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Identifying and Validating Vocational Skills Domains and Indicators in Classroom Assessment Practices in TVET

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Abstract: Technical and vocational education training (TVET) assessment is crucial in determining students' desired learning outcomes. However, there are several issues with TVET assessment, including vocational skills that are not aligned with the learning outcomes. Teacher assessment practices are also inconsistent with the assessment's purposes. Due to that, this study aims to discuss the classification and integration of vocational skill domains and indicators for classroom assessment practice in TVET subjects. This study employed the modified Delphi technique (MDT), which consists of two study phases. The first phase identifies vocational skill domains by exploring the concept of TVET assessment and student skill development by conducting a literature review. The second phase involved validating vocational skill indicators and TVET assessment practices indicators through the consensus of 19 TVET experts. According to the literature findings, TVET assessment requires the integration of industrial revolution (IR) 4.0 generic skills and career adaptability skills, in addition to technical skills, which serve as the foundation for developing skills and competencies. TVET assessment aspects include cognitive, psychomotor, and affective aspects, and all domains and indicators have high expert consensus.

Keywords: vocational skills; TVET assessment; classroom-based assessment; modified Delphi techniques; the range of quartiles

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Citation: M. Yusop, S.R.; Rasul, M.S.; Mohammad Yasin, R.; Hashim, H.U. Identifying and Validating Vocational Skills Domains and Indicators in Classroom Assessment Practices in TVET. *Sustainability* **2023**, *15*, 5195. https://doi.org/10.3390/su15065195

Academic Editors: Chia-Li Lin and Chi-Yo Huang

Received: 30 January 2023
Revised: 5 March 2023
Accepted: 8 March 2023
Published: 15 March 2023

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1. Introduction

TVET, as part of lifelong learning, can occur at the secondary, postsecondary, and tertiary levels and includes work-based learning, continuing education, and professional development, all of which can lead to qualifications. TVET is also part of the United Nations (UN) goals to increase the number of youth and adults with skillsets, such as technical and vocational skills for the workforce, decent jobs, and entrepreneurship [1]. Future workers also must be equipped to handle the continuously evolving demands of the workplace. Therefore, TVET and the industry need to provide various skills in producing workers with various competencies to meet future work needs. To ensure that all levels of future workers have the knowledge and are highly competent, TVET institutions need to assist in restructuring the workforce as part of the preparation for its future workforce [2]. Expanding the current scope of TVET and delivery mechanisms, preparing teachers and trainers who can effectively transfer their knowledge and skills, and enabling the workforce to adapt to technological shifts are all necessary components of skills for development strategies. This scenario demands authentic learning and assessment of the intended learning outcomes for the TVET students. As stated by [3], TVET student development necessitates a robust assessment system that can assess students' abilities in terms of knowledge, skills, and attitudes. In addition, an effective TVET system should be able to produce measurable outcomes for evaluation and assessment [4,5]. The evaluation will represent two crucial aspects. One is formative with a future goal, which is to gain feedback. The second crucial aspect is summative, which assesses concrete achievement and acquires evidence [6]. In an ideal world, the two modes would be complementary. Consistent improvements from the evaluations are required to ensure the development of knowledgeable and skillful students [7].

Teachers are also crucial in ensuring that learning outcomes are fulfilled. Well-versed teachers in the assessment methods used play an essential role in ensuring that the assessment is accurate and effective. They can also help provide reliable information on students' abilities to stakeholders such as schools, parents, the Ministry of Education, and the students themselves. Teachers who conduct assessments should have a broad and in-depth understanding of the assessment's methods, criteria, and expected outcomes [8]. The assessment process consists of four steps: generating and collecting evidence of achievement, evaluating the evidence against the outcomes, recording the evaluation findings, and using the information to aid the learner's development and improve the learning and teaching process [9].

As a result, this research aims to identify and validate the elements of developing vocational skills in TVET classroom assessment practices. Therefore, this study was conducted to answer two research questions, which are:

1. What are the domains and indicators of vocational skills in classroom assessment practices in TVET?
2. What are the domains and indicators of classroom assessment practices in TVET?

There are five sections altogether in this study. The study starts with the introduction, which introduces the background context of this study. The introduction explains the purpose of the assessment in TVET to develop students' learning outcomes, how the TVET curriculum in Malaysian secondary schools was implemented, and how TVET programs led to MOE's vocational education qualifications. The introduction follows a statement about the problem that caused the researchers to conduct this study. A review of the research on developing vocational skills and classroom assessment practices is also explained in this part. The next part discusses the material and methodology, which consists of a modified Delphi technique (MDT), the sample selection for the qualifications of experts panel in MDT and MDT procedures for obtaining agreement between experts, and research procedures that consist of reliability and validity of instruments. The third part of this study provides data analysis from evaluating the experts' consensus and discusses the study's findings, which are the finding of domains and indicators in developing vocational skills and TVET assessment practices. The fourth part of the study analysis contains the findings for the domains and indicators successfully obtained and the implications of the finding in the context of Malaysian TVET assessment and curriculum. The conclusion and future research suggestions are elaborated on and explained in the fifth part.

1.1. TVET Programmes Leading to MOE's Vocational Education Qualifications

The Malaysian Ministry of Education (MOE) emphasized the future of TVET in Malaysia through the Malaysian Education Blueprint (MEB, 2013–2025), launched in 2012. One of the main recommendations in the seventh chapter of the Action Plan (System Structure) contained in the MEB 2013–2025 is to change the ratio of Science and Art stream students from 60:40 to the ratio of Vocational, Science, and Art streams at 40:36:24 [10,11]. Indeed, TVET will be included as an elective paper in the Malaysian Certificate of Education (SPM). Furthermore, the MEB Action Plan recommends that public TVET institutions focus on courses related to high-tech industries. The availability of TVET subjects at the secondary school level, including primary vocational education (PAV), technical secondary schools (TS), and vocational colleges (VC), further explains this MOE initiative [12]. Grade 6 students (13 years old) can pursue PAV in a secondary school suited to nonacademically oriented students and choose an essential skill. They also receive the Malaysian Skills Certificate Levels 1 and 2. PAV students who have completed Form 3 (PT3) can further their studies for the postsecondary vocational program (PVMA) program or pursue a skills training path (at a public or private training institute) that leads to five skill qualification levels in the skills sector. They can also pursue a four-year vocational education program at MOE's vocational college, resulting in the Malaysian Vocational Diploma (DVM) certificate. The Ministry of Higher Education (MOHE) recognizes the DVM and allows vocational graduates to continue their education in higher education.

The TVET curriculum in secondary schools for those who do not take PAV starts at the lower secondary level by taking the subjects of Design and Technology and Basic Computer Science. In continuation of TVET subjects at the upper secondary level, TVET students need to choose a combination of TVET subjects such as Design, Home Science, Basic Sustainability, Computer Science, Agricultural Science, Business, Economics, Accounting or Technology Communication, and Graphics. The Secondary School Standard Curriculum (KSSM) in the Special Circular No. 9/2016 was implemented according to levels starting in 2017 for upper secondary level students. Expansions in the Malaysian Curriculum put those subjects in specialized elective subjects (MPEI) [13]. Students can choose the elective, and the chosen elective subjects can be taken together with the other core subjects. KSSM for special elective education (MPEI) is an elective subject under the Science, Technology, Engineering, and Mathematics (STEM) group.

MPEI focuses on a competency-based curriculum, and assessment refers to industry standards, professional bodies, and national and international certification. This subject is assessed in a centralized examination (SPM) and classroom assessment [14]. However, the assessment for TVET subjects in secondary schools differs from the assessment for TVET in VC, which has a competency-based assessment concept [15,16]. The difference in the form of assessment is due to the direction of the education. Therefore, TVET students need to consider the direction of their TVET education. School leavers who have completed SPM can also register at MOHE Community College, Polytechnics, and Malaysian Technical University Network (MTUN) for vocational education to pursue the certificate, diploma, and advanced diploma qualifications. TVET providers under MOHE each have a specific target audience with different qualifications. For example, Community Colleges offer qualifications mainly at the certificate level, while Polytechnics offer diplomas and advanced diplomas. MTUN offers both diploma courses and bachelor's degrees. TVET education in the context of this study refers to the TVET curriculum of the Malaysian Ministry of Education, specifically for secondary schools.

1.2. Problem Statement

The assessment of learning outcomes is a part of the system evaluation of education. With good cause, there is a rising global interest in how teaching approaches and classroom activities impact student learning results and psychological development [17]. We assess learning outcomes to highlight what the student understands and can accomplish due to the learning process concerning the educational objectives [18]. Various challenges need to be overcome to conduct a practical TVET assessment. During the vocational skills demonstrations, the students' comprehensive mastery of work processes and the task itself are the focus of the assessment [19].

However, the vocational skills demonstrations only cover some of the vocational skills required of the student [20,21]. On their own, they cannot provide in-depth evidence of students' theoretical knowledge (extent of knowledge and ability to apply it, ability to understand links between different things, and ability to form coherent entities of details), social skills (ability to act independently and in interaction with others as a team member or leader), and reflective skills (ability to learn and to evaluate and develop personal activity and that of others) [22,23]. Participating in TVET for skill development benefits everyone, but it does not happen nearly enough [24]. OECD 2011 and OECD 2008 [25] addressed barriers to broader practice in classroom assessment as a lack of connection between systemic, school, and classroom approaches to assessment and evaluation, which do not measure the knowledge and skills required in the workplace and real-life situations [26]. Therefore, proper TVET assessment becomes essential in shaping and building a competitive, highly skilled generation to meet the challenges.

The success of Malaysia's assessment system for TVET in secondary schools through classroom assessment is still insufficient. Based on the analysis of the Mastery Level (TP) in the assessment of TVET students in one of the districts in Malaysia in 2021 for Design and Technology, only 15.1% of students achieved TP 5 and only 2.32% achieved TP 6 out of 11,749 total students. Only 30.8% of the 820 level-five candidates for the Computer Science subject received TP 5, and 1.09% achieved TP 6 [27]. Based on the description of the Mastery Level of classroom assessment on MOE's framework, TP 3 demonstrates that the student merely knows, understands, and is skillful. TP 6 means that students have attained the highest level of mastery: the capacity to use their knowledge and abilities systematically, constructively, artistically, and innovatively to create new concepts and to be positive examples for other students [28]. As a result of the classroom assessment evaluation, it can be determined that TVET students lack mastery of the classroom assessment. Additionally, this circumstance demonstrates the necessity of enhancing teachers' assessment practices [29]. TVET subjects at secondary schools are assessed using a combination of central assessment and classroom assessment, with 70% of the final exam mark and 30% of the coursework mark allocated, requiring teachers and students to prioritize and focus on all kinds of assessment by MOE [30].

1.3. A Literature Review in TVET Assessment

TVET is a critical path in producing human capital that is highly skilled, knowledgeable, innovative, capable of facing global and regional competition, and always relevant to current needs [31]. According to [32], the curriculum of TVET is practical but also emphasizes developing the soft skills necessary for sustainable work, not only in the technical disciplines. Action-oriented school-based types of learning, such as learning in the workplace and an experimental laboratory environment, need exam assignments that consider the "paradigmatic work contexts" of skilled jobs [33]. One aspect of education in almost every nation is to provide young people with the information and skills required for work [34]. TVET institutions or training centers often educate students for training that combines theoretical knowledge and practical skills, enabling TVET students to handle problems, such as identifying faulty components or systems. Students may focus on mending components or systems by emphasizing TVET education via knowledge and skill equivalence so that the sequence, scope, and selection of components and systems run. As recommended by [35], to generate competent students who can fulfill industrial expectations, policy makers have to encourage interchange and collaboration between TVET institutions and industry so that vocational teachers and students will spend time in the industry to enhance their knowledge and vocational trainers in firms spend time in TVET institutions to strengthen their pedagogical competencies.

Consequently, teaching TVET students also depends on how training institutes or centers integrate theories and skills [36]. TVET requires mastery of information and practical skills, writing, and hands-on practice to complete tasks that match TVET curriculum requirements. Teaching approaches and assessment practices must also be prioritized to achieve students' learning outcomes, as stated in TVET requirements [37]. Assessing student outcomes involves synthesizing formal information about how well students learn. As a result, teachers must prioritize their understanding of the suitable assessment approaches and techniques to be utilized, and they must master the skills to implement such assessments in terms of proper processes, instruments, approaches, and work stages [38].

Assessment is an essential element in the learning process [39]. The purpose of the assessment conducted by the teacher is to see the learning outcomes that the students can achieve. Some judgments are usually made when grades or marks are assigned after the process [40]. This is because, although the importance of assessment in student learning has become increasingly recognized over the last three decades, it continues to impact externally conducted accountability and high-importance certification examinations, indicating a need for quality assessment in teachers' assessment practice [41,42]. Furthermore, curricular changes in TVET emphasize curriculum design with objectives or efficiency. Specifications of assessments should be clear and precise to highlight what the assessments are for and how they will be used. Appropriate procedures to gather and interpret information efficiently, assess competency, and record and report evaluation outcomes to stakeholders must also be employed in assessments [43]. Therefore, classroom assessment practices and vocational skills development are suggested for this study and can be expanded in its application. Assessing students in the classroom is considered a comprehensive evaluation that includes summative and formative evaluations ideal for assessing and improving students' knowledge, skills, and positive values [44].

2. Materials and Methods

This study employed a survey design using a quantitative approach to achieve the study's objectives. The modified Delphi technique (MDT) identifies and defines the essential vocational skills domains in constructing new technical and vocational assessments through validation experts. The MDT approach was used through the questionnaire instrument to develop indicators. It was used in this study after considering several factors: (i) reduction of the number of rounds and shortening of the data collection period; (ii) providing controlled feedback; (iii) expert opinions are free from biased influences and more-dominant and -experienced individuals; (iv) experts reach consensus and make decisions; and (v) errors that occur are corrected [45]. The MDT research methodology was utilized to develop consensus among the expert panel about the TVET assessment. The researchers gathered the information for this study from articles, books, government agency reports, and electronic references based on the literature review. The keywords used in the search were "vocational skills", "classroom assessment in technical and vocational education training", and "assessment practices in technical and vocational education training".

2.1. Data Collection Method

Researchers gathered information from the data collection by conducting a literature review of previous studies on the TVET assessment model, which has been applied in teaching and learning. The researchers also identified the vocational skills required in the TVET assessment. The researchers then identified indicators for each factor to create the questionnaire for the modified Delphi study. The Delphi panel is a group of experts from a list of specialties offered by Malaysia's various TVET institutions and industries. In the second round, they received the questionnaires (the factors and their respective items) from the researchers. Using a five-point Likert scale, the experts had to state their level of agreement with each item in this round. The second round's results were then carried over to the third round. The third round followed the same procedure, with the experts stating their level of agreement with each item. In each round, the experts were given two weeks to interact, examine, and respond to the instrument.

2.2. Delphi Panel

There are several points of view about the number of study samples in conducting the Delphi technique. According to [46], a sample size of 10–30 participants is sufficient to conduct the Delphi technique. However, [47] proposes that if the Delphi sample background is homogeneous, 10 to 15 people can be employed as a study sample. According to [48], the sample size of Delphi studies should be between 10 and 18 persons, and those included should have experience and should have been working for a long time. Therefore, the researchers identified 19 experts to meet the modified Delphi approach criteria. The criteria for selecting experts are those with experiences in the issues discussed and who capable of contributing opinions, conducting assessments, and making decisions to achieve consensus [49]. According to [47], two groups are qualified as Delphi experts: (i) top-management, which refers to decision-makers who will use the Delphi study's results; and (ii) professional staff in the relevant field. Thus, in this study, experts were chosen based on the following criteria: (i) experts involved in the implementation of the TVET curriculum;

(ii) experts knowledgeable in the Malaysian TVET curriculum; (iii) experts directly involved in TVET assessment practices; (iv) experts' knowledgeable competencies of development for TVET students and industrial professionals. The Delphi panels were chosen from the Technical and Vocational Education Division, the Ministry of Education department developing the TVET curriculum and assessment. Researchers also included expertise from Malaysian TVET educational institutions who teach and conduct assessments in TVET education, as well as industry partners participating in the employment sector selection of TVET graduates. The participation of industry professionals and accredited centers in curriculum development and evaluation should be encouraged to fulfill the organization's present and future industry demands [50]. Table 1 shows the Delphi panel by category, with institutions and qualifications represented.

Table 1. The Delphi Panel Categories.

Delphi Panel Categories	Institution	Qualification	No. of Experts
TVET Lecturer (Malaysian Technical University Network, MTUN)	The University of Malaysia Pahang	PhD	1
TVET Lecturer/Practitioners Malaysian Ministry Of Higher Education (MOHE)	Community College	Master's Degree	3
TVET Instructors/practitioners under the supervision of the Malaysian Ministry of Education (MOE)	-Technical and Vocational Education Division -Institute of Teacher Education -Aminudin Baki Institute -School Improvement Specialist Coach -Malaysian Vocational College	Master's Degree	2 2 1 1 1
TVET instructors/practitioners at Human Resources Department Training Institute (ILJTM) and Skills Development Department	-Malaysian National Youth Skills Institute -MARA Skills Institute	Degree with a professional certificate	1 3
Industry (Supervisor and Engineer)	Industries/companies involved in TVET	Degree with professional Certificate	4
		Total	19

2.3. Research Procedure

The modified Delphi methodology is a method for reaching an agreement among experts via a face-to-face interaction questionnaire [46], and it is utilized in developing TVET assessment practice indicators. The MDT proposed by [46] was applied in this study, where the first round of interviews in the Delphi method was not needed, and the process started with the exploration of domain and indicators [51–53]. This is because the researchers sufficiently define the issue in the first round of the Delphi method.

In the first round, researchers studied the concept of assessment, vocational skills TVET assessment models, and conducted document analysis relevant to skills education in Malaysia. This step aims to create a benchmark to directly identify the relevant variables and indirectly form the domain of study. Next, the instrument in the form of questionnaires is produced. Researchers have also established the selection of experts. A panel of experts in the relevant field was selected based on their credentials to evaluate and provide feedback on the criteria required for each of the selected items. The chosen experts have related experience and are responsible for teaching and assessment in Malaysia's TVET system. The questionnaire developed by the researchers consists of two sections: Section A pertains to the experts' consensus on the development of vocational skills indicators, including technical skills, IR 4.0 generic skills, and career adaptability skills. Section B consists of the experts' consensus on classroom assessment practices that may be applied to assess the development of vocational skills. Appendix A provides explanations of the questionnaire matrix.

In the second round, the researchers distributed the research questionnaire face-to-face and clearly explained the purpose and objectives of the studies. The researcher also explained that the questionnaire items were constructed to form domains and indicators of vocational skills and assessment practices in TVET. The experts chosen were given a week for them to provide feedback through the questionnaire that had been distributed. The experts were asked to evaluate, indicate their level of agreement, and comment on statements related to elements of classroom assessment practice in TVET and vocational skills development using the questionnaire. Afterwards, the researchers collected and analyzed the completed answered questionnaires by the experts. The panel of experts' feedback and suggestions concerning the instrument was then considered, and improvements were made for the next round.

In the third round, researchers provided a questionnaire to the experts based on the feedback gathered from the previous round of evaluation of each item. The same procedures were conducted. The experts were given a week to review the assessment of all the items the researchers analyzed. After considering all factors, the experts were asked to decide. They could decide to maintain their choices or change any of the answers. The results were analyzed, and the findings and the experts agreed on the selected elements of the classroom assessment practice in TVET and vocational skills development. Thus, the findings from this third round were applied to determine the elements of classroom assessment practice in TVET and vocational skills development. This study has managed to collect data from 19 experts who are experts in TVET education in the Malaysian context, TVET assessments, and skills development. Table 2 summarizes the modified Delphi study implementation, data collection, and analysis.

Table 2. Summary of modified Delphi.

No	Implementation Phase	Method of Data Collection	Analysis Technique
1.	Round 1	The interviews were not needed	None
2.	Round 2	Questionnaire	Range of Quartile (ROQ)
3.	Round 3	Questionnaire	Range of Quartile (ROQ)

The Statistic Package for the Social Sciences (SPSS) software was used in each round of data analysis for the MDT (round two and round three). The SPSS analysis results were then presented as descriptive statistics. The data from the Likert scale obtained in the second and third rounds were then converted into modified Delphi data and analyzed using Excel software. This study used mode score, median score, and ROQ to represent expert consent. The Range of Quartile (ROQ) was used to determine the relationship of each item with the expert panel. This means that the ROQ score reflects the level of agreement among the expert panel on a questionnaire instrument. ROQ consists of Q1, Q2, and Q3 values and is often expressed as Q3–Q1. Q1 represented the first quartile, while Q3 represented the third quartile. Levels for modified Delphi scales were 0.0, 1.00, and 2.00, where ROQs with values 0.0 to 1.0 indicated a high degree of expert agreement and acceptability of the items generated. The item has moderate agreement if an item obtains an ROQ score of 1.01 to 1.99, while if an item obtains a score of 2.00 or above, the item does not obtain agreement among the expert panel. The calculation method for ROQ is as follows in Figure 1.

$$= \text{Quartile } 3 - \text{Quartile } 1$$

$$= Q3 - Q1, \text{ where } Q1 = n/4,\ Q3 = 3n/4$$

Figure 1. The calculation method for ROQ.

Agreement on the items was determined based on the range scores as in Table 3 in the field of education.

Table 3. Three-point modified Delphi scale.

Modified Scale	Level of Consensus	Results
0–1	High consensus	Accepted
1.01–1.99	Moderate consensus	Accepted
$\geq$2	No consensus	Rejected

Source: Adapted from [54].

2.4. Validity and Reliability of the Modified Delphi Instrument

Before the item was sent to the MDT panel, the researchers conducted the instrument validity test. This study used content validity techniques through the proof to obtain content validity by using a group of experts appointed to assess the accuracy of item content with the concepts the study necessary to measure [55]. Six experts were appointed in the content validity process to the number of experts used in previous studies [56]. In addition, this study appointed experts consisting of university lecturers with the academic qualification of a Doctor of Philosophy in TVET. The expert's experience had to be at least three years in the field and in the research topic that requires consensus [57]. All six experts selected as a content validity panel have one of the relevant academic qualifications by the scope of this study and have at least three years of experience in the relevant field. Content validity is also evaluated statistically using the Content Validity Ratio (CVR) method. This calculation uses a formula developed by [58] and is increasingly used by researchers to determine content validity statistical statistics [59–61]

The CVR value is the average degree of appropriateness of the items obtained from the total content validity panel. According to [62], the CVR value makes deciding whether to keep or drop items easier due to content validity expert evaluation. The format used to obtain the CVR value is a three-point scale on each item of the instrument, representing (1) Very Essential, (2) Less Essential, and (3) Not Essential. Once all the panels' responses were collected, the items marked "Very Essential" by the experts were counted. According to [58,63], the critical value of CVR for six experts is 1. Reference [58] recommends two ways to update or eliminate items below this crucial value of 1, namely, improving or eliminating items below this value [64]. After calculating the value of each CVR item, items with a value of 0.33 are eliminated, items with a value of 0.67 require improvement, and those with a value of 1 are retained. The number of items was dropped after content validity, and the number of items was modified and added based on expert recommendations. Table 4 shows that experts evaluated the item in each indicator, and the researchers improved the item based on experts' recommendations.

The researchers then ran a pilot study after the experts had reviewed and validated each item and made any necessary amendments. The pilot study should be conducted to test relevant questions and respondents' comprehension of the stated things [65]. For instrument development, [66] recommends using a sample size of 10–30 participants for the pilot study. Based on this assertion, the researchers used 15 TVET lecturers from community colleges in East Malaysia as the sample for the pilot study. The instrument's reliability determines the stability and consistency of the questionnaire items [67]. Reliability, in other words, refers to the consistency of a test. When a test has high reliability, the measurement value is almost the same as measuring the same behavior at different times [68]. The questionnaire's reliability test requires the suitability and understanding of the study participants on the items in the questionnaire. The conditions for seeing the questionnaire as appropriate are based on the value of Cronbach's Alpha. References [69,70] stated that the minimum Cronbach's Alpha value accepted is 0.7. The interpretation of Cronbach's Alpha reliability test scores is shown in Table 5. The results of Cronbach's Alpha test are shown in Table 6.

Table 4. Results of Content Validity Reports (CVR) value for the modified Delphi instrument.

Indicators	CVR Value	Item Number	Total Item	Researchers' Action
Technical Skills	1.0	A2–A5, A9, A11, A13, A15–A18	11	Item remained
	0.67	A7, A8, A10, A12, A15, A19, A20	6	Needs to be improved
	0.33	A1, A6, A14	3	Eliminate item
IR4.0 Generic Skills	1.00	B1-B4, B6-B13, B15-B22, B25-B30, B32-B50, B53-B55	48	Item remained
	0.67	B5, B14, B23, B24, B31, B51, B52	7	Needs to be improved
Career Adaptability Skills	1.0	C1–C4, C7–C15, C17, C18, C20	16	Item remained
	0.67	C5, C6, C16, C19, C21, C22, C23	7	Needs to be improved
Classroom Assessment Practices in TVET	1.0	D1–D4, D6–D15, D17–D37, D40, D41, D43, D44	39	Item remained
	0.67	D5, D16, D38, D39, D42	5	Needs to be improved
		Total Item	142	

Table 5. Cronbach's Alpha interpretation of reliability test scores.

Alpha Coefficient (α) Score	Reliability
>0.8–1.0	Very good and practical with a high level of consistency
>0.7–0.8	Good and acceptable
0.6–0.7	Acceptable

Sources: Adapted from Johnson, and Christensen (2000) [70].

Table 6. Cronbach's Alpha score for each indicator.

Indicators	Alpha Coefficient (α) Score
Technical Skills	0.736
IR 4.0 Generic Skills	0.752
Career Adaptability Skills	0.851
Classroom Assessment Practices In TVET	0.924
Mean	0.816

Cronbach's Alpha value for the item vocational skills and classroom assessment practices in TVET is $\alpha = 0.816$. The reliability of this study meets the validity with the characteristics of stability, consistency, and accuracy [68].

3. Results

Data analysis in the formation of domains and indicators for vocational skills and classroom assessment practice in TVET are categorized as the following: (i) identifying domain and indicator in vocational skills and classroom assessment practices in TVET, and (ii) validating domain and indicator in vocational skills and classroom assessment practices in TVET.

3.1. Identifying Domain and Indicator in Vocational Skills and TVET Classroom Assessment Practices

An analysis of the literature review of previous studies and documents related to TVET assessment practice was conducted in the early stages of a modified Delphi study to determine the appropriate assessment for TVET students in the Malaysian context. The researchers also conducted literature reviews to learn more about the student learning outcomes intended in TVET assessment to develop vocational skills required for TVET students. Identifying domain and indicator was carried out to create a questionnaire.

3.1.1. Vocational Skills as Student Learning Outcomes in TVET Assessment

According to [71], competence is obtained via learning and accumulation and divided into general vocational skills, professional vocational skills, professional competency, career adaptability-ability, and social competence. In TVET, building student competencies and learning outcomes through competency building is the desired strategy. If the skills are acquired to meet the industry's needs and current conditions, they can help students to develop their careers and place them in a healthy, competitive environment in the workplace. Various research has been conducted on TVET assessment measuring and enhancing student skills. The assessment study of [72] revealed that assessment in TVET is related to employability skills development. Assessment in TVET by [73] is connected to the framework of expertise in the areas of technical competence, generic competence, and industry competence; by [74] is related to technical skills and soft skills; by [75] is related to leadership skills and entrepreneurial competencies. The TVET assessment studies by [76,77] are about developing project competencies in TVET students, including knowledge, skills, and abilities. The study by [78] relates to soft skills construction [79,80] related to problem-solving competence.

Formation of student performance learning outcomes in the form of performance achievement is also essential in building the careers of TVET students. The TVET assessment study of student performance formation by [81] is related to progressive performance and technology innovation performance; by [82] is related to comprehensive skills. Assessment's influence on students' learning outcomes demonstrates that assessment has a role in determining the beneficial impacts students acquire. Teachers' evaluations often generate a pleasant learning environment, raise motivation and skills, improve student learning outcomes, and promote the development of information and skills required in real life [9,26,83–85]. The assessment also generates a positive attitude in pupils, such as responsibility, confidence, supporting one another, having a pleasant and satisfying viewpoint on the assessment, and developing a good personality [86,87]. Furthermore, [72,88] also reveal that teacher evaluations significantly influence students' ability to develop a strong coherence between theory and practice.

3.1.2. TVET Assessment Practices

Assessment is a component of the educational system that assesses students' ability to determine the scope of previously stated learning goals. TVET assessments are written, as are practical tests that measure students' knowledge in cognitive domains, abilities in psychomotor domains, and attitudes in emotional areas [89]. A constructive approach to learning outcomes in the form of competence development is required in TVET. If the gained competencies satisfy the demands of the industry and current circumstances, competencies may help students grow their careers and subsequently position them in a healthy competitive environment in the world of work. TVET students' future professions depend on their ability to demonstrate their learning through performance. Furthermore, these findings have shown how assessment is used to build students' skills in the fourth industrial revolution (IR 4.0), as studies that were conducted to assess and develop these skills revealed that the level of readiness and acceptance of students toward IR 4.0 is still moderate [90]. It is crucial, because for students to lead the industry's 4.0 transformation, they must be equipped with 21st-century competitive skills [91]. TVET assessment studies include a wide range of teaching and learning methodologies. Assessment is also observed to be efficiently performed to evaluate students' performance using technology such as computers, as the research carried out by [71,77,85] contrasts traditional assessment. This research also demonstrates that teachers are critical in effectively implementing assessments. Teachers' abilities and expertise are important markers in student evaluation.

3.1.3. Conceptual Underpinning Development of Classroom Assessment Practices in TVET

Classroom assessment practices can be broadened in scope because they are viewed as a holistic evaluation that includes summative and formative tests designed to measure and develop students' knowledge, abilities, and positive values [92]. According to the literature review, the most common type of assessment applied in TVET is competency-based. Because the skills and competencies that need to be developed for TVET students should be assessed using competency-based assessments, the researcher adapted the skills that need to be designed in classroom assessment for TVET students in the Malaysian context, as classroom assessment practices were identified as a gap in this literature review. The researcher also found that the vocational skills developed in TVET assessment practices include appropriate domains and indicators. Based on a literature review, four (4) leading indicators of classroom assessment practice in TVET were identified: (i) assessment concept, (ii) assessment aspects, (iii) assessment approaches, and (iv) level of mastery. It also identified three (3) leading indicators of vocational skill development, which are as follows: (i) technical skills, (ii) IR 4.0 generic skills, and (iii) career adaptability skills. Technical skills are crucial in learning outcomes for each TVET student, and it is also a priority to develop students' competence in technical and vocational fields [93]. Because limited studies have been conducted to assess and build these skills based on this literature review, this study will examine how classroom assessment can build students' generic skills in IR 4.0. This suggestion is significant because TVET students must have the skills to compete in the twenty-first century to lead the industrial revolution 4.0 [94]. Career adaptability skills are also important indicators that should be incorporated into TVET classroom assessment practice because they help students learn basic knowledge about their chosen career while instilling confidence to remain competitive in today's demanding workplace [95].

As a result, based on the gaps discovered, the researchers expanded the research to go in-depth about the subindicators in vocational skills and classroom assessment practices that will be adapted and developed in this assessment. According to [96–98], subindicators in technical skills are the method, process, and technique, which are essential in doing technical work. IR 4.0 generic skills' subindicators found in the literature consist of entrepreneurial skills, interpersonal abilities, skills application of technology, teamwork skills, leadership ability, communication abilities, complex problem-solving skills, knowledge of ICT and technical skills, communication skills, data processing capability, emotional intelligence, and self-awareness [99–104]. Referring to findings in [105,106], career adaptability consists of confidence, curiosity, control, and concern. The learning theories and model of classroom assessment practices developed by [28,44,107–109] have become the primary reference in developing indicators and subindicators for TVET assessment practices suitable for the Malaysian context. The theories and models of classroom assessment practices consist of the concept of assessment (assessment for learning, assessment as learning, assessment of learning), assessment approaches (oral assessment, written assessment, observational assessment, outcome-based assessment), and level of mastery (knowledge, perception, and civility). The conceptual framework of the model can be referred to in Figure 2. Table 7 shows the findings on indicators and subindicators' development by studies that have been classified according to their categories.

Table 7. Findings in domains and indicators in vocational skills development and classroom assessment practices in TVET in the literature.

Domains	Literature Reviews	Indicators	Sub Indicators
Vocational Skills (Vocational skills refer to technical and soft skills that enable individuals to learn and develop skills creatively involving practical skills and specific activities for the chosen job)	[96–98]	Technical Skills (Students' knowledge and analytical abilities in using tools and procedures in specific fields. Students comprehend and are competent in doing specified tasks, particularly those requiring methods, processes, procedures, or techniques.)	• Method • Process • Technique
	[99–104]	IR 4.0 Generic Skills (Students' abilities other than technical skills that may help students master learning, receive desired occupations, enhance their quality, and have the ability to increase an organization's performance via their engagement in the IR 4.0 era.)	• Entrepreneurial skills • Interpersonal abilities • Skills application of technology • Teamwork skills • Leadership ability • Communication abilities • Complex problem-solving skills • Knowledge of ICT and technical skills • Communication skills and data processing capability • Emotional intelligence and self-awareness skills
	[105,106]	Career Adaptability Skills (Psychosocial characteristics in which a student is accountable for understanding their duties but finds themselves unexpectedly faced with transition and trauma regarding a task that exists in learning and employment.)	• Concern • Curiosity • Control • Confidence
Classroom assessment practice in TVET (Assessment in TVET examines students' abilities on the elements to be accomplished and evaluates teachers' teaching approaches)	[28,44,107–109]	Concept of Assessment (Consists of an assessment that the teacher can use to assess students' knowledge and abilities.)	• Assessment for Learning • Assessment as Learning • Assessment of Learning
		Assessment Approaches (Consist of approaches that the teacher would apply to evaluate students' knowledge and abilities.)	• Oral assessment • Written assessment • Observational assessment • Outcome-based assessment
		Level of Mastery (Students' level of mastery that can be evaluated by their level of knowledge, perception, and civility.)	Know, perceive, and be civil

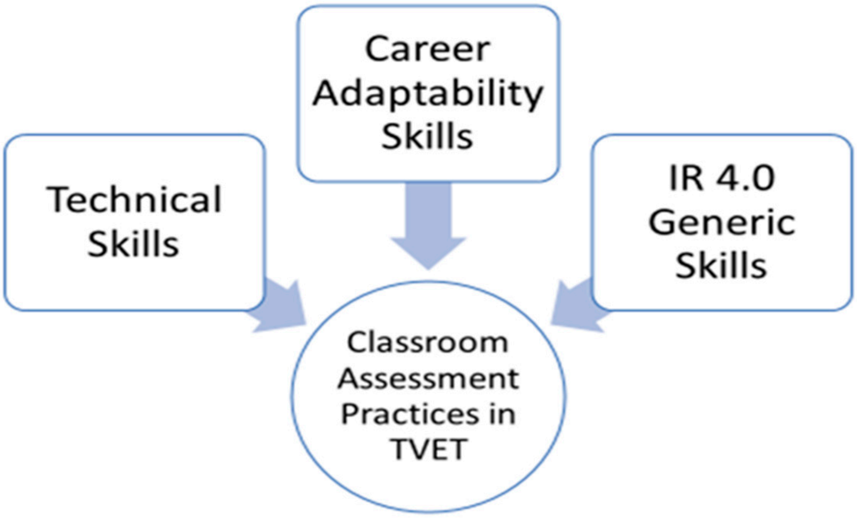
Career Adaptability Skills
Technical Skills
IR 4.0 Generic Skills
Classroom Assessment Practices in TVET

Figure 2. Conceptual Framework of Classroom Assessment Practices in TVET [28,44,107–109].

3.2. Validating Domains and Indicators for the Vocational Skills and Classroom Assessment Practice in TVET through the Second and Third Modified Delphi Round

After completing the domains, indicators, and subindicators obtained through the literature review, the researchers compiled the domains, indicators, and subindicators and formed a questionnaire to obtain expert consensus. The second phase implies validating vocational skill domains and indicators and classroom assessment practices in TVET domains and indicators through the consensus of 19 TVET experts. The Delphi experts' consensus analysis on each item in the constructed questionnaire was given in the second and third rounds. The second finding involves validating vocational skill indicators and TVET classroom assessment practices indicators through the consensus of 19 TVET experts, revealing that all the items have had a high level of expert consensus. Survey instruments were created based on domains and indicators discovered while researching the concept of assessment in TVET and developing student competencies. The researchers' survey instruments describe the student's ability to create their vocational skills, whereas classroom assessment practice is an assessment TVET employed by teachers in assessing and implementing the students' vocational skills. The indicators, domains, and items developed in this study can be seen in Appendix A.

3.2.1. The Vocational Skills Domain

The vocational skills domain consists of three sets of skills, namely, (1) technical skills, (2) IR 4.0 generic skills, and (3) career adaptability skills.

1. Technical Skills indicators

The technical skills indicator consists of three elements: (1) method, (2) process, and (3) technique. A total of 17 items have been proposed as indicators based on the literature review findings that the researchers conducted in two rounds (second and third rounds). The item description for the method (number of items = 6) in the technical skills indicates that all items have a high consensus. Each item received a high ROQ score in the second and third rounds, with scores of 0.4 and 0.2. The item description for the process includes six items in the technical skills, indicating that the experts accept all items. Six items in the process element received a low consensus in the second round, with an ROQ score of 2.0. The experts proposed that two items should be revised because the items had the same meaning. After the revised process, the items had a high consensus: a 0.7 ROQ score for the third round. The item description for the element of the method, process, and technique consists of 16 items in the technical skills for the final finding and indicates that the experts accept all of the items provided by the researchers. The third-round result shows that all experts agreed for items proposed by researchers to be developed as indicators for technical skills in classroom assessment practices in TVET. Table 8 shows experts' consensus for the technical skills indicator.

Table 8. Finding of MDT experts' consensus for Technical Skills indicator.

Domain		Indicators	Second Round			Consensus	Third Round			Consensus
			M	Med	ROQ		M	Med	ROQ	
Vocational Skills	a.	Technical Skills								
	i.	Method	4.8	4.8	0.4	High	4.8	5	0.2	High
	ii.	Process	3.35	4.8	2.0	Low	4.5	4.5	0.7	High
	iii.	Technique	4.70	5	0.75	High	4.9	5	0	High

Details of the data from the modified Delphi technique in the second and third rounds for the items of the technical skills indicator.

2. IR 4.0 Generic Skills

IR 4.0 generic skills for TVET consist of 10 elements. The elements are (1) entrepreneurial skills, (2) interpersonal abilities, (3) skills application of technology, (4) teamwork skills, (5) leadership abilities, (6) communication abilities, (7) complex problem-solving skills, (8) technical competence and ICT knowledge, (9) communication skills and data processing capability, and (10) emotional intelligence and self-awareness skills. A total of 60 items were developed to form an IR 4.0 generic skills indicator based on the literature. The researchers conducted two rounds (second and third rounds).

The details of the findings for constructing entrepreneurial skills indicate five items. The ROQ score obtained 2.0 (low) for the items in the second round. Based on the experts' opinion, two items need to be revised and one item should be divided into two different items, namely, '*using the resources that exist in the entrepreneurial field*' and '*utilizing the resources that exist in the entrepreneurial field*'. In the third round, the ROQ score obtained 1.5 (moderate). Entrepreneurial skills indicate five items for the final finding.

The interpersonal abilities element had seven items. The ROQ score obtained in the second round is 2.5 (low). After the revised process and through the third round, each item received a moderate score for ROQ (1.5). Similarly, there was moderate consensus for item number 6. The experts suggested dividing the item into two separate items because the items seem identical in significance. The item '*influencing friends to complete tasks by cultivating and sustaining strong connections*' also has to be divided into two items. The item should read '*influencing friends to complete tasks through establishing strong relationships*' and '*influencing friends to complete tasks by maintaining strong relationships*'. These indicators indicate seven items for the final finding.

Skills application of technology consists of five items that received a moderate (1.5 ROQ) in the second and high consensus (0.4 ROQ) among the experts in the third rounds. Based on the views of experts, item no. 15 needs to be revised from the item '*using technological equipment safely*' to two different items, namely, '*using technological equipment safely from the aspect of equipment safety*' and '*using technological equipment safely from the aspect of cybersecurity*'. The item of skills application of technology indicates six items for the final finding.

The teamwork skills item consists of five items. The ROQ score in the second round is low (2.0). Based on the experts' suggestion, item no. 20 needs to be revised and divided into two different items, which are from '*work effectively in your own team and various teams in projects and assignments*' to '*work electively with your own team in completing projects and assignments*' and '*work electively with various other teams in completing projects and assignments*'. The experts stated that item no. 22 should be eliminated because it has the same meaning as item no. 21. Item no. 21 was '*always have a responsible attitude towards group work*'. For the third round, all the items had high consensus from experts, with an ROQ score of 0.4. The final finding developed five items for this indicator.

The leadership abilities item (total number of items = 8) received high consensus among the experts' panel. The ROQ obtained in the second round is 0.25 and 0 in the third round. However, the experts proposed that the word '*planning*' in item no. 23 ('*planning the assignments to other friends with tolerance and fairness*') needs to be changed to the phrase '*distribute*' for the next level of study. The number of items remained eight for the final finding. Communication work abilities items (total number of items = 8) also received high consensus among experts. The ROQ score obtained in the second round was 0.4 and 0.2 in the third round. The number of items remained eight for the final finding.

Complex problem-solving skills items (total items = 6) received high consensus among experts. The ROQ score obtained 0.5 in the second and 0 in the third rounds. However, the experts proposed that the word '*making*' in item no. 42 ('*making accurate decisions to solve the problems ethically*') needs to be revised to the phrase '*choosing*' for the next level of study. The item of technical competence and ICT knowledge (total number of items = 5) had a high level of consensus. The ROQ obtained in the second round is 0 and 0.5 for the third round. The final number of items remained five.

Communication skills and data processing capability (total number of items = 5) received a moderate (1.5 for ROQ score) consensus level among the experts. Item 51 needs to be improved from '*using Information Technologies (IT) to update data*' to '*using information and communication technology (ICT) skills' for data processing in information management and processing*'. All the items indicated a high level of consensus, which is 0 (ROQ score), and the final number of items for this indicator remained five. There were six proposed items for the IR 4.0 general skills indicator, including self-awareness and emotional intelligence. All the items received a high level of consensus, which is 0.7 and 0 in the second and third rounds for the ROQ score, respectively. Six items remained for this indicator.

The findings for the mean, median, ROQ, and consensus level of the MDT expert are shown in Table 9. All the experts agreed that 10 elements are needed to develop IR 4.0 generic skills indicators.

Table 9. Finding of MDT experts' consensus for IR 4.0 Generic Skills indicator.

Domains		**Indicators**	**Second Round**			**Consensus**	**Third Round**			**Consensus**
			M	**Med**	**ROQ**		**M**	**Med**	**ROQ**	
	b.	**IR4.0 Generic Skills**								
Vocational Skills	1.	Entrepreneurial skills	4.2	4.8	2.0	Low	4.2	4.8	1.5	Moderate
	2.	Interpersonal abilities	4.5	5	2.0	Low	4.6	5	1.5	Moderate
	3.	Skills application of technology	4.7	5	1.5	Moderate	4.8	5	0.4	High
	4.	Teamwork skills	3.7	4	2.0	Low	4.7	5	0.4	High
	5.	Leadership abilities	4.9	5	0.25	High	4.9	5	0	High
	6.	Communication abilities	4.75	5	0.4	High	4.8	5	0.2	High
	7.	Complex problem-solving skills	4.8	5	0.5	High	4.9	5	0	High
	8.	Technical competence and ICT knowledge	4.8	5	0.4	High	4.8	5	0	High
	9.	Communication skills and data processing capability	4.4	5	1.5	Moderate	4.9	5	0	High
	10.	Emotional intelligence and self awareness-skills	4.7	5	0.7	High	4.9	5	0	High

Details of data from the modified Delphi study in the second and third rounds for the items of the IR4.0 Generic Skills indicator.

3. Career Adaptability Skills

Indicators of career adaptability skills for TVET students include four (4) elements, namely, (1) concern, (2) curiosity, (3) control, and (4) confidence. For the career adaptability skill indicator, 20 items were proposed based on the literature. The analysis was carried out in two rounds (rounds two and three). The concern item (total number of items = 5) in the career adaptability skills indicator received a high consensus among the experts, with an ROQ score of 0 for the second round and 0.5 for the third round. The total number of items in this indicator remained at five. The curiosity item in the career adaptability skills indicator received a high consensus ROQ of 0.8 for the third round and 0.1 in the third round. The total number of items in this indicator remained at five. The control item in the career adaptability skills indicator received a high level of consensus, which is 0.5 and 0 for the second and third rounds, respectively. The total number of items remained at five. The confidence item in the indicator of career adaptability skills recorded a high ROQ score of 0.8 and 0.1 for the third round, with a total of five items. The total number of items in this subindicator remained at five. The findings for the mean, median, ROQ, and consensus level of the MDT expert are shown in Table 10. All the experts agreed that items proposed by the researchers indicate four elements needed for developing indicators in career adaptability skills.

Table 10. Finding of MDT experts' consensus for Career Adaptability Skills indicator.

Domain	**Indicators**		**Second Round**			**Consensus**	**Third Round**			**Consensus**
			M	**Med**	**ROQ**		**M**	**Med**	**ROQ**	
	c.	**Career Adaptability Skills**								
Vocational Skills	i.	Concern	4.5	5	0.9	High	4.9	5	0	High
	ii.	Curiosity	4.6	5	0.8	High	4.9	5	0.1	High
	iii.	Control	4.7	5	0.5	High	4.9	5	0	High
	iv.	Confidence	4.7	5	0.8	High	4.9	5	0.1	High

Details of data from the modified Delphi study in the second and third rounds for the items of the career adaptability skills indicator.

3.2.2. The Classroom Assessment Practice in TVET Domain

The classroom assessment practice in the TVET domain consists of three (3) indicators: (1) the assessment concept in TVET, (2) assessment approaches in TVET, and (3) the level of mastery. The assessment concept in TVET indicators forms three (3) elements of assessment: assessment for learning, assessment as learning, and assessment of learning. Assessment as learning forms two (2) assessment categories: self-assessment and peer assessment. The assessment approaches in TVET consist of four (4) assessment categories: oral, written, observational, and outcome based.

For the classroom assessment practice in TVET indicators, 57 items were proposed based on the findings in the literature. The analysis was carried out in two rounds (rounds two and three). Assessment for learning consists of seven items. The second round of the MDT showed a high ROQ score of 0 for the second and 1.0 for the third round. The final items for this indicator remained seven items.

Assessment as learning in the assessment concept in TVET also forms seven items. Each item received a high consensus among the experts for the second and third rounds, which was 0 and 1.0. The final items for this indicator remained seven items. Self-assessment elements in assessment as learning indicators had developed five items. The ROQ scores for the second and third rounds are 0.5 and 0. Each item received a high consensus among the MDT experts, and the final items remained five. Peer assessment in assessment as learning consists of five items. The consensus value for the second round and third are high, which is 0 for the ROQ score. Each item received a high consensus among the MDT experts, and the final items remained five. Assessment of learning consists of five items. The consensus values for the second round and third are high, which are 0 for the ROQ score. Each item received a high consensus among the experts, and the final items remained five.

The assessment approaches indicators consist of four elements of assessment, namely, (1) oral assessment, (2) written assessment, (3) observational assessment, and (4) outcome-based assessment. The oral assessment in the assessment approaches element consists of five items. The consensus value for each round is high, which is 0 for the ROQ score. Each item received a high consensus among the MDT experts, and the final number of items remained five. The written assessment in the assessment approaches in TVET indicators consists of five items. The consensus value for each round is high, which is 0 for the ROQ score. Each item received a high consensus among the MDT experts, and the final items remained five. The observation assessment in the assessment approaches indicators consists of five items. The ROQ values for the second and third rounds were high, at 1 and 0. Each item received a high consensus among the MDT experts, and the final number of items remained five. Outcome-based assessment in the assessment approaches element consists of five items. The ROQ value for the second and third rounds was high, 0.5 and 0. Each item received a high consensus among the MDT experts, and the final number of items remained five.

The mastery level indicators in the classroom assessment practice in the TVET consists of nine items. The ROQ scores for the second and third rounds were high, at 0.5 and 0. Each mastery level item received a high consensus among the study participants. The findings for the mean, median, ROQ, and consensus level of the MDT expert are shown in Table 11. All the experts agreed that the item proposed by the researchers indicated that three indicators were needed for developing indicators in classroom assessment practices In TVET.

Table 11. Finding of MDT experts' consensus for Classroom Assessment Practices in the TVET domain and indicators.

Classroom Assessment Practices in TVET Domain and Indicators	Second Round			Consensus	Third Round			Consensus
	M	Med	ROQ		M	Med	ROQ	
1. Assessment Concepts in TVET								
i. Assessment for learning	4.6	5	1	High	4.9	5	0	High
ii. Assessment as learning	4.7	5	1	High	4.9	5	0	High
• Self-assessment	4.8	5	0.5	High	4.9	5	0	High
• Peer assessment	4.7	5	0	High	5	5	0	High
iii. Assessment of learning	4.6	5	1	High	4.9	5	0	High
2. Assessment Approaches in TVET								
i. Oral assessment	4.8	5	0	High	4.9	5	0	High
ii. Written assessment	4.8	5	0	High	5	5	0	High
iii. Observational assessment	4.7	5	1	High	4.9	5	0	High
iv. Outcome-based assessment	4.7	5	0.5	High	4.9	5	0	High
3. Level of Mastery	4.8	5	0.5	High	4.9	5	0	High

Details of data from the modified Delphi study in the second and third rounds for the item of classroom assessment practices in TVET domains and indicators. All the experts agreed that the item proposed by the researchers indicated 3 indicators needed for developing indicators in classroom assessment practices In TVET.

4. Discussion

From the three rounds of the Delphi technique, two (2) domains were obtained in the literature review in the first phase: vocational skill development and classroom assessment practices in TVET. The researchers also revealed that three (3) indicators are required in developing vocational skills among TVET students: technical skills, IR 4.0 generic skills, and career adaptability skills. On the other hand, the domain of classroom assessment practices in TVET consists of four (4) indicators: the concept of assessment, assessment aspects, assessment approaches, and level of mastery. The researchers successfully developed 155 items (vocational skills = 98 items; and classroom assessment practices in TVET = 57 items) based on exploring the research concept and expert consensus in each round of the MDT study. In the second and third rounds of the Delphi method, experts agreed upon all of the qualities discovered in each domain and indicator and that all items connected to the two (2) main domains, seven (7) indicators, and thirty (30) subindicators attained a high degree of agreement. The mean and median scores were 5. The range of quartile score is 0 to 1, showing that all things achieved a high degree of expert agreement. Based on the literature review, several subindicators in developing vocational skills encourage TVET students to be more prepared while understanding all critical concepts and abilities in developing vocational skills. Because the circumstance is crucial, they may apply it to the challenge. This illustrates the significance of vocational skills' development in technical and vocational education. Vocational skills are practical skills that are required for a job or field. However, in this study, vocational skills refer to technical and soft skills that enable individuals to learn and develop skills creatively, involving practical skills and specific activities for the chosen job. As a result, in this study, vocational skills combine technical skills, IR 4.0 generic skills, and career adaptability skills. Learning vocational skills expands individual opportunities by revealing hidden personal talents.

Subindicators that obtain expert agreement through the second and third rounds of the Delphi technique, that is, technical skills in detail, can be classified according to methods, processes, and techniques [96]. This is consistent with a study conducted by [89], which states that doing exercise after exercise can increase the efficiency of implementing psychomotor movement. Technical skills in this study refer to specialized knowledge and analytical abilities in using tools and procedures in specific fields. Students comprehend and are competent in doing specified tasks, particularly those requiring methods, processes, procedures, or techniques. Vocational education also needs psychomotor skill development and training [110]. One of the aspects discovered in the study [5,84,111,112] is that technical and vocational fields are directly involved, such as technical skills, including graphic communication through design activities, preparation of engineering drawings, technical drawings, or even geometric drawings. As a result, technical capabilities and the exchange of visual ideas with others are critical components of the design process, particularly in the early phases.

In this context of research, generic skills are defined as abilities other than technical skills that may help students master learning, receive desired occupations, enhance their quality, and have the ability to increase an organization's performance via their engagement in the IR 4.0. Subindicators of IR 4.0 generic skills, a discovery in this study, are based on complex problem-solving skills, ICT and technical skills, communication and data processing capability, emotional intelligence, and self-awareness. The IR 4.0 generic skills findings were similar to the studies [87,94,113–116]. Entrepreneurial skills have been regarded as one of the essential generic skills needed in this study, and [117,118] stated that entrepreneurial skills are also the generic skills required for the workforce in the twenty-first century. Apart from that, learning features that are focused on critical thinking, problem-solving, metacognition skills, digital era literacy, innovative thinking, effective communication, and high productivity are on the agenda of 21st-century issues that must be addressed in the education system [119]. Therefore, efforts are being made to design different teaching and learning systems to enhance students' creative capacity [120].

In this research, career adaptability refers to psychosocial characteristics in which a student is accountable for understanding their duties but finds themselves unexpectedly faced with transition and trauma regarding a task in learning and employment. Results showed that all experts agree on the subindicator of career adaptability skills as the leading indicator of vocational skills. This demonstrates that career adaptability skills are essential in developing technical and vocational students' competencies. The study [121] indicated that employability skills and career adaptability are significantly related, demonstrating the critical impact that curriculum has on students' future success in the workplace. As a result, education should stress technical knowledge and instill communication and interpersonal skills in students [122]. Students that work effectively in groups may manage, solve, and use practical communication skills in their studies or employment. This also enables teachers to include these abilities in their teaching and assessment to assist students in understanding the professional path, developing career knowledge, and remaining positive throughout their career journey [122–125].

Assessment practice is an assessment component that has been provided to explain the assessment strategy teachers employ. The TVET classroom assessment practices indicator obtained high consensus among experts. It also reported high consensus among experts on the subindicator, which is a concept of assessment, assessment aspects, assessment approaches, and level of mastery. According to the Malaysian Education Blueprint 2013–2025 (Ministry of Education Malaysia, 2013), in combination with the Malaysian Philosophy of Education, classroom assessment is the key to holistically developing a child in terms of cognitive, emotional, and psychomotor development skills [126]. As shown by this technical and vocational assessment, a method for assessing student knowledge, skills, and attitude from several aspects may be developed. It aids teachers in constructing lesson plans and selecting suitable assessment processes and techniques while also assisting them in completing these activities. It also demonstrates the importance of assessments in measuring students' overall knowledge and abilities. Practical work or "hands-on" experience is vital in the vocational curriculum to convert cognitive conceptual information into psychomotor capabilities [127]. Practical work is essential for student preparation in practice and mastering a precise and proper work method to fulfill real-world employment demands [128]. A successful teaching plan and approach for technical and vocational skill mastering must have specific features capable of fostering innovation. The implications for developing vocational skills will facilitate the ability of teachers and other practitioners in vocational education to arrange learning to meet specific objectives. The process of vocational teaching and learning should go from constructive to abstract and from recent experience to new experience, and this process should be connected with the growth of vocational skills.

5. Conclusions

The findings have identified three main classifications of vocational skills indicators: technical skills, IR4.0 generic skills, and career adaptability skills. On top of that, four indicators in classroom assessment practice can also be identified: the concept of assessment, assessment aspects, assessment approaches, and mastery level. This study hoped to impact the field of TVET in terms of curriculum development in teaching, learning, and assessment in TVET practices. In addition, the study's consequences for practice are as follows. This study's results could potentially significantly impact Malaysia's TVET education system, whether via students, teachers, institutions, or the Malaysian Ministry of Education. This study is also critical to TVET since it contributes to the objective by producing competent and trained human resources. It provides information to students and stakeholders so they can build a positive environment that enhances student skills and competencies.

Additionally, it may assist the Malaysian Ministry of Education to establish a more successful education program that develops student competencies in the context of current industry demands. Fast actions are taken to provide appropriate assessment by emphasizing the mastery of knowledge, intellectual capital growth, building a progressive attitude culture, and encouraging the practice of high virtue ethics, and moral values can help to expand the objective of assessment in TVET. It also underlines the importance of utilizing suitable assessment concepts and approaches while conducting assessments. Teachers should thoroughly understand assessment practices and objectives, and have a desire to learn outcomes since accurate assessment data enable teachers, students, parents, and institutions to implement the necessary actions [129].

Assessment in education examines students' abilities on the elements to be accomplished and evaluates instructors' teaching approaches. Assessing how students use their knowledge and skills enables educators to track and assess their progress and differentiate education appropriately. Knowing how to evaluate students legitimately, particularly concerning higher-order thinking abilities, implies that teachers are no longer bound by assessment techniques developed by textbook publishers and others [130]. As a result, teachers may use a more extensive range of instructional methods. In order to guide future research, it is necessary to evaluate the study's results and conclusions in light of its limitations. First, from a methodological standpoint, the data were obtained from a Malaysian setting, and a total of 19 participants were enough for this research; the conclusions of this study may apply to other cultures and nations for some circumstances. To ensure students are assessed according to the knowledge and skills required by their industry's employers, classroom-based assessment practices in TVET should be based on current and relevant industry standards and competencies. If assessment processes are aligned with internationally recognized industry benchmarks, then students' competencies will be applicable outside of Malaysia and transferable to international audiences. Utilizing classroom assessment practices as authentic assessment that matches real-world work situations can help TVET students enhance their skills and abilities. This study's findings on teachers as practitioners of this new classroom assessment practice in TVET may be studied further as an additional suggestion for future research. This classroom assessment practice in TVET attempts to determine if the domains and indicators are suitable for implementing TVET students in the Malaysian context.

Author Contributions: S.R.M.Y. came up with the idea for this article; S.R.M.Y., M.S.R. and R.M.Y. performed the literature search, methodology, data analysis, result, and discussion; S.R.M.Y., M.S.R., R.M.Y. and H.U.H. drafted and critically revised the work; S.R.M.Y., M.S.R., R.M.Y. and H.U.H. were responsible for writing review and editing; M.S.R., R.M.Y. and H.U.H. read and approved the final manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by STEM Enculturation Research Centre funding grant code PDE52 and the Faculty of Education, Universiti Kebangsaan Malaysia funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Indicators, Domains, and Items Developed in This Study

Table A1. Technical Skills Indicator, Domain, and Items.

Indicators	Domains/Items Developed
Technical Skills	**A. Method**
The TVET students should have mastery of tools and materials and efficiency in directing behavior and actions regarding methods, processes, and techniques when doing tasks.	The TVET students can carry out technical work with the knowledge they have from the planning aspect in carrying out tasks given in an orderly, neat, and systematic manner to achieve the objective.
	B. Process
	The TVET students can apply their knowledge by performing work steps, following work rules, and focusing on safety.
	C. Technique
	The TVET students can explain the function of technical equipment and select, use, and operate technical work tools and materials correctly and efficiently in carrying out tasks.

Table A2. IR 4.0 Generic Skills Indicator, Domain, and Items.

Indicators	Domains/Items Developed
IR 4.0 Generic Skills	**A. Entrepreneurial Skills**
The TVET students should have mastery of basic skills and technical skills, i.e., cognitive, personal, and interpersonal skills relevant to a job.	The TVET students' ability on subattributes such as entrepreneurial experience, identification of entrepreneurial opportunities, risk tolerance, internal locus of control, achievement, perseverance, and financial management.
	B. Interpersonal Skills
	The TVET students can facilitate interaction and communication with others in which social rules and relationships are created, communicated, and changed in verbal and nonverbal ways. The process of learning this skill is called socialization.
	C. Skills application of technology
	The TVET students can choose and operate technological equipment following the tasks given for learning purposes.
	D. Teamwork Skills
	The TVET students can manage a team that improves results by combining effort, knowledge, skills, and abilities to produce higher work performance.
	E. Leadership Skills
	The TVET students can collectively gain support and trust from their peers by showing their prestige, abilities, and leading in every job and task.
	F. Communication Skills
	The TVET students can mediate in conveying a learning issue by using easy-to-understand language to make the learning process more effective.
	G. Complex Problem-Solving Skills
	The TVET students can think critically and creatively, use their thoughts to generate ideas and alternative actions, and establish arguments for overcoming shortcomings or obstacles to achieving the desired goals.
	H. Technical Competence and ICT Knowledge
	The TVET students can adapt and use ICT thoughtfully and appropriately, plan, and increase the process's efficiency and the effectiveness of teaching and learning.
	I. Communication Skills and data processing capability
	The TVET students can interact using ICT to obtain information, and they can use data and manage the information obtained for such learning needs.
	J. Emotional Intelligence and Self-awareness Skills
	The TVET students' ability in social intelligence involves monitoring feelings and emotions in oneself and others and recognizing and using them when acting or making a better decision.

Table A3. Career Adaptability Skills Indicator, Domain, and Items.

Indicators	Domains/Items Developed
Career Adaptability Skills	**A. Concern**
The TVET students should have the attitudes and abilities required to succeed in making the transition from school to the world of work that drives toward the needs of the ever-changing job market.	The TVET students' ability to depict the future, prepare and make plans for their career, and find out about education and career prospects.
	B. Curiosity
	The TVET students' ability to explore the learning environment and its relation to career, research career options, and consider and take notes of career opportunities.
	C. Control
	The TVET students have to be efficient, careful, strict, and disciplined, as well as to learn according to their ability.
	D. Confidence
	The TVET students have to be optimistic, brave, responsible, confident, and trusting.

Table A4. Classroom Assessment Practices In TVET Indicators, Domain, and Item.

Indicators	Domains/items developed
Classroom assessment practice in TVET	**A. The Assessment Concepts**
The teachers continuously and systematically gather and analyze information about students' knowledge, skills, and attitudes to improve teaching and learning in TVET.	The concept of assessment that teachers can carry out according to the period and appropriateness of time in applying skill elements in TVET learning. ● Assessment for Learning ● Assessment as Learning ● Self-assessment ● Peer assessment ● Assessment of Learning
	B. The Assessment Approaches
	Teachers can carry out forms and types of assessment to assess student mastery from the aspects of skills that teachers want to apply. ● Oral assessment ● Written assessment ● Observational assessment ● Outcome-based assessment
	C. Level of Mastery
	The level of mastery that TVET students can achieve illustrates their ability to master the skills that teachers want to apply in learning TVET subjects. ● Knowledge ● Perception ● Civility

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