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The Evaluation of TVET Instructor's Training Needs Analysis Using Curriculum Development Based on Vocational Ability Structure in Malaysia

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***Abstract*—This paper aims to evaluate the use of a method called Curriculum Development Based on Ability Structure (CUDBAS) in evaluation TVET Instructor's Training Needs Analysis. This method profiles each instructor into a structured measurement based on ability of work. The results from the measurements are analysed systematically with the goal to reduce the competency gap among the instructors and simultaneously identify experts within this group to be fully utilized across agencies and ministries in Malaysia. As a result, training can be planned and implemented effectively with cost saving by matching trainer and trainee into a single system toward the right trainer, right training and right time. An online survey was conducted to evaluate user's satisfaction level of using the system from multiple public agencies those currently using the method. The result of the survey is analysed in order to explain the influence of the identified factors that lead to user's satisfaction. The ouput of the result may cause implement of TNA (Training Need Analysis) using CUDBAS to be be more widely use within public agencies in Malaysia.**

***Index Terms*—Instructors, Training Needs Analysis, TVET, Curriculum Development, Vocational Ability Structure.**

I. Introduction

IN Malaysia, public TVET (Technical and Vocational Education and Training) training providers consist of a few Ministries with different certification and standard curriculum. There are about seven (7) ministries involved and each ministry has its own agency and institution to conduct the training. The ministries involved are the Ministry of Human Resource (MOHR), Ministry of Education (MOE), Ministry of Rural Development (MORD), Ministry of Youth and Sports (MOYS), Ministry of Public Works (MPW), Ministry of Defend (MOD), and the Ministry of Agriculture (MOA). In addition, every Malaysian state has its own training institution [1]. Multiple qualifications and certifications are offered by agencies under every ministry shown in Table I. Because there is no single authority over the TVET landscape, these agencies are only responsible to report to their own ministry, resulting in the lack of coordination among ministries and thus overlapping courses in multiple institutions which created confusion for all stakeholders especially both students and employers [2]. This problem leads to negative implications to the standardization of training, qualification and certification, cost-effectiveness, quality assurance, recognition and the further education of TVET graduates.

TABLE I
OVERVIEW OF TVET DELIVERY SYSTEM IN MALAYSIA BY MINISTRIES

Certificate Offered	MOHR	MOE	MORD	MOYS	MPW	MOD	MOA
B. Eng Tech	-	-	Offer	-	-	-	-
Adv. Dip. Tech	-	-	Offer	-	-	-	-
Adv. Dip. Skill	Offer	Offer	-	Offer	-	-	Offer
Dip. Skill	Offer	Offer	-	Offer	-	-	Offer
Poly Dip	-	Offer	-	-	-	-	-
Tech Cert	-	-	Offer	-	Offer	Offer	Offer
Skill Cert	Offer	Offer	Offer	Offer	Offer	Offer	Offer

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Therefore, with multiple providers for TVET education in Malaysia by public institutions, there is an urgent need to consolidate and establish a training control for TVET instructors centrally and systematically so that it becomes a standard that includes all agencies involved in providing TVET services.

Pillay [3] proposed 5 pillars of education and training in Malaysia as depicted in Table II, showing the variety of groups responsible for offering the service.

TABLE II
5 PILLARS OF EDUCATION AND TRAINING IN MALAYSIA

Pillar	***Type***	***Details***
1st	Public higher education institutions	Includes polytechnics and community colleges under the Ministry of Higher Education
2nd	Malaysian Skills Certification System	5-tiered skills qualification based on the National Occupational Skills Standards
3rd	Company-based training	Comes under the Human Resource Development Fund established in 1993 to promote the training of employees
4th	Private higher education institutions	Under the purview of the Private Higher Education Institutions Act 1996, and accredited by the Malaysian Accreditation Agency
5th	Continuing education and training	Caters to the demands of employers, community or society at large for further education, skills upgrading, retraining, career advancement and enrichment

In order to address the issue of lacking of coordination among ministries and overlapping courses from multiple institutions, a few efforts were implemented under 11th Malaysia Plan which covered a 5 year plan from 2016 - 2020 to transform TVET for fulfilling industry needs by strengthening the quality and TVET program delivery [4]. The focus of this strategy is to increase employability of the TVET graduates through curriculum development by industry, overlapping recourse and program reduction, cost-effectiveness increment, financial support for TVET program enrollment and improvement of training delivery by improving the quality of instructor.

One of the efforts under this plan is the development of a centralised database to profile all TVET instructors in Malaysia by identifying the competency gap and then provide a plan toward effective training. Center for Instructor and Advanced Skill Training (CIAST) is a training institute under the Ministry of Human Resource responsible to develop the database that covers about thirty thousand TVET instructors in Malaysia. . CIAST has decided to use CUDBAS as a tool to analyse the TVET instructor training needs analysis because the implementation of CUDBAS is simple based on brainstorming by small groups, rapid execution and having wide application.

II. LITERATURE REVIEW

CUDBAS stands for "Curriculum Development Based on Ability Structure" was developed in 1990. In 1989, the Ministry of Labor took the lead in undertaking the development of a teaching skills training system called Progressive Training System for Instructor (PROTS), which was one of Japanese government's attempts to develop a teaching skills training system for instructors who provide technical guidance overseas [5]. It was developed by Prof. Dr Kazuo Mori which took 4 years to develop the equipment, materials and 13-volume tutorial teaching materials required for the 63 hour-seminar. He claimed that CUDBAS has been adopted in multiple regions and has been introduced and deployed in more than 20 countries in the world to date. CUDBAS also has gained popularity in Japanese corporate education and industiries and has been practiced in different parts of Japan such as Hokkaido, Tohoku and Hokushinetsu.

CUDBAS is a tool to identify abilities which contain skill, knowledge and attitude required for work. The abilities are developed by a small brainstorming group of experts from related fields or work and prioritized based on importance and necessity. The assessment is conducted at each individual's level of skill and competence for the tasks for optimum performance based on produced abilities. Its innovation can be an added value to Training Needs Analysis (TNA). The scope application of CUDBAS is not just for curriculum development but can be applied into employment, entrance examination, training and evaluation. Izwah [6] applied the usage of CUDBAS for various areas such as curriculum development, course scheduling and training development and suitable for improving the quality and production according to specific need of the organisation.

Generally, training is a process of getting skills, knowledge and attitude to perform a task or job effectively. Training does not happen in small organizations and can be divided into proactive or reactive, formal or informal and short-term or long-term [7]. Need analysis is the process of evaluating the organization, individual employees, and employees' tasks to determine what kinds of training is needed [8]. Training needs analysis is effectively a skills gap analysis and its purpose is to find out the current state and formulate a desired state. The difference between the two states will lead to identification of the gap and plan a training programme that addresses it [9]. Meanwhile Brown defined TNA as an ongoing process of gathering data to determine what training needs exist so that training can be developed to help the organization accomplish its objectives [10]. The purpose of a training needs analysis is to close the gap between the actual and desired situations by determining discrepancies in outcomes, placing them in order of priority and selecting the most important for closure or reduction [11].

It is a data-centric approach to discovering skill gaps where the current state and the desired states are parameterised and then quantified for comparison. The result of TNA is a series of actions, in particular, what training activities are required to get the organisation from its current state to the desired state and the result of TNA can also be no actions required [12].

There a few factors that can trigger a training needs analysis:

1) New technological change
2) New competitors
3) New customer behaviour or social trends leading to need for new skills
4) Customer surveys and feedback
5) New markets
6) Drop in organisational productivity
7) New legal challenges
8) Information management
9) Upskilling and reskilling staff

TNA can be categorised into proactive TNA and reactive TNA. Proactive TNA is an analysis that is planned strategically and carefully without focus on a definite problem. It is used to deliver new techniques or processes to employees, as well as strengthen existing expectations. This method anticipates future trends and prepares people for the foreseen challenges. It happens when there is an unknown weakness of the workforce and can indicate where help is required. The focus of this analysis is on creation of the training plan and begins with an assessment of the training needs [13]. Meanwhile the reactive TNA happens when a specific problem is identified and then analysis is conducted to correct the problem. Reactive TNA is used to correct that problem, creating a program or training to correct the specific problem [14].

The TNA model can be grouped into two types. The first type model of TNA was introduced by McGhee called McGhee and Thayer's Three-Level Analysis in 1961 [15]. The model provides an approach of conducting a TNA at three levels hierarchily namely organisational, operational (or task), and individual (or person) which descends from the organisational level to the personal level.

At organisation analysis level, performance of the organisation can be viewed by focusing on strategic planning, business needs and goals. The assessment starts with the internal environment of the organisation such as procedure, organisation structures, policies, strengths and weakness and then external environments such as opportunities and threats. SWOT analysis is used to identify weaknesses, strengths, threats and opportunities where weakness can be dealt with training intervention, strength can be strengthened with continuous training, threat can be eliminated with retraining and opportunity can be exploited by balancing it against costs.

At the operational analysis, the focus is on works being assigned to employees. The understanding of job by employees is analysed to ensure that the job is clearly understood by doing technical interview, observation, survey, psychological test and etc. From this analysis, task to be done and task will be done can be obtained in the future.

At Person Analysis, team or individual is analysed how well they/he perform(s) the task/job. Organisation checks whether the employee's performance is at the desired level or below expectation. There will be a need for training if actual performance is less than expected performance. A few tools can be used to evaluate the extent of teams and individuals skills, knowledge and abilities including interview, observation and job profile.

The second model is based on performance analysis developed by Robert Mager and Peter Pipe in 1970 [16]. This model is a revised version of the five "W" and one "H" questions technique used in root cause analysis to determine the cause of a problem by simply asking until the answer presents itself and a flow chart used to identify a performance problem and describe it as measurable, observable, performance based terms. This simplicity makes the Mager and Pipe model extremely powerful and easily goes through a systematic process to address a performance problem [17].

III. MATERIALS AND METHODS

The main reason for the development of training needs analysis for TVET instructors by profiling each instructor is to plan more than 30,000 TVET instructors training toward year 2020. It is also a mechanism to measure the requirement of instructors' training structurally, efficiently and cost-effective by creating a centralised TVET instructor competency profile database systematically. The main purpose is to identify TVET instructor competency gaps with systematic methodology so that the accurate training can be identified, planned and implemented or in short "Right Trainer, Right Training, Right Time". There are three components of instructor's competency evaluated which consist of vocational or professional, pedagogy and management and the process of profiling the instructor undergoes four activities cycle as in figure 1.

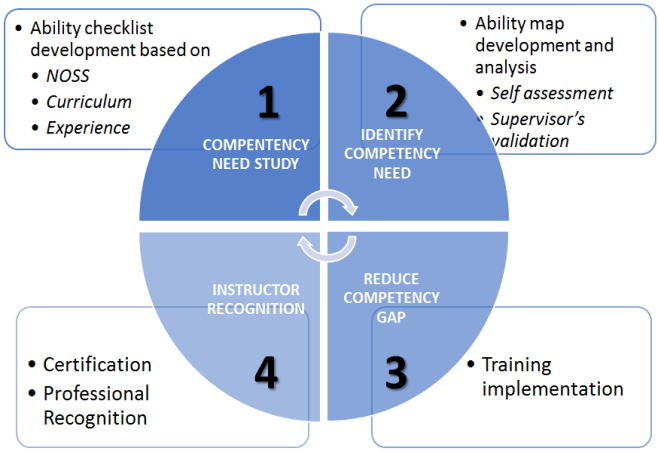

Figure. 1. Activity cycle of development of TVET instructor competency profile.

The first activity of the cycle is competency need study. This study identifies a training field of ability checklist to be developed by a group of experts from each agency. The factor of selection depends on how many instructors in the training field meaning more instructors get higher priority. The development of ability checklist refers to expertise and experience of an expert panel, National Occupational Skills Standard (NOSS) and syllabus. The panel forms a meeting to brainstorm and produce a set of ability checklist for a competency. The ability checklist of a competency contains element of skill, knowledge and attititude and 3 level of

importance.

The Second activity is identification of competency gap where self assessment is conducted by instructor for three types of competency components and then validated by instructor's supervisor which is assigned during registration by instructor's institution administrator. Instructor puts value from 1 to 5 to indicate his own level of competency as shown in Table III. After self-evalution, this evalution form will be submitted to his/her supervisor to validate the correctness of self evalution. This activity produces an ability map as shown in figure 2 can be analysed to categorise level of expertise of instructors as shown in figure 3.

TABLE III
FIVE COMPETENCY SCALES OF AN ABILITY

Scale	Indicator
1	Unable to practice the job without supervision. No knowledge about the job.
2	Able to practice the job but still need an assistant. Little knowledge about the job
3	Able to practice the job without assistant, knowledgeable and reliable.
4	Able to practice with confident, having mastered the skill, knowledgeable but less creative
5	Able to practice the job perfectly, guide others, extra knowledge about the job and creative.

No	Importance	Ability	Mean	SD	Hafiz Bin Saad (KP : 761228025295, U : 42, P : 0)	Mohd Ropi Abdullah (KP : 700426035957, U : 49, P : 20)	Norakma Binti Nawawi (KP : 791203105616, U : 39, P : 3)	Nozie Mazzuana Binti Md Arof (KP : 780219105836, U : 41, P : 1)	Sarizan Bin Saaldon (KP : 790506085855, U : 40, P : 0)	Sharina Binti Mohd Said (KP : 760112105424, U : 43, P : 1.9)	Mean	SD
1-1	A	Can Design Hierarchal Network	2.0	1.5	1	5	3	1	1	1	2.0	1.5
1-2	A	Can Design IP Addressing	2.0	1.5	1	5	3	1	1	1	2.0	1.5
1-3	A	Know Open System Interconnection (OSI) Model	2.0	1.5	1	5	3	1	1	1	2.0	1.5
1-4	A	Know Network Topology	2.0	1.5	1	5	3	1	1	1	2.0	1.5
1-5	A	Know Network Analyzing Techniques	1.8	1.5	1	5	2	1	1	1	1.8	1.5
1-6	A	Can Link Between LAN And WAN	1.8	1.5	1	5	2	1	1	1	1.8	1.5
1-7	A	Can Plan Network Upgrading	1.8	1.5	1	5	2	1	1	1	1.8	1.5

Figure 2. An ability map is produced after self-assessment by instructors and validated by instructors' supervisor.

Competence	No. Area	Respondents	Expert (Score>= = 4.5)	Advanced (4 <= Score <4.5)	Competent (3 <= Score <4)	Not yet Competent (Score <3)
Vocational & Professional	16	189	11 (5.8%)	19 (10.1%)	53 (28.0%)	106 (56.1%)
Pedagogy & Social	1	128	25 (19.5%)	39 (30.5%)	52 (40.6%)	12 (9.4%)
Management	1	154	11 (7.1%)	34 (22.1%)	77 (50.0%)	32 (20.8%)

Figure. 2. Ability map analysis to categorise level of expertise.

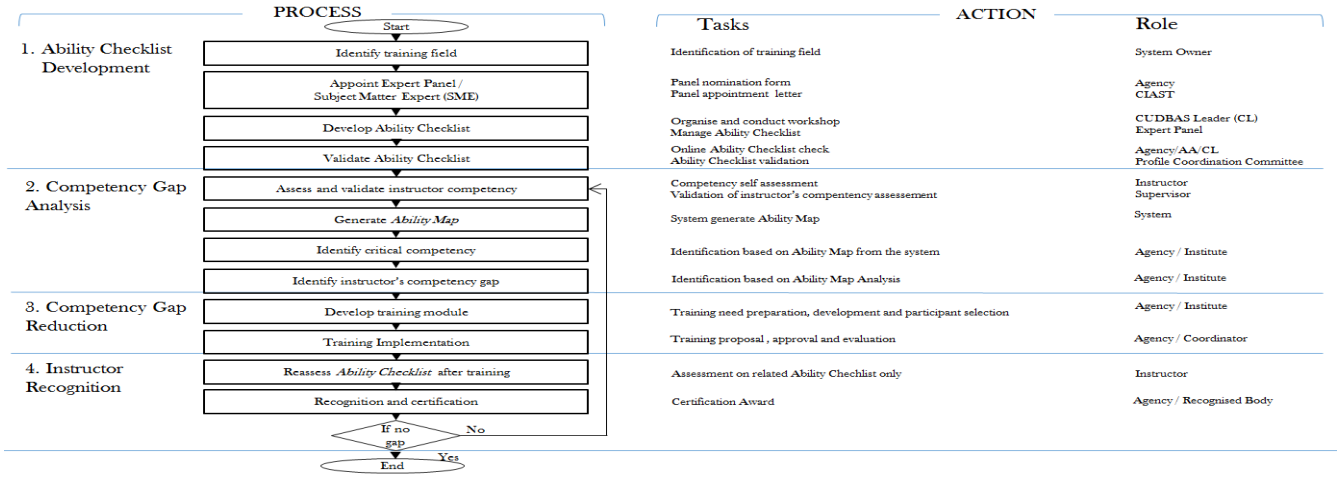

Figure. 3. General flowchart of the Online Training Needs Analysis.

The categorization is conducted by getting average value of all evaluated abilities of a instructor for a competency. The average value is between 1 and 5 and 4 categories is identified namely Expert with average score is greater or equal to 4.5, Advance with average score is between 4 and 4.5, Competent average score is 3 to 4 and Not Yet Competent with average socre is less than 3.

The next activity is implementation of training to reduce the competency gap based on ability map analysis. There are various of training mode provided based on instructor's competencies and scores such as reskilling, upskilling, modular, customised, professional and sharing of industry expertise. Each agency is responsible to develop and propose the training based on ability map analysis through the system and the approval by training committee.

The last activity of the circle is instructor recognition. In this activity, every instructor who completed the training developed from the system will be reassessed to prove the competency gap is reduced and then awarded with certification based on Recognition of Prior Achievements and professional certification.

The most practical implementation of this system is through online web based because previous study showed that online system based on web is the most effective in identifying training needs assessment which is widely accessible by using internet [18]. It is powered by Yii2, a generic web programming

framework based on PHP and MySQL database to enable the development of the modern web application fast, secured and scalable at low cost [19]. This online web application is used to register all instructors from multiple agencies, register the ability checklist, conduct self evalution by instructors and validation by supervisor, training implementation and report generation . General flowchart of the system, actions and the role of main users in the system is shown in figure 4.

An online survey was conducted for about 2 months from the first week of August to 2nd week of October 2018 covers 5176 respondents in the system consisting of instructors, heads of department, training coordinators and agency administrators from 18 agencies to evaluate the effectiveness of using the system. This represents 21.12% of total active registered users from the system. A model was developed regarding three factors contributing to the effectiveness of using the system namely knowledge, user satisfaction and user-friendliness as shown in figure 5 using SmartPLS [20]. This software is used to analyze and develop the model because it is a variance-based structural equation modeling that can be used to estimate path models, compute standard results assessment and support additional statistical analyses [21].

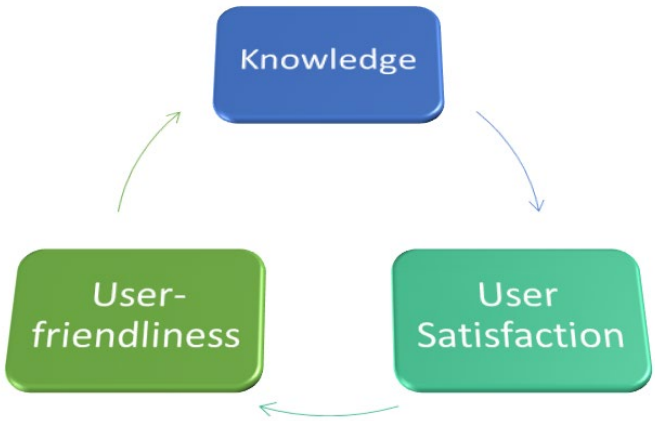

Figure. 4. Structural model contributing to the effectiveness of the system.

IV. RESULTS AND DISCUSSIONS

This study explains the implementation of an online Training Needs Analysis system for TVET Instructor Based on Vocational Ability Structure to solve instructors' competency gap problem among multiple TVET providers in Malaysia and evaluates the satisfaction of using the system. The total registered active users and total respondents from each agency is shown in table III. Top three respondents come from Polytechnic, Human Power Department and Community College but if referring to ratio of registered active users to total respondents, Human Power Department scored the highest with 51.58%, followed by the Ministry of Youth and Sport 43.4% and Community College 36.10. Although Polytechnic has the highest registered active users and highest respondents, it scored very low percentage respondents with only 16.61%. This was because during the survey period, polytechnic was on two semester breaks and final semester examination. The lowest respondent comes from Malaysian Armed Forces with only one respondent represents 0.65% followed by Royal Police Technical College with 4 respondents represents 2.96% and Center of Technical Excellence Sarawak (CENTEXS) with also 4 respondents represents 18.18%.

TABLE IV
TOTAL RESPONDENT FROM MULTIPLE AGENCIES REGISTERED WITH THE SYSTEM

#	*Agency*	*Registered Active User*	*Total Respondent*	*Percent (%)*
1	Human Power Department	2232	1149	51.58
2	Ministry of Youth and Sport	1073	465	43.34
3	People's Trust Council (MARA)	1452	46	3.17
4	Polytechnic	7266	1207	16.61
5	Community College	2964	1070	36.10
6	Department of Vocational and Technical Education (BPTV)	4113	218	5.30
7	Royal Police Technical College	135	4	2.96
8	Malaysian Armed Forces	155	1	0.65
9	Prisons Department of Malaysia	422	23	5.45
10	Social Welfare Department	75	11	14.67
11	Agricultural Skill Training Division	451	37	8.20
12	National Anti-Drug Agency (AADK)	202	69	34.16
13	Center of Technical Excellence Sarawak (CENTEXS)	22	4	18.18
14	Department of Skills Development (JPK)	491	196	39.92
15	Malaysian Construction Industry Development Board (CIDB)	273	79	28.94
16	German-Malaysian Institute (GMI)	229	12	5.24
17	University of Kuala Lumpur (UniKL)	1229	95	7.73
18	GIATMARA	1554	471	30.31
19	Others	165	19	11.52
	Total	**24503**	**5176**	**21.12**

Table IV shows the min score from all agencies for all three factors. The highest mean score is from Malaysian Armed Forces value at 5.00 followed by Royal Police Technical College value at 4.38 and Center of Technical Excellence Sarawak (CENTEXS) value at 4.37. These highest mean score agencies have less active registered users and least total respondents.

TABLE V
THE MIN OF THREE FACTORS OF EACH AGENCY

#	*Agency*	*Total Respondent*	*Factor*			*Min*	*Interpretation*
			Knowledge	*Satisfaction*	*User-friendliness*		
1	Human Power Department	1149	4.10	4.01	4.03	4.05	High
2	Ministry of Youth and Sport	465	4.13	4.04	4.03	4.07	High
3	People's Trust Council (MARA)	46	4.27	4.10	4.01	4.13	High
4	Polytechnic	1207	4.09	4.03	4.01	4.04	High
5	Community College	1070	4.23	4.18	4.17	4.19	High
6	Department of Vocational and Technical Education (BPTV)	218	4.29	4.23	4.22	4.25	High
7	Royal Police Technical College	4	4.41	4.33	4.40	4.38	High
8	Malaysian Armed Forces	1	5.00	5.00	5.00	5.00	High
9	Prisons Department of Malaysia	23	4.33	4.23	4.25	4.27	High
10	Social Welfare Department	11	4.24	4.21	4.14	4.20	High
11	Agricultural Skill Training Division	37	3.96	3.88	3.82	3.89	High
12	National Anti-Drug Agency (AADK)	69	4.36	4.22	4.25	4.28	High
13	Center of Technical Excellence Sarawak (CENTEXS)	4	4.41	4.29	4.40	4.37	High
14	Department of Skills Development (JPK)	196	4.18	4.08	4.02	4.09	High
15	Malaysian Construction Industry Development Board (CIDB)	79	4.16	4.05	4.03	4.08	High
16	German-Malaysian Institute (GMI)	12	4.08	3.79	3.75	3.87	High
17	University of Kuala Lumpur (UniKL)	95	4.20	4.06	4.02	4.09	High
18	GIATMARA	471	4.22	4.12	4.13	4.16	High
19	Others	19	4.31	4.20	4.16	4.22	High
	Min	**5176**	**4.16**	**4.08**	**4.07**	**4.10**	**High**

The lowest score for knowledge is from the Agricultural Skill Training Division (3.96). This agency also scores less than four for satisfaction and user-friendliness factors. This is because the Agricultural Skill Training Division is the only agency providing training in agriculture caused development for the ability checklist is slow and the ability checklist cannot be shared with other agencies. German-Malaysian Institute (GMI) scores lowest mean score valued 3.87 with knowledge score is 4.08, satisfaction score is 3.79 and user-friendliness score is 3.75. This agency offers courses with hands-on practical and theory in the fields of Production Technology and Industrial Electronics where till the date of end of the survey, the ability checklist does not fully cover for the courses offered in this agency. Majority agencies have mean scores more than 4.0 for all factors indicating effectiveness of the system still at a high level.

Internal consistency reliability is a measurement conducted to see the level of validity and reliability of the items for each variable and it is the first criterion of the measured measurement model. Composite reliability (CR) is an evaluation method to test the internal consistency reliability model and in this study, this value shows for all variables are between 0.7 and 0.95, not more than 0.95. This is proof that the level of internal consistency of the items for each variable is high and reliable.

A convergent validity test was carried out to identify how many individual items in one variable have positive relationships with alternative items measuring the same variable. A high variation between one another must be indicated by the items in each particular variable so that it can explain the validity of the measured variable. The average variance extracted value (AVE) was obtained from the analysis of the measurement model for all variables above the minimum set requirement of 0.50. As a conclusion, the items that measure these variables have a convergent validity level of satisfaction.

The output of structural model assessment shows that knowledge factor has a significant positive relationship with satisfaction. This proves there is a direct relationship between knowledge and satisfaction. The increase of knowledge will gain more satisfaction. There is also a significant positive relationship between knowledge and user-friendliness indicating another direct relationship between knowledge and user-friendliness. More knowledge causes the system to be more user friendly. Relationship between user-friendliness and satisfaction also shows a significant positive relationship causes user-friendliness of the system increases the satisfaction.

The evaluation of this structural model uses a systematic approach to evaluate the capability and accuracy of the model predictions (R2), the real effect of independent variables on dependent variables (f2) and relevancy of prediction model (Q2) if capability of prediction model is high. The value of R2 is between 0 and 1. The higher value of R2 will get better accuracy of prediction.

The findings show the value of R2 of user-friendliness is 0.654 at 95% confidence level. This means user-friendliness and knowledge are both changing together in a systematic pattern by sharing 65.4% of those changes. Therefore, there is a correlation between the pattern of user-friendliness for 65.4% by changing the knowledge factor pattern, while the remaining 34.6% changes are explained by other factors. The second R2 value is satisfaction factor shares 0.878 changes by user-friendliness factor and knowledge factor at confidence level 95%. Therefore 87.8% pattern change of satisfaction factor is influenced by change of pattern of user-friendliness factor and knowledge factor, meanwhile another 12.2% is by other factors. As a conclusion, any change in one of the variables in this model, either user-friendliness or knowledge cause the dependent variable is predictable.

V. Conclusion

The evaluation of Training Need Analysis using Curriculum Development Based on Vocational Ability Structure (CUDBAS) successfully involves all agencies that provide training in TVET with participation more than 80% of about 30,000 TVET instructors all around Malaysia. The finding from an online survey proves that user's satisfaction is at a high level and the system is effective based on user's satisfaction. The use of this method can be further extended to other agencies to improve their training implementation. However more factors should be included for the future study to get higher accuracy in measuring user's satisfaction. Other than that, this effort is hoped to be a catalyst in producing better cooperation and collaboration among agencies toward single authority in managing TVET in Malaysia.

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