

TVET Educational Learning Strategies and their Impact on Students: A Systematic Literature Review

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Abstract

Inequality of participation and access to quality education for disadvantaged students in the TVET education system is an issue that is often reported by researchers around the world. Learning strategies play an important role in increasing student participation. This systematic literature review was conducted to identify the impact of TVET education learning strategies, analyses the impact and adapt appropriate learning strategies in increasing the participation of urban and rural students to reduce the inequality of access in TVET education. A thematic analysis through 22 papers were selected from Scopus, Web of Science (WOS), ERIC, and Science Direct databases under the guidance of the PRISMA procedure specifically in comparing the TVET learning strategies best practices and the impact of the diversity of learning strategies that practiced. The finding of this SLR review reveals that job-based learning dominates TVET education, and that technology integration has a significant impact on current trends in industry demand. Therefore, the proposal to use the integration of technology in the existing TVET education needs to be considered to increase the participation of urban students as well as the access of rural and rural students as well as improve the development of human resources in achieving the SDGs.

Keywords: Systematic literature review; TVET education; learning strategies; technology integration; student participation

Introduction

The Sustainable Development Goals are a series of 17 global objectives that were established in 2015 by the United Nations to address poverty, inequality, climate change, and sustainable development. Quality education and reducing inequality are two of the targets that must be accomplished on a national and international level by 2030. One of the objectives outlined by the United Nations (UN) is to guarantee quality education that is inclusive and equitable for everyone. One educational system that is crucial to attaining this aim is technical and vocational education and training (TVET) (DOSM, 2018).

In Malaysia, the TVET system is focused on developing skilled human capital for the labour market, continuing education, and entrepreneurship. The Malaysian government created the Economic Transformation Program (ETP) to enable the boost in human capital development in an effort to promote student engagement in TVET. The transformation of vocational schools into vocational colleges and initiatives under the Malaysian Education Development Plan 2015–2025 (Higher Education) are intended to increase the output of skilled and semi-skilled workforce while placing an emphasis on the development of human capital that contributes to Malaysia's overall development and the achievement of the global Sustainable Development Goals agenda (UNESCO, 2021).

TVET Education in Malaysia and Best Practices in TVET Learning Strategies

Vocational College is the primary technical and vocational training provider for the Malaysian Vocational Diploma (DVM), Malaysian Skills Certificate (SKM), and Malaysian Vocational Certificate (SVM). TVET education in Malaysia is a school-based approach under the Ministry of Education along with regular secondary schools that offer Secondary Vocational Program (PVMA) offers TVET education courses at the lower and upper secondary levels before moving on to higher levels and especially semi-skilled and semi-skilled workers for industry. Several methods have been put into place by the Ministry of Higher Education (KPT) to prepare highly skilled students for the labour market. Through the implementation of the Fourth Industrial Revolution (4IR) National Policy, the TVET Master Trainer Program, and other initiatives, more TVET graduates are expected to be produced. These initiatives are part of the 12th Malaysia Plan. The goal of this program is to prepare IPTA/IPTS, Polytechnic, and Community College students for the most modern industrial environment possible (EPU, 2021; Ministry of Education, 2013; Vocational, 2018). It also focuses on automation, robotics, and artificial intelligence.

Department of Skills Development (JPK) under the Ministry of Human Resources is one of the providers of TVET education in Malaysia. JPK developed the National Occupational Skill Standard (NOSS) as a skill learning standard in Malaysia that must be followed by other TVET education providers in Malaysia. In addition to practicing TVET education through classroom learning at training providers, the initiative under Development of Human Resources Corporation (PSMB) has implemented the National Dual Training System (NDTS) which combines classroom learning and industry experience as practiced in the best TVET education countries such as Germany, Finland and Switzerland. The diversity of KSM's strategies in the promotion and quality assurance of TVET is an initiative in human resource development, improving student skills and the output of TVET graduates (EPU, 2016).

The best practices in TVET include methods, strategies and approaches that have been successfully incorporated into the educational system and have had a favourable effect on the students and the relevant industry. The dual system-based German TVET learning approach has served as the foundation for TVET education all over the world. The success of the TVET system in Germany can be attributed to the mix of classroom instruction with practical industry experience. One of the factors contributing to the low young unemployment rate and high skill level of this group is the dual system that emphasizes the approach of skill development, marketability, and competency (Ministry of Education, 2015). Finland has a similar approach, emphasizing work-based learning through programs like apprenticeships and industrial training, giving TVET students their competency and flexibility in selecting their course of study (Ministry of Education, 2015).

TVET System Issues in Malaysia

Several ministries in Malaysia are involved in the delivery of TVET education. The choice of the target group's breadth and the skills imparted are where each ministry's duties in the delivery of TVET education intersect and are unclear (MOHE, 2019). A UNESCO report (UNESCO-UNEVOC, 2021) that examined whether the TVET curriculum is accessible to underprivileged students around the world, including immigrants, women, rural and inland ethnic minorities, and indigenous students, touched on the issue of unequal participation in the TVET system. According to the Penang Institute, there is still racial segregation in Malaysia, and there are disparities in TVET participation by ethnicity, gender, and individuals with disabilities (Nadya Subramaniam, 2023). According to the Employment and Labor Statistics Report Series 34 Bill 1/2023 (DOSM, 2023) skilled labour employment in Malaysia from 2015 to 2020 was only at 28.9%, falling short of developed nations where skilled worker involvement in the industry reached 70%. The purpose of the study is to evaluate potential strategies for boosting economic development after COVID-19 and increasing the participation of urban and particularly rural students in TVET. In order to accomplish (SDG) 4 TVET quality education and to minimize inequality, to achieve equity of access, and to access opportunities between urban and rural locations, learning methodologies must be consistently developed to attract student engagement.

Research Objectives

This systematic literature review aims to achieved the following objectives of the study that have been set as follows:

- 1) Identify learning strategies practiced in TVET education systems globally
- 2) Analyse the impact of learning strategies practiced on students' awareness, achievement and competency
- 3) Identify learning strategies that can be adapted in the Malaysian TVET system in increasing enrolments and balancing the participation of urban and rural students in Malaysia.

Methodology

The methodology of this study uses a systematic literature review through a thematic analysis (Braun & Clarke, 2006) guided by the PRISMA protocol through a search of relevant articles to identify learning strategies practiced at all levels of the education system, identify spaces and opportunities that can be adapted and gaps which can be improved according to the global education model. The method of searching for secondary data and primary data as support in this systematic literature review is through quality article sources from Scopus, Web of Science (WOS), ERIC and Science Direct journal databases. In order to achieve the goals of this study, a literature synthesis analysis through the PRISMA protocol (Page et al., 2021) containing 27 checklists was used and the selection of appropriate articles was based on the submitted journal database. The flow chart in Figure 1 refers to the articles that have been selected and will be analysed.

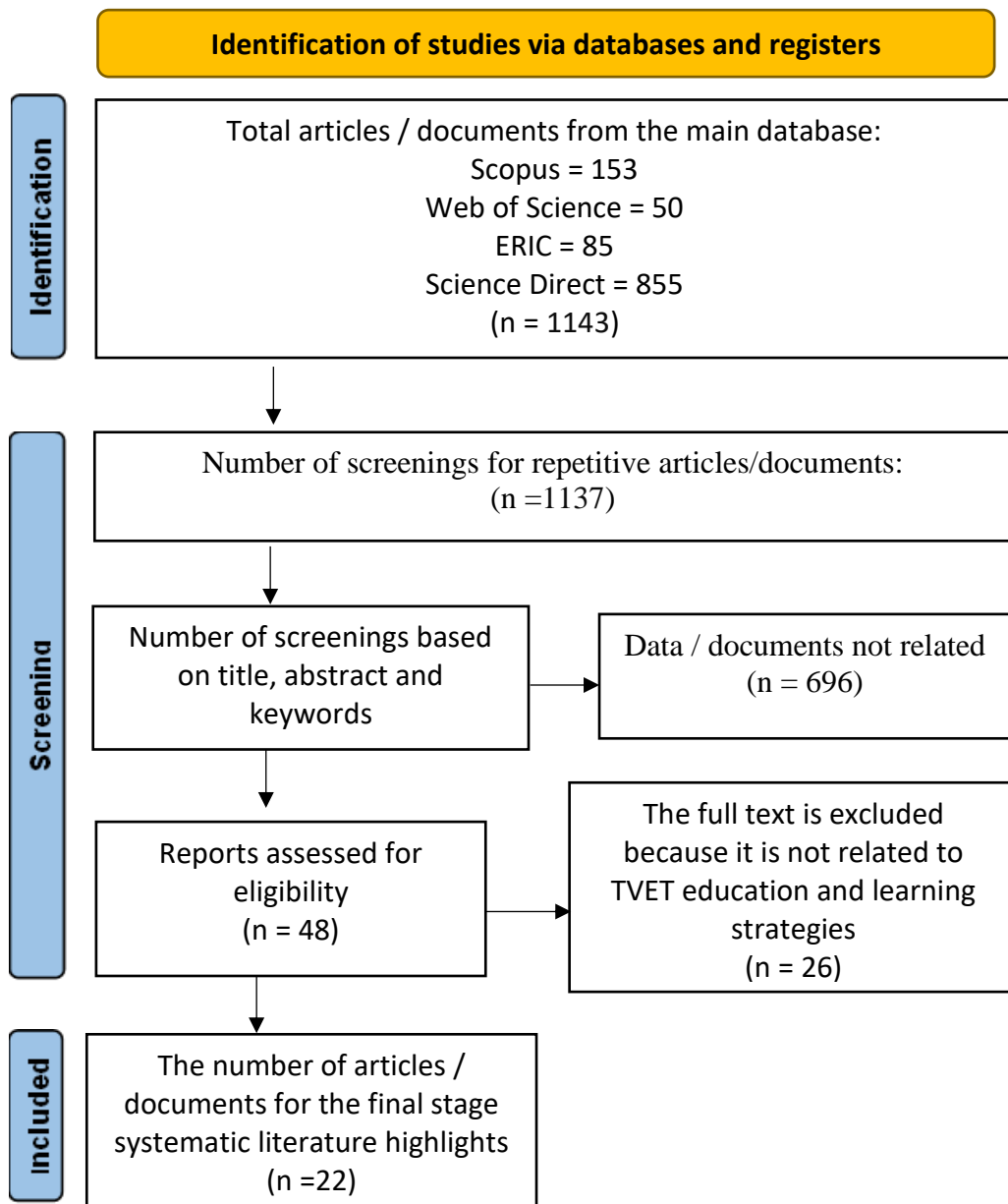


Figure 1: PRISMA flow diagram (Page et al. 2021).

Identification Phase

Guided by the PRISMA guidelines, the first protocol is the identification phase. In this phase, a Boolean search strategy was used when searching the Scopus, Web of Science, ERIC and Science Direct databases for the process of identifying articles based on titles, abstracts and keywords. Keywords related to technical and vocational education, the impact of learning strategies, admission comparison, urban and rural students and learning approaches and their related synonyms, and are referred to in Table 1.

Table 1:
Search strategy for this study

Database	Search string
Scopus	TITLE-ABS-KEY (((“Vocational Education” OR “Vocational Model” OR “Vocational Learning “OR” Pedagogical Method” OR “Dual System” OR “SDG 4”) AND (“Participation” OR “Enrolment” OR “Accessibility” OR “Entry”) AND (“Rural-Urban” OR “Living Location” OR “Province” OR “Nationals” OR “Regional” OR “Asia” OR “ASEAN” OR “Arab” OR “ARABIAN” OR “Europe” OR “American” OR “OCEANIA”) AND (“Comparison” OR “Compare” OR “Comparative” OR “Differences” OR “Difficulties” OR “Demographic”))))
Web of Science	TS= ((“Vocational Education” OR “Vocational Model” OR “Vocational Learning” OR “Pedagogical Method “OR” “Dual System” OR “SDG 4”OR“Learning Strategies”) AND (“Impact” OR “Influenced” OR “Participation” OR “Enrolment” OR “Accessibility” OR “Entry”) AND (“Rural-Urban” OR “Living Location” OR “Province” OR “Nationals” OR “Regional” OR “Asia” OR “ASEAN” OR “Arab” OR “ARABIAN” OR “Europe” OR “American” OR “OCEANIA”) AND (“Comparison” OR “Compare” OR “Comparative” OR “Differences” OR “Difficulties” OR “Demographic”))
ERIC	TX (vocational school and TVET) AND TX (learning styles in education) AND TX (impact or effect or influence or outcome or result or consequence) AND TX (student engagement) AND TX (quantitative or qualitative or mixed methods)
Science Direct	((“TVET Education” OR “Vocational School”) AND (“Pedagogy” OR “Learning”) AND (“Rural-Urban” OR “Global”) AND (“Comparison” OR “Enrolment”))

Screening Phase

The number of articles that were evaluated and screened based on the abstract, title, and keywords was 441 after a total of 6 articles were eliminated due to the repetition of articles from different databases. The 48 publications were reduced to just those that were relevant to technical and vocational training education, the effect of learning methodologies, urban or rural locations, and enrolments comparisons. The 48 remaining articles were prepared, and Table 2 served as the basis for the inclusion and exclusion criteria.

Table 2:
Inclusion and exclusion criteria

Inclusion	Exclusion
The study is from 2010 to 2023.	Study outside the selected year range.
Articles have been peer-reviewed by experts in related fields.	Conference proceedings, books and encyclopaedias.
Articles is in English language and related to technical and vocational training education, the impact of learning strategies, location as well as involving enrolments and the inequality of involvement of urban or rural students.	Articles is not in English language and outside the TVET system, the impact of the learning strategy is not specified, the location of the study is not specified and there is no other impact such as motivation and participation.

Inclusion Phase

After going through the screening process, 22 articles were chosen from the Scopus, Web of Science (WOS), ERIC, and Science Direct journal databases. These articles were checked for validity and high quality by experts in technical and vocational training education, impactful learning approaches high that can be modified to draw the participation of urban and rural students, especially to answer the statement of the research problem in reducing the inequality of involvement of urban and rural students in Malaysia. The selected articles have been read, analysed and reviewed with several other fellow researchers and through the agreement of the researcher's supervisor with full precision to evaluate the perspective of the article writer, the findings and identify gaps that can be used as subsequent studies. Table 3 provides a summary of the publications chosen for evaluation as shown below.

Table 3:
Summary of the selected articles

No.	Title & Author's Name	Research Objectives & Methodology	Outcomes	Learning Strategies
[1]	Developing Two-Year Apprenticeships in Norway and Switzerland (Schmid et. al., 2021)	Objectives: Develop, determine and select learning outcomes in designing a two-year apprenticeship system in Norway and Switzerland and carry out a comparison of apprenticeship systems and study their impact on the TVET system. Methodology: Interview (Qualitative)	The findings of the research showed that both nations with a two-year apprenticeship system allow youths who have trouble enrolling in or finishing upper secondary school to earn certificates and useful skills. Comparing the two-year apprenticeship curriculum design to TVET programs with longer durations and higher output expectations, it is claimed that the complexity of the competency to train is reduced. and in the curriculum for the apprenticeship.	Apprenticeship - Competency Based Learning
[2]	Online Education in the Russian Arctic: Employers' Confidence and Educational Institutions' Readiness (Zaikov et. al., 2021)	Objectives: Develop online vocational education, measure the level of employer confidence in this non-traditional education and demonstrate the readiness of vocational education institutions to alter the implementation	The study's conclusions demonstrate how online learning and remote training programs can promote equity between urban and rural locations. According to the study's findings, 58% of employers support accepting qualifications submitted online compared to 42% who do not. This demonstrates the idea that	e-Learning - Technology Based Learning

		of remote training programs. Methodology: Questionnaires (Quantitative)	online learning is becoming more popular and that it can constantly be enhanced also creates more access to TVET system.	
[3]	The Effectiveness of Gamification for Students' Engagement in Technical and Vocational Education and Training (Laily et. al.,2022)	Objectives: Developing mobile applications that incorporate gamification as a way to boost student participation. In order to create learning content prototypes, this study suggests a design and development research (DDR) strategy using an adaptation of the ADDIE paradigm. Methodology: Causal-Comparative (Quantitative)	A more significant mean score difference between the pre- and post-test and a positive learning experience were discovered to be two ways that gamification during learning activities can boost student engagement. Additionally, gamified mobile applications can be widely used in a variety of TVET courses to improve student learning outcomes. The fundamental contribution of this project is to create a mobile learning application prototype for TVET integrated learning with gamification to boost the possibility of participation and affective impact.	Game Based Learning
[4]	Improving Graduate Outcomes: Implementation of Problem-Based Learning in TVET Systems of Nigerian Higher Education (Ugochukwu et. al., 2021)	Objectives: Explores how Higher Education in Nigeria's technical and vocational education and training (TVET) system could gain advantages through the implementation of problem-based learning (PBL), that is capable of producing high-quality graduate outcomes. Methodology: Interview (Qualitative)	The findings of the research indicate that the PBL approach in Nigeria's TVET system has a positive impact on the quality of TVET graduates because it can promote learning, encourage the integration of theory and practice, boost student self-efficacy, let students developed their own learning, increase graduate productivity, and increase graduate employability.	Problem Based Learning
[5]	Modularisation approaches in Initial Vocational Education:	Objectives: Investigate the current status and strategy of a modular approach in	Based to the study's findings, European nations that use a modular system are able to adapt to the	Competency Based Learning

	evidence for policy convergence in Europe? (Matthias Pilz et. al., 2018)	various European nations within the framework of policy convergence at the end of 2013 to increase TVET's flexibility. Methodology: Interview (Qualitative)	changing needs of the labour market and develop relations with it. Students' learning will be more flexible due to this technology.	
[6]	Conceptualizing case-based simulation framework: Evidence from electrical technology in TVET case study (Azid et. al., 2023).	Develop an Electrical Case-Based Simulation (CBS) framework that contributes to the transformation of TVET learning pedagogical practices. Methodology: Mixed Method	The study's findings indicated five themes for the structural category (increasing students' thinking skills in electrical technology, workplace scenarios, student involvement, improving students' problem-solving electricity, solving skills, and triggering learning activities) and three themes for the process category (achieving the learning outcomes of the electrical course, opportunities to learn, and related to electrical technology content). It may be concluded from the ICC results and the perspectives of the curriculum implementers that the case-based simulation accurately represents the working environment.	Virtual Reality
[7]	Towards a Value Co-Creation Process in Collaborative Environments for TVET Education. (Badawi & Dragoicea, 2023)	Creates a conceptual framework for the development of skills in an online community for collaborative TVET incorporating the Collaborative Knowledge Sharing Environment (CKSEnv) and to evaluate CKSEnv's effectiveness and applicability in achieving its objectives.	The effectiveness and efficiency of the system, according to the study's findings, provide an answer to the question of what makes an information system practical and simple to use. Usability is an external aspect that has a direct impact on efficiency in the sense that it determines how simple a system is to use and how	Collaborative TVET e-Learning

		Methodology: Questionnaires (Quantitative)	quickly or other vital assets it wastes. Utility has an impact on effectiveness, while usability has an impact on efficiency. The perception of utility and usability is influenced by both efficiency and efficacy.	
[8]	A Survey of Technical and Vocational Students' Motivation, Style and Achievement in Information Technology and Society Courses (Wu et. al., 2010)	Examining the relationship between technical and vocational the preferences of pupils for learning motivation, and academic achievement as it relates to information technology courses (ARCS Model). Methodology: Mixed Method	The study's findings showed that there is no significant relationship between academic achievement, learning style, or motivation for learning. However, based to the ARCS model, learning motivation is related to students' academic success. Academic achievement is not significantly impacted by learning style. The findings provide a summary of recent studies in courses on information technology and culture as well as an overview at current trends in Taiwan.	ICT Based Learning
[9]	Training needs assessment of cooperatives in applicable technical and vocational educations in Kermanshah (Iran) (Gilan et. al., 2012)	Objectives: Determining cooperation training programs for technical and vocational needs in the Kermanshah province of Iran in the sectors of agriculture, industry, and services. The needs analysis approach and determine of the disparity between these two statuses issues. Methodology: Questionnaires (Quantitative)	The study's findings achieve an appropriate equilibrium for the demand for training across all industries. A total of 64.7% of the participants reported improving job communication, competencies, and knowledge as their primary motivations for taking the training course. Professional classes are crucial as well to improve their technical and theoretical knowledge.	<i>Competency Based Learning</i>

[10]	<p>Association between deprivation and cognitive ability among Chinese adolescents: Examining the mechanisms of parental involvement in a rural–urban dual system</p> <p>(Jiang & Dong, 2020)</p>	<p>Objectives: Investigating the diverse mediation roles played by parental involvement and life status in the moderating and direct links between deficiency and adolescents' cognitive performance. Rural-urban disparities in the factors driving this will be examined.</p> <p>Methodology: Questionnaires (Quantitative)</p>	<p>Findings revealed that deprivation predicted poor adolescent cognitive ability, while only maternal involvement showed a mediating effect. The level of deprivation among urban youth is lower than that of rural youth, and the level of parental involvement and cognitive ability among urban youth is higher than that of rural youth. In addition, deprivation has a greater impact on cognitive ability among urban youth than rural youth.</p>	Competency Based Learning
[11]	<p><i>Experiential</i> learning (EL) and its effectiveness from the perceptions of hospitality students</p> <p>(Jing Lyua et. al., 2016)</p>	<p>Objectives: Exploring EL methods adopted in Chinese hospitality education, the influence of EL on-student learning outcomes, and the effectiveness of EL methods from the students' perspective.</p> <p>Methodology: Questionnaires and Observation (Mixed Method)</p>	<p>The findings of the study found that it enhances academic learning and helps students achieve the intellectual goals commonly associated with liberal education including a deep understanding of the subject, the capacity for critical thinking and application of knowledge, and the ability to engage in lifelong learning, increasing student engagement, and encouraging active learning, critical thinking, and a sense of civic responsibility.</p>	Competency Based Learning
[12]	<p>Understanding the massive open online course (MOOC) student experience: An examination of attitudes, motivations, and barriers. Computers and Education</p>	<p>Objectives: Examining student motivation, barriers and challenges seen by interviewing students in two courses using MOOCs.</p> <p>Methodology: Questionnaires and Observation (Mixed Method)</p>	<p>The findings of the study show that MOOCs can offer a constructive learning environment with manageable emotional levels, increased knowledge, work performance, convenience and personal interests of students.</p>	Massive Open Online Course (MOOC)

	(Shapiro et. al., 2017)			
[13]	The Use of Personal Learning Environment (PLE) to Support an Online Collaborative Strategy in Vocational Education Pedagogy Course (Muchlas et. al., 2023)	Objectives: Learn the formation of an individual learning setting based on Google applications to facilitate collaborative learning is explained in the context of academic learning for students. Methodology: Causal-Comparative (Quantitative)	This study found that PLE is proven to increase collaborative activities in online learning significantly. Reflective features are the type of PLE that have the most significant influence in creating a good collaborative environment. This research also found that appropriate collaborative activities can improve students' understanding of TVET pedagogy.	ICT Based Learning
[14]	Improvement of Metacognitive and Critical Thinking Skills through Development of the a 'Teaching Factory Based on Troubleshooting (TEFA-T) Model in Automotive Vocational Learning (Hasan et. al., 2020)	Objectives: Identify the improvement in students' metacognitive and critical thinking skills through the development of the 'Teaching Factory Based on Troubleshooting' (TEFA-T) model in automotive vocational learning. Methodology: Questionnaires and Observation (Mixed Method)	The findings of the study show that the TEFA-T Learning Model has high validity through testing using the Aiken'V formula and Confirmatory Factor Analysis (CFA) and Structure Equation Modelling (SEM), with Chi-Square and χ^2/df values of 219.76 and 0.8292, used to determine the model suitability test (goodness-of-fit models). Furthermore, the practical test has confirmed as "Very Practical" with an average score of 4.56 and an Achievement of 90.02%. In conclusion, using the TEFA-T learning model to improve students' academic achievement, metacognition and critical thinking skills.	Visual Reality
[15]	Virtual CEOs: A blended approach to digital gaming for enhancing higher order	Objectives: Analyse the use of online games for improving perspective besides assessing academic achievement, critical and	Throughout the intervention, participants in the DGBL group showed significantly greater creative thinking than those in the comparison group,	Game Based Learning

	<p>thinking and academic achievement among vocational high school students.</p> <p>(Ya-Ting Carolyn Yang, 2015)</p>	<p>creative thinking, and problem-solving skills. The group that utilizes technology-enhanced approaches to learning will be used for comparison in order to evaluate the impact of Digital Games-Based Learning (DGBL) on KBAT and learning achievement.</p> <p>Methodology: Causal-Comparative (Quantitative)</p>	<p>according to the study's findings. Participants in the DGBL also significantly improved their critical thinking skills compared to those in the comparison group. Additionally, DGBL participants significantly increased their academic accomplishment compared to comparison group participants and significantly improved their problem-solving abilities. As a result, DGBL improves problem-solving, critical thinking, creative thinking, and academic performance.</p>	
[16]	<p>How are apprentice satisfaction and concerns changing as a consequence of the coronavirus pandemic?</p> <p>(Hochmuth, et. al., 2022)</p>	<p>Objectives: Outlines the changes that occurred in Germany's vocational schools during the coronavirus pandemic. The use of digital teaching by vocational schools is the main topic of discussion. Further research is done on the difficulties faced by apprentices as well as their technical tools.</p> <p>Methodology: Questionnaires and Observation (Mixed Method)</p>	<p>The findings of the study found that there is a clear potential for improvement in the general use of media and the organization of lessons with the help of direct communication. (25%) of the apprentices stated that the teacher does not use direct communication and that lessons occur exclusively asynchronously. In terms of performance, some apprentices expect there to be opportunities to improve performance as a result of this outbreak. The majority (58%) of women worry that their academic performance will decline compared to male respondents (26.6%).</p>	<p>Apprenticeship - ICT Based Learning</p>
[17]	<p>Disruptive Learning Media Integrated E-Generator Practice System to Advance Self-</p>	<p>Objectives: Developing disruptive learning innovations through e-generator practice systems, testing the feasibility of disruptive learning</p>	<p>The evaluation found that the product's viability test verification scores are 90.1% (aspect of user benefits), 90.5% (aspect of application display), 93.8% (aspect of novelty of information),</p>	<p>Mobile-Based Application.</p>

	<p>Efficacy Learners Levels in Era of Education 4.0</p> <p>(Ulfatin et al., 2023)</p>	<p>innovations through e-generator practice systems; and testing the effectiveness of disruptive learning innovation through the e-generator practice system to increase the self-efficacy level of students in the 4.0 education era.</p> <p>Methodology: Causal-Comparative (Quantitative)</p>	<p>97.6% (aspect of content), 90.6% (aspect of ease of use), and 91.5% (aspect of competency achievement); and disruptive learning innovation through the e-generator practice system has been shown to be effective in raising the level of student self-efficacy.</p>	
[18]	<p>Investigating the Effectiveness of Desktop Virtual Reality for Teaching and Learning of Electrical/Electronics Technology in Universities</p> <p>(Ogbuanya & Onele, 2018)</p>	<p>Objectives: Comparing the efficiency of desktop virtual reality with conventional classroom learning practices for electrical/electronic technology teaching and learning.</p> <p>Methodology: Causal-Comparative (Quantitative)</p>	<p>A total of 149 students took part in the experiment, 74 in the virtual reality group and 68 in the non-virtual reality group, according to the comparison of respondents. Males made up 78.52% of the sample while females made up 21.48%. Results demonstrate that desktop virtual reality improves students' academic performance, learning interest, and engagement.</p>	Virtual Reality
[19]	<p>An Innovative Model as Evaluation Model for Information Technology-Based Learning at ICT Vocational Schools</p> <p>(Divayana et. al.,2021)</p>	<p>Objectives: Develop an evaluation model of Description-Input-Verification-Action-Yack-Analysis-Nominate-Actualization (DIVAYANA) model as an evaluation model for the implementation of information technology-based learning in ICT vocational schools.</p> <p>Methodology: Causal-Comparative (Quantitative)</p>	<p>The findings of the study found that the analytical technique used to analyse the quantitative data from the initial field study in this research is quantitative descriptive showing the level of effectiveness of the DIVAYANA model is 88.571%, where this model can be categorized as an effective assessment model for information technology-based learning in ICT vocational schools. This is to encourage the digitization of education in TVET and further improve students' ICT competence.</p>	ICT -Blended Learning

[20]	<p>Mobile Learning Methodology for European Trainers and VET Systems Quality Improvement</p> <p>(Almeida & Moldovan, 2014)</p>	<p>Objectives: Develop Global SRS, a mobile learning approach with the primary goal of enhancing the TVET system's quality in Europe through the development of teachers' and students' Information and Communication Technology (ICT) skills and the promotion of a more engaging and flexible learning environment.</p> <p>Methodology: Questionnaires and Observation (Mixed Method)</p>	<p>The findings of the research show that the development of Global SRS based on mobile computing is a creative and innovative pedagogical tool to encourage a more dynamic training environment and guide trainees toward the learning process to enhance interactive and dynamic teaching models by improving communication in student teaching feedback.</p>	ICT Based Learning
[21]	<p>Implementing Experiential Learning in High School Agriculture and Forestry Curriculum: A Case Study in Guatemala</p> <p>(Quesada et. al., 2020)</p>	<p>Objectives: Explain the current status of experiential learning for the purpose of teacher professional development programs, available resources, limitations, and the ability of teachers to implement learning through experience in the field of agriculture and forestry curriculum in Guatemala.</p> <p>Methodology: Questionnaires and Observation (Mixed Method)</p>	<p>Teachers can identify the resources and constraints that determine how experiential learning is implemented in their education programs. The teacher will modify the standard program, which incorporates a considerable experiential learning style, based on the recommendations and examples given by the instructor. Field-based activities make it easier to integrate experiential learning approaches than classroom activities.</p>	Competency Based Learning
[22]	<p>Learning Style Approaches for Gen Y: An Assessment Conducted</p>	<p>Objectives: Identifying the preferred learning preferences of technical students from various faculties at Malaysian public universities. In order to</p>	<p>The study's conclusions indicate that a large majority of students at public technical colleges in Malaysia—roughly 77.72% or 143 students from the overall sample—have a</p>	Competency Based Learning

	<p>in a Malaysian Technical University (Fesol et. al.,2016)</p>	<p>attain high quality in the teaching and learning process, educators can make the most of their teaching materials by adapting them to the educational needs of their students.</p> <p>Methodology: Questionnaires (Quantitative)</p>	<p>learning style related to visuals, with 58.15% or 107 students having just a visual learning style. The findings indicate that visualization is one of the most popular learning methods among technical students. The second learning style that is quite popular is one that is kinaesthetic in nature. 49 students, or about 26.63% of the sample as a whole, selected this learning method.</p>	
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Findings

The TVET system's quality education is an effective motivation for increasing student involvement and balancing participation between urban and rural areas. In order to reduce inequality in access to TVET education, which will lead to job opportunities and narrow the income gap for rural people, indicators have been set at the national and global levels (Liu et al., 2020). Research by (Fesol et al., 2016; Gilan et al., 2012; Jiang & Dong, 2022; Lyu et al., 2016; Okolie et al., 2021; Pilz et al., 2018; Quesada et al., 2020; Schmid et al., 2021) found that competency-based learning, project-based learning, and problem-based learning dominate the TVET education learning strategy.

Technology-based approaches are starting to play a significant part in TVET education in addition to job-based learning. The 21st century learning strategy focuses more emphasis on the incorporation of technology to create students who possess the quality of critical thinking and technical literacy. The use of computer and information technology, as well as a multi-discipline learning model based on technological innovation, have all contributed significantly to improving the quality of TVET students, which is able to encourage the participation of more students in the TVET system (Almeida & Moldovan, 2014; Azid et al., 2023; Badawi & Drăgoicea, 2023; Divayana et al., 2021b; Hochmuth et al., 2022; Maksum et al., 2022; Muchlas et al., 2023; Ogbuanya & Onele, 2018; Samah et al., 2022; Shapiro et al., 2017; Ulfatin et al., 2022; Wu et al., 2010; Y. T. C. Yang, 2015; Zaikov et al., 2021). This factor, along with recent advances in technology, has a significant impact on the pace that the community's economy is expanding. In order to address all of these needs, TVET education must be standardized to reflect the demands of modern work environments and must align with the Sustainable Development Goals.

There is a relationship between quality learning approaches and student involvement in the TVET system, according to various studies based on a review of 22 articles. Based on the results of the study in Table 4, 14 articles that highlight studies related to technology integration approaches with various disciplines, various disciplines that show a positive impact, and this strategy can be adopted by teachers to diversify teaching methods and learning in the classroom. Technology integration plays an important role in attracting student participation.

Table 4:
Impact of learning based on technology integration in TVET education

Author's	A	E	AC	AF	SS	ES	F
Zaikov et. al. (2021)		√					
Laily, Amirah & Kamrul (2022)			√				
Azid et. al. (2023).		√			√		
Badawi, S. & Dragoicea, M. (2023)			√				√
Pai-Lu Wu et. al. (2010)				√			
Shapiro et. al. (2017)		√	√	√			
Muchlas et. al. (2023)			√		√		
Maksum, Yuvenda, & Purwanto (2020)			√	√	√		
Yang (2015)					√		
Hochmuth et. al. (2022)			√				
Nurul et. al. (2023)			√	√			
Ogbuanya & Nonele (2018)		√	√				√

Divayana, Suyasa & Widiartini (2021)			√				
Almeida & Moldovan (2014)					√		
A = Awareness of SDG's E = Enrolment AC = Academic improvement / competency			AF = Affective SS = Soft Skill E = Employability F = Flexibility				

According to data on employment and labour statistics for 2023, Malaysia's current skilled worker percentage is 28.9% (Department of Statistics Malaysia, 2022). According to data from the 2021 Global Human Resource Development Index, Switzerland, Norway, Australia, Austria, Denmark, Sweden, Germany, the Netherlands, and Finland rank among the top energy resource developing nations. More in-depth look, these nations have a solid reputation in the TVET system and that many other nations have adopted their learning strategies. The TVET system, which is designed to support both a dual system and apprenticeship, is synonymous with the work-based learning method. Table 5 shows the impact of this approach based on the results of the study of 11 articles that have been critically analysed.

Table 5:
The impact of the work-based learning approach in TVET education

Artikel	A	E	AC	P	SS	ES	F
Schmid et al., 2021		√	√				
Okolie et al., 2021			√	√		√	
Pilz et al., 2018							√
Gilan et al., 2012			√		√		
Jiang & Dong, 2022		√	√				
Lyu et al., 2016			√		√		
Quesada et al., 2020			√				
Fesol et al., 2016			√				
A = Awareness of SDG's E = Enrolment AC = Academic improvement / competency			AF = Affective SS = Soft Skill E = Employability F = Flexibility				

The problem-based learning method (PBL) is another formal learning strategy that has an advantage, particularly in the TVET system. PBL is one of the strategies that emphasizes student success and increases student marketability, according to research and selected publications (Okolie et al., 2021) simultaneously one of the methods that may enhance the interest of students in the TVET system and participation percentages.

Discussion

The influence of the various learning methodologies used in the 22 articles that made up this part demonstrate how students' interest in TVET is raised and drawn to countries with the finest TVET practices. The foundation for the growth of human resources and the advancement of the involved nation as a significant force in creating skilled workers at the rate of global industry is equal participation and access chances in this TVET education

platform. The participation of urban and rural students must be balanced in order to improve the economic situation and afterwards aid in growing the employment of skilled labour in order to accomplish the fifth Sustainable Development Goal.

The Impact of the Diversity of Technology Approaches in the TVET System

The rise of digital technology, according to UNESCO and the ILO, has presented challenges and issues for the TVET system itself in terms of developing skills and human capital. TVET education has made use of technology as a driver of digital innovation in reforms to teaching techniques, assessment, and certification among other areas (Charles et al., 2022). According to the results of most studies, digital gamification approaches to learning are increasingly being used in TVET education where they have been proven to have a good impact on motivation. This gamification strategy has an advantageous impact, particularly in increasing interest in learning and improving learning outcomes (Dahalan et al., 2023; Díaz-Ramírez, 2020; Esichaikul et al., 2019; Legaki et al., 2020; Pathak et al., 2021; Samah et al., 2022b), deepening understanding from the viewpoint of the student's thinking (Legaki et al., 2021), individual satisfaction (Wirani et al., 2021) and enhance the teaching and learning process (Cechella et al., 2021) because ICT and digital technology are an integral component of the entire teaching and learning process (Esichaikul et al., 2019) have a positive impact on student learning outcomes when compared to traditional learning.

Findings from systematic literature review (Dahalan et al., 2023) has been put into practice, and the outcomes of the 17 publications chosen that address gamification show that, in overall, this method of learning has a positive impact on academic achievement, enhancing student engagement and motivation. Reported by (Sung, 2018) Technology has a major effect on student enrolments, as evidenced by the integration of technology into the TVET learning method. Singapore, South Korea, and Australia have seen an increase in TVET enrolments, and these countries offer a model of best practice for ICT integration techniques including virtual online learning and simulation, e-portfolios, and flipped classrooms (Thang et al., 2018). Table 6 refers to evidence to support the impact of technology integration on student enrolments from an international perspective.

Table 6:

The impact of a technology-based approach on student enrolments

Author's	Findings
Australian Council for Educational Research, 2019	The TVET system's use of technology has enhanced learning outcomes and raised student engagement. The study's results also highlight students' propensity to enrol in TVET programs that provide access to digital learning resources and opportunities for using technology in hands-on training.
European Commission, 2020	The enrolment of students benefits from the digitization of TVET through technology integration. According to the report, access to digital tools and resources is a strong motivator for student involvement in the TVET system, particularly for those looking to develop knowledge and skills for the workforce.
Commonwealth of Australia, 2018	Technology integration in TVET increases self-esteem and makes education more accessible in a number of areas. Findings indicate that learners are more probable to enrol in TVET programs because of the availability of online programs and the wide range of digital technologies that can improve each student's learning experience.

UNESCO, 2017	Technology's integration into the TVET system has improved the TVET program's appeal and had a favourable effect on student enrolments. The integration of learning through online platforms and digital tools has made education more flexible and accessible.
(Paryono, 2017)	The integration of technology can enhance TVET programs' quality while encouraging sustainable development. Research on the appeal of digital tools and resources for students in narrowing the competency gap between education and the workplace was highlighted in this report.

According to the findings of the analysis from the study findings in Table 6, the incorporation of technology in the TVET program has had a favourable impact on student enrolments and makes education more accessible, flexible, and relevant.

The Impact of Work-Based Approach

Work-based learning is a combination of classroom learning with industry experience. This approach consists of apprenticeships, industrial training and industrial linkage programs. The dual system in Switzerland is one of the best models of TVET education in the development of human capital. The employment-based approach practiced is similar to the practice in Germany, Austria, Denmark and Norway where student participation in TVET upper secondary education ranges from 30 to 70 percent. Among the strengths of the Swiss TVET system is the participation of up to 70 percent of young people in TVET education is one of the reasons why the number of skilled workers in this country is very high and it is one of the factors driving the industrial-based economy in this country. (The National Centre on Education and the Economy, 2015).

A work-based approach benefits students in terms of their academic performance, emotions, marketability, and enrolment. The data in Table 7 demonstrates how this strategy has affected students' involvement in TVET. The Human Resource Development Index for 2021 lists Switzerland, Norway, Denmark, Sweden, Australia, and Germany as the top countries for developing human resources. Work Based Learning (WBL) program are more likely to finish their education and go on to pursue a career than those based on the TVET system, which emphasizes traditional classroom learning (Paryono, 2017a; Diem, A. et.al., 2021; Hoffmann, Mohnen, & Wolter, 2019; Swiss Federal Office for Professional Education and Technology, 2020; Skule, Høst & Kårstein, 2019) encourage pupils to pursue further education and training (Paryono, 2017b; Yndestad & Kvalsvik, 2018; EVA, 2016; Swedish National Agency for Education, 2017; National Centre for Vocational Education Research (NCVER), 2018; German Federal Institute for Vocational Education and Training (BIBB), 2020) and develop students' soft skills (Paryono, 2017c; Norwegian Ministry of Education and Research, 2020).

Impact of Work-Based Approaches and Technology Integration Combined

A work-based approach to technology integration has been the subject of numerous research. It uses interactive tools, courses delivered online, and simulations to improve learning (Dunn & Wallace, 2017). Gamification is one component of a technology-based strategy that can be used in connection with a job-based strategy. In work-based learning programs, including gamification components like leaderboards, badges, and awards can motivate and engage students more. This approach significantly improves student engagement and learning (Liao, Wang, & Chen, 2019). Some case studies regarding technology integration such as in the Swiss

apprenticeship system, e-DAP is designed as a reflective learning practice to support cross-regional apprenticeship systems (Francesca Amenduni & Alberto Cattaneo, 2021).

The development of Mobile Vocational Education (MoVE) in rural India involving multimedia video lectures and mobile learning for Automotive programs (Akshay et al., 2012) has shown very positive findings through this approach. This method has made TVET training more accessible to rural people in India and increased the accessibility of vocational training. Communities of Practice (CoP) developed by the Box Hill Learning Network in Australia (Renwick, 2001) aim to develop community practice, online job-based training and develop learning strategies that give a positive impact. The technology-based learning approach (TEL) is one of the important components in TVET education to improve the quality of learning in today's digitization era. TVET education in Australia, Singapore and South Korea are among the examples of Asia Pacific countries that emphasize the integration of this technology. Australia and Singapore practice blended learning where a combination of classroom and online learning in accessing learning materials and reference materials interactively online. Simulator and virtual learning are also implemented in an effort to improve student skills without having to face-to-face and mobile learning is among the initiatives in the learning approach for the integration of Singapore's TVET educational technology. (Australia TVET, 2009; Kozma et al., 2011).

South Korea practices Smart Learning Environment where a combination of classroom and online learning in accessing learning materials and reference materials interactively online. As in Singapore, simulator and virtual learning is implemented in an effort to improve students' skills without having to face-to-face, including mobile learning (Mobile Learning). In addition, online learning platforms such as K-MOOC (Korea Massive Open Online Course) provide an interactive learning space that can be accessed anywhere with internet coverage. (Jeong, 2020; Joon Hwang et al., 2010).

Limitations of the Study

This systematic literature review was conducted based on high quality articles from Scopus, Web of Science and Science Direct journals. Searching for high-quality article journals from journals such as Google Scholar, Taylor & Francis and PubMed are among the journals that have a high reputation in terms of peer reviewed processes, impact factors and indexed journals can also be considered as authentic reference sources. In addition, learning strategies in TVET education must be in line with the Sustainable Development Goals in student learning outcomes. In addition to focusing on learning strategies in balancing student participation, it is also necessary to emphasize the equality of participation for rural and rural students who have ethnic and cultural diversity. These factors need to be considered to enrich the study for students from ethnic diversity from localities in Malaysia that are indeed the cause of limited access to quality TVET education.

Conclusion

The main purpose of this research is to systematically review the impact and adaptation of TVET education learning strategies in increasing the participation of urban and rural students to reduce the inequality of access in TVET education. The study offers several significant contributions for practical purposes and the body of knowledge. From the review, interested parties including policymakers, the general public, researchers, and practitioners in education can develop both short-term and long-term adaptation strategies for the students. The result offers some basics on how to integrate global education knowledge with scientific findings in

adapting appropriate learning strategies in increasing the participation of urban and rural students to reduce the inequality of access in TVET education. Furthermore, the results inform the researchers on the specific learning strategies related to TVET education globally adapted. The review concluded that job-based learning dominates TVET education, and technology integration has a significant impact on current trends in industry demand. Job-based learning is a vital component of TVET education that aligns education with the demands of the job market, enhances the employability of students, and empowers them to confidently pursue their career goals. It's a dynamic and effective approach to TVET education that has many advantages for society, employer, and students. The integration of technology in the existing TVET education needs to be considered to increase the participation of urban students as well as the access of rural and rural students as well as improve the development of human resources in achieving the SDGs. The incorporation of technology in the TVET program has had a favourable impact on student enrolments and makes education more accessible, flexible, and relevant. Moreover, the government assistance is vital to the successful adaptation of learning strategies in TVET education. By providing financial support, facilitating partnerships, and ensuring the quality and accessibility of TVET programs, governments can contribute to a well-rounded and effective TVET system that meets the needs of industries and empowers individuals to build successful careers also increase the student's participation in TVET education.

The researcher would like to provide some recommendations as a result of the literature findings and supporting data. A qualitative study needs to be conducted to evaluate the effectiveness of learning strategies among TVET graduates, especially from rural and rural areas, in order to delve deeper into students' perceptions of learning strategies that have a high impact, can increase motivation and thus increase student participation. This is to investigate the extent to which their TVET education had an impact on them when they were enrolled in the TVET system and to determine which learning methods were more successful based on their post-graduation learning experiences. In addition, more focused interviews are needed to obtain the views of rural students regarding access to TVET education in Malaysia and what efforts can be made to increase and balance the participation of urban and rural students.

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