	1.06	.7

K11	Information Technology Skill	.48	.99	-.1	.99	-.1
K12	Collaboration between Researcher and Education Service Provider	.42	.93	-.8	.93	-.8

V. CONCLUSION

This paper presents the results on Rasch analysis 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 Rasch model. The results are also supported by Cronbach's Alpha of person and item reliability at 0.88 and 0.72 respectively. Based on the summary of statistic this analysis, the validity and reliability for 11 domain of future vocational learning skills. 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 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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REFERENCES

[1] Peters, M. (2017). "Technological Unemployment: Educating for the Fourth Industrial Revolution." Journal of Self-Governance and Managment Economics 5 (1): 25-33.

[2] Mustapha, R., Nashir, I. M., bin Azman, M. N. A., & Hasnan, K. A. (2020). Assessing the Implementation of the Project-Based Learning (PJBL) in the Department of Mechanical Engineering at a Malaysian Polytechnic. Journal of Technical Education and Training, 12(1).

[3] Grewall, D., Motyka, S., & Levy, M. (2018). The Evolution and Future of Retailing and Retailing Education. Journal of Marketing Education, Vol. 40(1) 85 –93.

[4] World Economic Forum (2017). Accelerating Workforce Reskilling for the Fourth Industrial Revolution an Agenda for Leaders to Shape the Future of Education, Gender and Work. White paper, Geneva: World Economic.

[5] Haron, M. A., Hussain, M. A. M., Zulkifli, R. M., Nashir, I. M., & Ma'arof, N. N. I. (2019). EMPLOYABILITY SKILLS NEEDED BY VOCATIONAL COLLEGE GRADUATES: FEEDBACK FROM THE INDUSTRY. Journal of Technical Education and Training, 11(4).

[6] Osman, N. W., & Kamis, A. (2019). Innovation leadership for sustainable organizational climate in institution

of technical and vocational education and training (TVET) in Malaysia. Asian Journal of Assessment in Teaching and Learning, 9(1), 57-64. https://doi.org/10.37134/ajatel.vol9.no1.6.2019.

[7] Crittenden, V., Robert, A., & Peterson, R. A. (2019). Digital Disruption: The Transdisciplinary Future of Marketing Education. Journal of Marketing Education, Vol. 41(1) 3 –4.

[8] Cyert, M. (2017). Developing a New Introductory Biology Curriculum. Accessed November 2, 2017. https://vptl.stanford.edu/spotlight/developing-new-introductory-biology-curriculum.

[9] Davis, K. J., Phillips, S. D., Blustein, D. L., & White, S. F. (2002). Preparation for the School-to-Work Transition: The Views of High School Students. 61(2), p. 202-216, https://doi.org/10.1006/jvbe.2001.1853.

[10] Mick, D. G. (2007). The End(s) of Marketing and the Neglect of Moral Responsibility by the American Marketing Association. 26(2), https://doi.org/10.1509/jppm.26.2.289.

[11] Wagiran, Endah R., & Azman, M.N.A. (2020). When vocational teachers improve their TPACK competencies through lesson study. International Journal of Psychosocial Rehabilitation, 24(4), 2469-2478.

[12] Seal, B. C., Allyn & Bacon. Best practices in educational interpreting. (2002).

[13] Finstad, K. (2010). The Usability Metric for User Experience. Interacting with Computers, Vol. 22(5), p. 323–327, https://doi.org/10.1016/j.intcom.2010.04.004.

[14] Mayer, E. (2018). The articulated peasant: household economies in the Andes. Westview Press.

[15] Parks, D. K., Onwuegbuzie, A. J., & Cash, S. H. (2001). Development of a measure for predicting learning advancement through cooperative education: Reliability and validity of the PLACE scale. Journal of Cooperative Learning. 36(1), p23-31.

[16] Nashir, I. M., Mustapha, R., & Yusoff, A. (2015). Delphi technique: Enhancing research in technical and vocational education. Journal of Technical Education and Training, 7(2).

[17] Nashir, I. M., Mustapha, R., & Yusoff, A. (2019). Rasch Model Validity for Robotics Learning Survey in Technical and Vocational Education System. HONAI, 2(1), 47-58.

[18] Nashir, I. M., Mustapha, R., Maarof, N. N. M. I., & Rui, T. J. (2020). Modified Delphi Technique: The Development of Measurement Model for Innovative Instructional Leadership in Technical and Vocational Education Systems. Journal of Technical Education and Training, 12(1).

[19] Bond, T. G., Fox, & Christine, M. (2015). Applying the Rasch Model: Fundamental Measurement in the Human Sciences, Third Edition.

[20] Linacre, J. M. (2015). Winsteps Rasch Measurement Computer Program User's Guide. Beaverton, OR: Winsteps.com.

[21] Kashfi, H., Yazdani, A. R., Latifi, M., & Bidabadi, F. S. (2011). Economic and managerial analysis of effective managerial strategies on prevention from ketosis in transition period in shahroud commercial dairy farms. ISRN Veterinary Science.

[22] Sumintono, B., & Widhiarso, W. (2015). Aplikasi Model Rasch Untuk Penelitian Ilmu-Ilmu Sosial. Cimahi: Trimkomunikata.