INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN PROGRESSIVE EDUCATION & DEVELOPMENT

OPEN ACCESS JOURNAL

Vol 14, Issue 4, (2025) E-ISSN: 2226-6348

An Integrated Framework for Advanced TVET in Higher Education: Aligning Curriculum with the Digital Economy through Competency-Based Design

Muhammad Danial Ikram Bin Rosdi, Mohd Fahmi Bin Adnan*

Department of Advanced Technical and Vocational Education and Training Faculty of Educational Sciences and Technology, Universiti Teknologi Malaysia, 81310 Johor Bahru, Malaysia

*Email: mohdfahmi.adnan@utm.my

DOI Link: http://dx.doi.org/10.6007/IJARPED/v14-i4/27066

Published Online: 25 November 2025

Abstract

The accelerating demands of the digital economy and Industry Revolution 4.0 (IR 4.0) necessitate the transformation of higher education curricula, particularly in the domain of Technical and Vocational Education and Training (TVET). Despite TVET's strategic importance in workforce development, its integration into higher education remains fragmented, with limited emphasis on advanced competencies aligned with current industry needs. This study aims to develop a curriculum framework that empowers advanced TVET integration in higher education through a Competency-Based Training (CBT) approach. Employing a qualitative case study design, data were collected from academic staff at Universiti Teknologi Malaysia (UTM) through semi-structured interviews and institutional document analysis. The study was guided by Tyler's curriculum development model and CBT principles to ensure alignment between learning objectives, learning experiences, teaching strategies and learning assessment. The findings reveal the presence of key advanced TVET elements such as digital tools, project-based learning, and holistic assessments but highlight systemic inconsistencies in their application across programmes. In response, this study proposes a structured, integrated curriculum framework that systematically bridges educational practices with the evolving needs of the digital economy. This framework provides strategic guidance for higher education institutions to enhance curriculum relevance, strengthen digital and professional competencies, and improve graduate readiness for innovation-driven employment landscapes.

Keywords: Advanced TVET, Curriculum Framework, Digital Economy, Higher Education, Competency-Based Training (CBT)

Introduction

The global economic landscape is undergoing a profound transformation, driven by the twin forces of the digital economy and the Industrial Revolution 4.0 (IR 4.0). This paradigm shift is fundamentally reshaping labour markets, creating new occupational profiles while

rendering others obsolete and demanding a new suite of complex, interdisciplinary competencies from the workforce (Schwab & Samans, 2016). Higher education institutions (HEIs) are at the forefront of this challenge, tasked with preparing graduates who can not only navigate but also lead in this dynamic environment. Within this context, Technical and Vocational Education and Training (TVET) has emerged as a critical strategic instrument for national development (UNESCO, 2016).

However, a significant and persistent problem exists: the integration of TVET into higher education is often fragmented, inconsistent and misaligned with the sophisticated demands of modern industries (Naziz, 2019). While there is a growing effort to incorporate TVET elements into university curricula, there remains a lack of clarity and cohesion in how these elements are systematically integrated. Key aspects of curriculum design including learning objectives, teaching strategies, learning experiences and assessment methods are frequently addressed in isolation rather than through a unified, evidence-based framework. This fragmentation hinders the development of a comprehensive educational approach that aligns institutional goals with industry demands and student aspirations.

The result is a persistent skills mismatch, where graduates may possess technical knowledge but lack the critical thinking, adaptability and digital fluency required to thrive (Rahman & Samad, 2021). This issue is exacerbated by the neglect of critical competencies such as communication and collaboration in favour of purely technical expertise, limiting the holistic development of students. Furthermore, while digital pedagogies have proven effective, their implementation is often hampered by gaps in technological access and the digital literacy of educators themselves. This creates a disconnect between theoretical knowledge and industry needs, leaving students underprepared for the dynamics of the modern workplace (Molele et al., 2024).

This paper addresses the critical need for a more systematic approach to TVET integration in higher education. Its primary objective is to develop and propose an integrated curriculum framework, grounded in empirical data from a case study at Universiti Teknologi Malaysia (UTM). To achieve this, the study is guided by the following research questions:

1. What advanced TVET elements are integrated into the higher education curriculum concerning the development of learning objectives?
2. What advanced TVET elements are integrated into the curriculum concerning learning experiences?
3. What advanced TVET elements are integrated into the curriculum concerning teaching strategies?
4. What advanced TVET elements are integrated into the curriculum concerning learning assessment methods?
5. How can a framework be developed to systematically integrate these advanced TVET elements into the higher education curriculum?

By analyzing the current state of TVET integration and identifying both strengths and systemic weaknesses, this study offers a tangible, actionable framework designed to guide HEIs in effectively embedding advanced TVET elements into their curricula.

Methodology

This study employed a qualitative case study design to conduct an in-depth exploration of the integration of advanced TVET elements into the higher education curriculum (Creswell, 2014). This approach was selected for its strength in investigating complex, real-world phenomena within their natural context, allowing for a rich, nuanced understanding (Yin, 2014). The research was conducted at Universiti Teknologi Malaysia (UTM), a premier public research university in Malaysia with a strong focus on engineering, science and technology.

The study's participants were selected using purposive sampling, comprising 6 to 10 key academic stakeholders at UTM, including curriculum developers, program coordinators and senior lecturers with a minimum of five years of experience in the TVET field (Palinkas et al., 2015). Data were collected using two primary qualitative methods: semi-structured interviews and document analysis (Bowen, 2009). The data were then analyzed using Braun and Clarke's (2006) six-step thematic analysis approach to identify, analyze and report patterns within the data. Ethical considerations were paramount, with informed consent obtained from all participants, anonymity protected and data stored securely.

Results and Analysis

The thematic analysis of data from Universiti Teknologi Malaysia (UTM) reveals a multifaceted landscape of advanced TVET integration. Structured around the four pillars of Tyler's model: Learning Objectives, Learning Experiences, Teaching Strategies and Learning Assessment. The findings directly address the research questions by identifying the specific advanced TVET elements embedded within the curriculum, highlighting both strategic advancements and persistent challenges in systemic implementation

Table 1
Thematic Map for Learning Objectives

	Main Theme	Sub-Theme	Key Elements
Learning Objectives	Alignment of Curriculum Objectives with Future Needs and National Aspirations	Alignment to National Aspirations and Policies	• Alignment with MQF Objectives Levels 7 & 8 • Referencing National and Global Policies • Curriculum Implementation Driven by Job Market
		Supporting Student Development Based on Industry Needs	• Connection with Current and Future Industry • Minimum Attributes for Advanced Element • Advanced Knowledge within Specific Domains.
	Innovative and Holistic Approach in Formulating Learning Objectives	Student-Centered Approach and Lifelong Learning	• Combining Student-Centered Objectives • Integration of Knowledge-Skills-Attitudes (KSA) • Achievement of Objectives through A+ Learning Development

		Technology-Driven and Flexible Curriculum Design	• Integration of Emerging Technologies • Technology-Based Curriculum • Flexible Curriculum Design

A key finding is the deliberate alignment of objectives with the highest levels of the Malaysian Qualifications Framework (MQF), specifically Levels 7 (Master's) and 8 (Doctorate), to foster advanced intellectual capabilities. As one respondent stated, *"...the standard for the objective must reflect the standard of a Master's and PhD..."*. This alignment necessitates the integration of High-Order Thinking Skills (HOTS) and is guided by national policies such as the *"Dasar TVET Negara* and the imperatives of IR 4.0".

The curriculum is also designed to be directly responsive to industry needs. One participant emphasized, *"...if the industry needs that thing, that is what must be in the curriculum..."*. This is reflected in the integration of emerging technologies like Electric Vehicles (EV) and Augmented Reality (AR) into specific domains. Furthermore, a holistic philosophy is embedded through the systematic integration of Knowledge, Skills and Attitudes (KSA), ensuring graduates are not only technically proficient but also possess a professional mindset. As another respondent explained, *"...the student must have skill, must have knowledge and also attitude..."*. This comprehensive approach ensures that learning objectives are forward-looking, industry-relevant and foster well-rounded professional development.

Advanced TVET Elements in Learning Experiences

The analysis of learning experiences, summarized in the thematic map in Table 2, revealed two primary themes: Authentic Learning Experiences Based on the Real World and Project-Based Learning and Market Innovation.

Table 2
Thematic Map for Learning Experiences

	Main Theme	Sub-Theme	Key Elements
Learning Experiences	Authentic Learning Experience Based on the Real World	Direct Collaboration with Industry	• Real Industrial Collaboration Experience • Real Industrial Exposure through Collaboration • Industry-Based Learning Experience
		Technology Simulation and Real-World Replication	• Simulation & VR for Resource Efficiency • Digital Replication of Practical Experience • Experience-Based Learning through Digital Modeling
	Project-Based and Market Innovation Learning	Innovation and Product Design Based on Research	• Innovation Experience through Research Development • Innovation Experience through Product Development • Project Design Based on Research Approach
		User Perspective and Market Adaptation	• Market-Oriented Thinking and User Perspective • Market-Oriented and Practical Experience

The curriculum prioritizes authentic, immersive experiences that bridge the gap between academic theory and real-world practice. The cornerstone of this approach is direct industry collaboration, where students engage in genuine projects that address real industrial challenges. The impact of this is profound, as one faculty member observed, *"...when they go to the industry, they bring back real experience... that has a big impact on their learning and we ourselves see that the output from the student is much better..."*.

Recognizing that direct industry placement is not always feasible, the curriculum strategically employs technology to create high-fidelity, pseudo-authentic experiences. The use of Virtual Reality (VR) and digital simulations serves as a pragmatic solution to democratize access to immersive learning. One respondent explained, *"...we use VR and simulation for labs because not all students can use the same machine at one time. So with VR, we can rotate usage and save time and cost..."*. Finally, learning experiences are designed with a market-oriented and user-centric focus, encouraging students to conduct needs analysis and develop solutions that are not only technically sound but also relevant and valuable in a real-world context

Advanced TVET Elements in Teaching Strategies
The findings on teaching strategies, as detailed in the thematic map in Table 3, are organized under two themes: Practical and Collaborative Learning Strategies and Educator Empowerment and Pedagogical Transformation.

Table 3
Thematic Map for Teaching Strategies

	Main Theme	Sub-Theme	Key Elements
Teaching Strategies	Practical and Collaborative Learning Strategies	Implementation of Project-Based Learning (PBL)	• Project-Based Learning • Project-Based Learning for Product Output • Implementation of PBL with Mastery
		Industry Involvement in Learning Design	• Industry Collaboration for Specialized Courses • Theoretical Foundation with High Practical Emphasis
	Empowering Educators and Pedagogical Transformation	Strengthening Lecturer Professionalism	• Capacity Building for Lecturers to Master Content • Enhancing Skills and Training for All Educators
		Pedagogical Innovation through Technology	• Flexible Pedagogical Approaches • Use of AI Tools and Internet Tools

The delivery of advanced TVET content necessitates pedagogical strategies that are agile, hands-on and focused on competency mastery. Project-Based Learning (PBL) is universally acknowledged as the most effective approach, with one respondent stating simply, *"...TVET... is actually project-based... that is actually the best..."*. This hands-on philosophy is reflected in the curriculum's structure, which mandates a high proportion of practical work, often between 50% and 70% of course time, ensuring theory is consistently grounded in application.

However, the successful implementation of this advanced curriculum reveals a critical challenge: the gap between the rapid evolution of industry technologies and the slower process of faculty development. As one participant noted, *"...The instructor... must always upgrade, upskill and reskill their knowledge..."*. The study found that while training initiatives on new technologies like AI and drones exist, they often lack long-term sustainability *"…it wasn't sustainable yet…"*. This highlights that the success of the advanced TVET model hinges on institutionalizing a robust and continuous program for faculty development to ensure effective delivery of the curriculum.

Advanced TVET Elements in Learning Assessment
The analysis of learning assessment methods, illustrated in the thematic map in Table 4, revealed two key themes: Authentic Assessment Based on Competency and Outcomes and Inclusive and Real-World Oriented Assessment.

The findings show a clear shift away from traditional examinations towards methods that evaluate a student's ability to apply knowledge in complex, real-world scenarios. A key innovation is the use of a triangulated assessment approach, which evaluates students from

multiple perspectives. As described by a respondent, *"...this assessment... is oral... written and tangible..."*. This holistic approach is further strengthened by the direct involvement of industry experts in the assessment process, with one participant stating, *"...we must involve industry as a panel to evaluate the project..."*.

Table 4
Thematic Map for Learning Assessment

	Main Theme	Sub-Theme	Key Elements
Learning Assessment	Authentic Assessment Based on Competency and Outcomes	Assessment of Real Output and Projects	• Project/Outcome-Based Assessment • Portfolio and Project Assessment Based on ROI • Formative Assessment of Products and Explanations
		Assessment of Competency and Field Relevance	• Competency-Based Assessment • Specific Field Linkages in Assessment • Industry Involvement in Assessment Panels
	Inclusive and Real-World Oriented Assessment	Multiple Methods and Synthesis Approach	• Triangulated Assessment (Oral, Written, Product) • Critical Thinking and Data Synthesis Assessment • Real-Life Application within the DECKER Framework
		Alternative Assessment and Design Challenges	• No Standard Assessment for Advanced Elements • Challenges in Designing and Using Rubrics • Alternative Assessment through Problem-Solving

However, this push for authenticity introduces a significant challenge: the difficulty of standardizing the assessment of advanced, often intangible, competencies like creativity and innovation. This was a point of concern for educators, with one stating honestly, *"...there is nothing... to measure advanced TVET..."*. This reveals a critical need for the development of flexible yet structured rubrics that can guide the evaluation of complex skills consistently, ensuring the assessment process is both relevant to industry and academically rigorous.

The Proposed Integrated Framework for Advanced TVET

Synthesizing the thematic findings, this research proposes an integrated framework designed to guide HEIs in systematically embedding advanced TVET elements into their curricula. This framework moves beyond a fragmented list of best practices to offer a coherent, interconnected model where each component reinforces the others. It is structured around the four pillars of Tyler's model, infused with the principles of CBT. The overall structure of this model is visualized in Figure 1, while its components and implementation examples are detailed in Table 5.

- Pillar 1: Strategic Learning Objectives: This foundational pillar emphasizes the need for learning objectives that are strategically aligned with high-level national standards (e.g., MQF Levels 7 & 8), responsive to national policies and forward-looking in their integration of industry-relevant technologies and competencies. The objectives must be holistic, encompassing the KSA (Knowledge, Skills, Attitudes) model.
- Pillar 2: Authentic Learning Experiences: This pillar focuses on creating an immersive learning environment that mirrors the complexities of the modern workplace. It advocates for a blended model that combines direct industry collaboration on real-world projects with the scalability and safety of technology-enabled learning, such as VR and digital simulations.
- Pillar 3: Agile Teaching Strategies: This pillar centers on pedagogical approaches that are flexible, student-centered and competency-focused. Project-Based Learning (PBL) with tangible outputs is the core strategy. Crucially, this pillar includes a mandatory and continuous faculty development program as an integral component.
- Pillar 4: Holistic Assessment Methods: This final pillar calls for a shift towards reliable and relevant assessment practices. It promotes a triangulated, competency-based approach that involves industry panels to ensure external validity. A key innovation is the explicit requirement to develop flexible, yet structured rubrics designed to assess advanced skills like innovation and complex problem-solving.

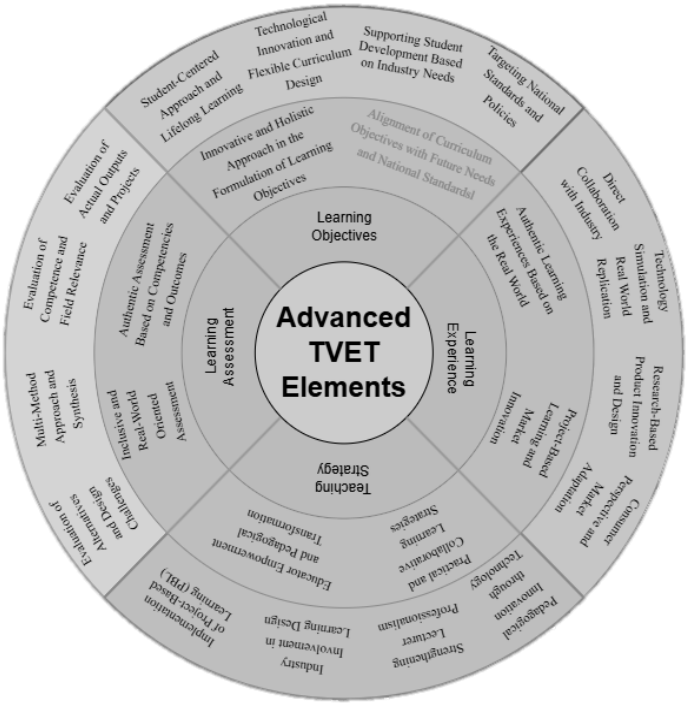

Figure 1: Proposed Framework for

Advanced TVET Elements

Table 5

The Integrated Framework for Advanced TVET Curriculum

Curriculum Component	Core Principle	Key Advanced Elements	Implementation Examples
Learning Objectives	Strategic Alignment & Holism	MQF 7/8 standards, IR 4.0 tech (AI, EV), KSA integration, student-centeredness.	Develop PLOs using higher-order verbs; co-create objectives with an Industry Advisory Board.
Learning Experiences	Authenticity & Immersion	Real industry collaboration, VR/simulation, market-oriented design, digital modeling.	Capstone projects solving real company problems; virtual labs for high-risk procedures.
Teaching Strategies	Agility & Competency-Focus	Project-Based Learning (PBL), high practical ratio, flexible pedagogy, continuous faculty development.	Implement multi-phase PBL with tangible outputs; mandatory annual industry immersion for faculty.
Learning Assessment	Reliability & Relevance	Triangulated methods (oral, written, product), competency-based rubrics, industry panel evaluation, ROI analysis.	Use DECKER framework for presentations; co-develop flexible rubrics with industry partners to assess innovation.

Discussion

The findings of this study indicate that the challenges in integrating advanced TVET are not the result of isolated shortcomings but are symptoms of a systemic misalignment between vocational and higher education systems. This "pedagogical dissonance", where a practical, "how-to-do" educational philosophy meets a theoretical, "how-to-think" one, creates predictable barriers for transitioning students (Postareff & Lindblom-Ylänne, 2008). The university environment, with its emphasis on theoretical knowledge and self-directed learning, is not inherently structured to accommodate the learning styles of students from a practice-oriented TVET pathway. This creates a significant "equity gap" where these students, despite their valuable technical skills, are placed at a structural disadvantage (Merriam & Baumgartner, 2020). The study confirms that while many advanced elements are present at UTM, their effectiveness is hampered by a lack of systemic cohesion a challenge this integrated framework is designed to overcome.

The acute struggle with technology-intensive subjects is a clear manifestation of the well documented "theory-practice gap" (Van der Westhuizen & Mpanza, 2024). This gap has tangible consequences on student performance and well-being, as evidenced by data on stress and academic performance, which are known predictors of student persistence (Hagedorn, 2012). Furthermore, the tension between an advanced curriculum and the need for continuous faculty development highlights a potential systemic failure point (Yin et al., 2024). An advanced curriculum on paper cannot be effectively delivered if educators are not continuously upskilled to keep pace with technological change (Darling-Hammond et al., 2017). The proposed framework addresses these issues by emphasizing the interconnectedness of all curriculum components, arguing that a change in one area such as adopting new technology requires corresponding adjustments in teaching strategies, faculty training and assessment methods.

Conclusion

This study provides clear empirical evidence of the multifaceted nature of integrating advanced TVET into higher education. The core issues identified stem from a deep-seated pedagogical disconnect, a resulting gap in systemic support and the challenge of keeping pace with rapid technological change. The proposed integrated framework offers a systematic, evidence-based solution by demonstrating the critical interconnectedness of curriculum objectives, experiences, strategies and assessments.

Based on these findings, this paper puts forth the following recommendations for higher education institutions, policymakers and vocational colleges:

1. Develop National Guidelines for Flexible Rubrics: To address the challenge of assessing advanced competencies, national bodies and HEIs should collaborate to develop standardized yet flexible rubrics that can guide the evaluation of skills like innovation, creativity and complex problem-solving (Boud & Falchikov, 2006).
2. Institutionalize Faculty-Industry Immersion Programs: Universities should establish formal, mandatory programs that require TVET faculty to spend time in industry settings regularly. This will ensure they remain current with technological advancements and workplace practices, directly enriching their teaching (Van der Bijl & Taylor, 2018).
3. Promote Curricular Agility through Policy: Institutional policies should be revised to allow for more rapid and flexible curriculum updates, moving away from rigid five-year review cycles to a model of continuous, iterative improvement responsive to industry feedback (Rosnan & Ahmad, 2024).
4. Invest in a Shared Digital Infrastructure: Policymakers and institutions should invest in shared digital platforms for VR/simulation and other immersive learning tools to ensure equitable access for all students and reduce the financial burden on individual faculties (Leong, 2024).

Limitations and Future Research

This study's findings are based on a single case study at a technology-focused university in Malaysia. While this provides depth and context, the generalizability of the framework to other types of institutions should be approached with caution. Future research should therefore focus on testing and validating the proposed framework's adaptability across a diverse range of HEIs and TVET fields. Longitudinal studies are needed to track the long-term impact of implementing this framework on key metrics such as graduate employability, innovation output and employer satisfaction. Furthermore, there is significant scope to expand the framework to explicitly incorporate cross-cutting themes critical to the 21st century, including sustainability, green skills and inclusivity (Ibrahim et al., 2024).

References

Amin, S., Suhaimi, S., & Nazuri, N. (2023). The present and future of Malaysian Technical and Vocational Education and Training (TVET). *International Journal of Academic Research in Business and Social Sciences, 13*(18). https://doi.org/10.6007/ijarbss/v13-i18/19952

Ansah, S., & Ernest, K. (2013). Technical and vocational education and training in Ghana: A tool for skill acquisition and industrial development. *Journal of Education and Practice, 4*(17), 172-180.

Baharuddin, S., Ibrahim, N., Iqbal, M., & Z. (2025). TVET education for community education 5.0 in Malaysia. *Semarak International Journal of Innovation in Learning and Education, 4*(1), 27-41. https://doi.org/10.37934/sijile.4.1.2741

Boud, D., & Falchikov, N. (2006). Aligning assessment with long-term learning. *Assessment & Evaluation in Higher Education, 31*(4), 399–413.

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal, 9*(2), 27-40.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101.

Chen, X., & Chan, S. (2024). Implementing digital pedagogy in TVET: A connectivist perspective. *Vocation, Technology & Education, 3*(1), 595. https://doi.org/10.54844/vte.2024.0595

Creswell, J. W. (2014). *Research design: Qualitative, quantitative and mixed methods approaches* (4th ed.). Sage Publications.

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development*. Learning Policy Institute.

Hagedorn, L. S. (2012). *Student success, retention and graduation: Definitions, theories, practices, patterns and trends*. Stetson University College of Law.

Hlebowitsh, P. S. (2021). Ralph Tyler, the Tyler Rationale and the idea of educational evaluation. In *Oxford Research Encyclopedia of Education*. Oxford University Press. https://doi.org/10.1093/acrefore/9780190264093.013.1036

Husin, N., Sedek, M., Sui, L., Hussein, N., & Tab, F. (2024). Decompartmentalization of TVET curriculum: Cross-curricular integration in final year projects to address the language needs in TVET programs. *International Journal of Academic Research in Business and Social Sciences, 14*(10). https://doi.org/10.6007/ijarbss/v14-i10/23108

Ibrahim, N., Rahim, Z., & Iqbal, M. (2024). Exploring generic green skills in enhancing TVET curriculum in Malaysia. *International Journal of Academic Research in Business and Social Sciences, 14*(10). https://doi.org/10.6007/ijarbss/v14-i10/23144

Jaedun, A., Omar, M. K., Kartowagiran, B., & Istiyono, E. (2020). A precedence evaluation of demand and supply between vocational high school graduates and workforce requirement in Indonesia. *Jurnal Penelitian Dan Evaluasi Pendidikan, 24*(1), 27–38. https://doi.org/10.21831/pep.v24i1.29580

Jayaprakash, S. (2024). Greening TVET for sustainable development: A path to a more sustainable future. *International Journal of Academic Research in Progressive Education and Development, 13*(1). https://doi.org/10.6007/ijarped/v13-i1/20877

Leong, W. S. (2024). Enhancing practical skills training through virtual reality in TVET education. *2024 International Conference on TVET Excellence & Development (ICTeD)*, 289-293.((https://doi.org/10.1109/ICTeD62334.2024.10844618))

Merriam, S. B., & Baumgartner, L. M. (2020). *Learning in adulthood: A comprehensive guide* (4th ed.). Jossey-Bass.

Molele, K., Scholtz, S., & Carolissen, A. (2024). Work-integrated learning for lecturers at a TVET college in the Western Cape. *South African Journal of Higher Education*.

Naziz, A. (2019). Collaboration for transition between TVET and university: A proposal. *Higher Education, Skills and Work-Based Learning, 10*(1), 186-197.

Okolie, U. C., Elom, E. N., Igwe, P. A., Binuomote, M. O., Nwajiuba, C. A., & Igu, N. C. (2020). Improving graduate outcomes: A case of a Nigerian private university. *Higher Education, Skills and Work-Based Learning, 10*(2), 355-370. https://doi.org/10.1108/heswbl-12-2018-0140

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research, 42*(5), 533–544.

Postareff, L., & Lindblom-Ylänne, S. (2008). Dissonance in experience of teaching and its relation to the quality of student learning. *Studies in Higher Education, 33*(2), 139–154.

Rahman, A., & Samad, A. (2021). Challenges of TVET graduates in Malaysian higher education. *Journal of Technical Education and Training, 13*(1), 45-58.

Redecker, C. (2017). *European framework for the digital competence of educators: DigCompEdu*. Publications Office of the European Union.

Rosnan, H., & Ahmad, M. (2024). Overcoming challenges in Malaysia's technical and vocational education: A path forward for TVET. *International Journal of Research and Innovation in Social Science, 8*(3), 370-379. https://doi.org/10.47772/ijriss.2024.803370s

Schwab, K., & Samans, R. (2016). *The future of jobs: Employment, skills and workforce strategy for the Fourth Industrial Revolution*. World Economic Forum.

Seman, N., & Sulaiman, S. (2024). Enhancing TVET education in Malaysia via HETVET @UiTM framework. *2024 IEEE 13th International Conference on Engineering Education (ICEED)*, 1-6.((https://doi.org/10.1109/ICEED62316.2024.10923816))

Tahir, R., & Abdullah, Z. (2024). Shaping industry 4.0 ready talent: TVET experts' strategies in content selection - NGT and ISM approach. *Evolutionary Studies in Imaginative Culture, 8*(1), 744. https://doi.org/10.70082/esiculture.vi.744

UNESCO. (2016). *Strategy for technical and vocational education and training (TVET) (2016-2021)*. UNESCO.

Van der Bijl, A., & Taylor, V. (2018). Integrating work-integrated learning in professional development qualifications for TVET lecturers.

Van der Westhuizen, C., & Mpanza, D. (2024). From vocational training to postgraduate education: Navigating the transition. *Cureus, 16*(5), e59838.

Yaakob, M. F. M., Awang, H., Ismail, M. A., Zain, F. M., Kasim, N., & Adnan, A. H. M. (2020). Backward and forward reviews on technical and vocational education and training (TVET) in Malaysia: The evolution and ICT-driven future prospect. *Universal Journal of Educational Research, 8*(6), 2213-2221. https://doi.org/10.13189/ujer.2020.080601

Yin, L., Rahman, K. A., Mamat, M. F., & Hashim, S. (2024). Beyond the classroom: Linking TVET educators' knowledge and skills for Industry 4.0 readiness. *Online Journal for TVET Practitioners, 9*(1), 3. https://doi.org/10.30880/ojtp.2024.09.01.003

Yin, R. K. (2014). *Case study research: Design and methods* (5th ed.). Sage.