

Conceptualizing Digital Teaching Competence in TVET Occupational Authenticity, Safety and Institutional Readiness in Malaysian Technical Higher Education

Mohd Hatta Md Hani^{1*}, Affero Ismail², Fikri Aulia³, Zawawi Mohamad⁴, Farez Mahmood⁵

¹Department of Information Technology, Centre of Diploma Studies, Universiti Tun Hussein Onn
Malaysia, Pagoh, Johor, Malaysia

²Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn Malaysia, Batu Pahat,
Johor, Malaysia

³Department of Educational Technology, Faculty of Education, Universitas Negeri Malang, Indonesia

⁴Non-Destructive Testing (NDT) Technology, Mechanical Department, ADTEC JTM Campus
Jerantut, Pahang, Malaysia

⁵Department of Computer Networks and Cybersecurity, Universiti Malaysia Pahang Al-Sultan
Abdullah (UMPSA), Malaysia

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ABSTRACT

Existing digital competence frameworks offer useful accounts of the capabilities educators need for technology-supported teaching. Their direct application to technical and vocational education and training (TVET), however, should not be assumed. Occupational learning requires educators to determine when a digital representation can adequately support learning, when physical performance remains indispensable, how digitally mediated activities may affect workshop safety, and whether institutional conditions allow technology to be implemented responsibly. Against this background, the paper examines the conceptual foundations underpinning MyDigCompTVET, a digital teaching competency framework developed for TVET educators in Malaysia. The empirical development of the framework is reported separately; the concern of this paper is to explain what makes digital teaching competence distinctive across classrooms, laboratories, workshops, simulations and workplaces. An integrative conceptual synthesis was undertaken using established educator-competence frameworks, complementary theoretical perspectives, selected vocational education studies and relevant Malaysian policy documents. The sources were examined through an extraction matrix that compared their principal constructs, assumptions about teaching environments, treatment of practical performance and implications for TVET. This comparison brought three recurring tensions into view: digitalization and occupational authenticity, innovation and physical safety, and individual capability and institutional readiness. Together, these tensions provide a basis for interpreting the five domains incorporated within MyDigCompTVET: Digital Knowledge; Digital Skills; Professional Development and Lifelong Learning; Digital Ethics and Readiness; and Technology Integration in TVET. The paper argues that technology integration in TVET is fundamentally an exercise of professional judgement rather than a matter of technology use alone. It also distinguishes educators' capabilities from the organizational conditions under which those capabilities are enacted, thereby avoiding the attribution of institutional limitations to individual competence. The paper's contribution lies in clarifying the conceptual reasoning underpinning MyDigCompTVET and identifying considerations relevant to its interpretation, implementation and subsequent validation within Malaysian technical higher education.

Keywords: Digital Teaching Competence; TVET Educators; Occupational Authenticity; Workshop Safety; Institutional Readiness; MyDigCompTVET

INTRODUCTION

Technical and vocational education and training (TVET) prepares learners for occupations in which digital systems increasingly influence production, maintenance, communication and technical decision-making. Developments in artificial intelligence, automation, connected equipment and data-intensive processes are not only changing the tools used at work but also reshaping the knowledge and judgment expected of graduates. The World Economic Forum (2025) anticipates substantial changes in the skills employers will require by 2030. TVET institutions must therefore respond to more than the introduction of new technologies. They must also consider how changes in occupational practice should be translated into learning activities that remain technically accurate, educationally meaningful and relevant to industry.

This concern is consistent with Malaysia's current policy direction. The Malaysia Digital Economy Blueprint connects national digital development with the cultivation of talent and institutional capability (Economic Planning Unit, 2021). Similarly, the Digital Education Policy and the National TVET Policy 2030 emphasise digital capacity, coordinated governance, and closer alignment among education, training, and economic development (Ministry of Education Malaysia, 2023; National TVET Council Secretariat, 2024). These priorities have particular significance for Malaysian technical universities, where diploma and bachelor programmes are expected to integrate disciplinary understanding, practical performance and industry-related learning outcomes. In this setting, digital transformation cannot be addressed solely by providing platforms, equipment, or connectivity. It also depends on educators' ability to decide how technology should be used within occupational teaching.

Access to technology does not, by itself, demonstrate digital teaching competence. An educator may be proficient with a learning management system but remain uncertain whether a simulation accurately represents an industrial process. Similarly, video recordings, digital portfolios or machine-generated data may provide convenient forms of assessment evidence, but their availability does not guarantee that they demonstrate the intended occupational competency. The consequences of an unsuitable decision may also extend beyond the quality of learning. In workshops and laboratories, inaccurate digital instructions, incorrect parameters, or poorly configured systems may pose physical risks to learners, educators, and equipment. Digital literacy and digital teaching competence should therefore be distinguished: the former concerns an individual's ability to use and understand digital technologies, whereas the latter involves professional judgement about their educational, occupational and ethical application.

Evidence from vocational education reinforces this distinction. Although teachers' digital competence is associated with their acceptance of technology, its enactment is also shaped by pedagogical beliefs, confidence and the conditions of the teaching environment (Antonietti et al., 2022; Cattaneo et al., 2022). More broadly, the educational value of technology depends on the relationship among educators' knowledge, instructional practice and the context in which teaching occurs (Gudmundsdottir & Hatlevik, 2018; Sailer et al., 2021). These relationships are especially important in TVET because learning outcomes frequently require observable evidence of a product, procedure or physical performance. Participation in an online activity may indicate engagement or conceptual understanding, but it cannot automatically be treated as evidence that a learner can perform an occupational task safely and competently.

Established digital competence frameworks provide a valuable basis for examining these issues. DigCompEdu connects educators' professional engagement with digital resources, teaching, assessment, learner empowerment and the development of learners' digital competence (Redecker & Punie, 2017). UNESCO's ICT Competency Framework for Teachers extends this perspective by linking educator practice with policy, curriculum, institutional organisation and professional learning (UNESCO, 2018). The ISTE Standards emphasise educator agency, collaboration and instructional design (International Society for Technology in Education [ISTE], 2017), while the technological pedagogical content knowledge framework, commonly known as TPACK, explains why technology must be considered in relation to pedagogy and disciplinary content (Mishra & Koehler, 2006). These frameworks are sufficiently broad to be applied across educational settings. That breadth is useful, but it also means that decisions concerning occupational authenticity, practical

performance, workshop safety and institutional readiness are often left implicit when the frameworks are applied to TVET.

This paper examines those decisions as part of the wider research programme through which MyDigCompTVET was developed. The empirical development of the framework through literature synthesis and interviews with Malaysian TVET and technology experts is reported in the accepted companion article, *Developing MyDigCompTVET: A Digital Teaching Competency Framework for TVET Educators in Malaysia Informed by Literature Synthesis and Expert Interviews*. The present paper addresses a related but distinct conceptual question: What makes digital teaching competence distinctive within occupational and practice-based education? It has two objectives. The first is to examine the tensions that arise between digitalisation and occupational authenticity, innovation and physical safety, and individual capability and institutional readiness. The second is to use these tensions to interpret the five domains of MyDigCompTVET within Malaysian technical higher education. Accordingly, the paper does not reproduce the interview analysis or report the subsequent Fuzzy Delphi, survey, Rasch or principal component analysis stages. Its contribution lies in explaining the conceptual reasoning needed to understand and apply MyDigCompTVET within the practical, occupational and institutional conditions of TVET.

CONCEPTUAL FOUNDATIONS

Digital competence as professional teaching practice

Digital competence continues to evolve as technologies, professional practices and expectations of participation change. Ilomäki et al. (2016) describe it as a broad construct that brings together technical ability, critical understanding, meaningful application and motivation. When considered in relation to educators, digital competence cannot be reduced to the ability to operate devices or software. It becomes part of professional teaching practice because educators use their knowledge to make decisions that affect learners. These decisions include selecting and adapting resources, organising interaction, designing learning activities, assessing evidence, managing data and supporting responsible participation. Professional digital competence is therefore expressed through purposeful educational practice rather than demonstrated solely through familiarity with technology (Gudmundsdottir & Hatlevik, 2018).

The distinction between using technology and using it competently is important. A learning activity may involve advanced technology without being pedagogically appropriate. Simulation, video, learning analytics and automated feedback can make complex processes more visible, provide opportunities for repeated practice and support timely intervention. The same technologies can also divert attention from the intended learning outcome, disadvantage learners with limited access, or generate evidence that is convenient to collect but insufficient for judging competence. The educational value of a technology consequently depends on the decisions surrounding its selection, design and use. As Sailer et al. (2021) indicate, technology should be considered alongside educators' competence and the quality of instruction, rather than treated as an independent solution to educational problems.

This professional dimension becomes more pronounced in TVET because teaching is directed towards occupational performance. TVET educators must connect conceptual understanding with procedures, tools, equipment, standards and conditions of practice. Some of this knowledge is explicit and can be represented through written explanations, diagrams or digital resources. Other aspects are tacit or embodied, such as the application of force, the sequencing of actions, the recognition of abnormal equipment behaviour, and the judgement of acceptable tolerances. These aspects may be difficult to reproduce fully through digital representation. Educators must therefore determine what can be taught or rehearsed digitally, what still requires supervised physical practice and how learning should move between the two environments.

The TPACK relationship among technology, pedagogy and content remains useful for understanding these decisions (Mishra & Koehler, 2006). In TVET, however, content knowledge needs to be interpreted more broadly than formal subject matter. It includes occupational procedures, practical judgement, industry standards, equipment limitations and safety requirements. Technology integration is pedagogically

appropriate only when these dimensions are preserved in the learning design. From this perspective, digital teaching competence in TVET is demonstrated through an educator's ability to select, adapt and sometimes limit technology in ways that support authentic, safe and assessable occupational learning.

What established frameworks contribute

Table 1 compares five conceptual resources used in this paper. The final column does not label the frameworks as deficient. It identifies matters that require explicit treatment when the framework is translated into TVET settings.

Table 1: Contributions of established frameworks and the TVET questions they leave open

Framework	Main contribution	Usefulness for TVET	Question requiring explicit treatment
DigCompEdu	Educator practices, resources, teaching, assessment and learner empowerment	Provides a broad educator competence structure	How are practical performance, industrial procedures and workshop safety represented?
UNESCO ICT-CFT	Links teaching with policy, curriculum, organisation and professional learning	Connects educator capability with system development	How do system-level expectations translate into technical teaching decisions?
ISTE Standards	Professional agency, collaboration, design, facilitation and analysis	Clarifies active educator roles	What observable occupational performance indicates each role?
TPACK	Integration of technological, pedagogical and content knowledge	Explains why tool skill alone is insufficient	How should tacit skills, equipment, standards, and physical risk factor into content knowledge?
Connectivism	Learning through changing networks of people, information and resources	Supports industry connection and continuous updating	What responsibilities govern networked learning in safety-sensitive practice?

Among the frameworks considered, DigCompEdu provides the most direct point of departure for examining educators' digital competence. Its structure connects professional engagement with the selection and creation of digital resources, teaching, assessment, learner empowerment and the development of learners' digital competence (Redecker & Punie, 2017). UNESCO's ICT Competency Framework for Teachers broadens this perspective by locating educator capability within curriculum, policy, institutional leadership and professional development (UNESCO, 2018). This system-level orientation is particularly useful where educators' practices depend on infrastructure, organisational support and coordinated institutional planning. The ISTE Standards contribute a complementary emphasis on educators as learners, collaborators, designers, facilitators and analysts, thereby drawing attention to professional agency in technology-supported education (ISTE, 2017).

These frameworks offer valuable and broadly applicable accounts of digital teaching. Their transferability is also a limitation when applied to TVET. Because they are not designed exclusively for occupational education, they do not always make explicit how educator competence should be demonstrated in workshops, laboratories, simulations or workplaces. Questions concerning practical performance, equipment use, occupational standards and physical safety may be accommodated within their existing constructs, but these matters require deliberate contextual interpretation rather than direct adoption.

TPACK and Connectivism contribute differently because neither was developed as a catalogue of educator competencies. TPACK explains the interaction among technological, pedagogical and content knowledge involved in instructional decision-making (Mishra & Koehler, 2006). Its relevance to TVET becomes clearer when content knowledge is understood to include occupational procedures, tacit skills, equipment constraints, industry standards and conditions of safe practice. From this perspective, effective technology integration depends on whether digital and pedagogical choices preserve the integrity of the occupational content being taught.

Connectivism, in turn, helps explain how educators maintain professional knowledge through changing networks of people, organisations and digital information (Siemens, 2005). This perspective is relevant to TVET because industry technologies, technical standards and workplace practices may change more quickly than formal curricula. Professional and industry networks can help educators remain current, but connections alone do not ensure reliable learning. Educators must still judge the authority, accuracy, safety and continuing relevance of knowledge obtained through those networks.

The synthesis, therefore, adopts adaptation rather than replacement as its guiding principle. Established frameworks retain their conceptual and explanatory value, while the TVET context changes how some of their constructs are understood, applied and evidenced. The purpose is not to create another framework from scratch, but to make explicit the occupational, practical, and institutional considerations required when general accounts of digital teaching competence are interpreted through My DigComp TVET.

Three tensions in TVET digital teaching

The comparison of the selected frameworks and literature brought three recurring tensions into view. These tensions arise because digital teaching in TVET requires educators to work between priorities that are individually legitimate but not always easily reconciled. Digital innovation may improve access, visualisation and practice, for example, while occupational learning still requires authenticity, safety and credible evidence of physical performance. Neither side of these relationships should be treated as inherently preferable. Competence is demonstrated through the educator's ability to judge what is appropriate for a particular learning outcome, group of learners and teaching environment.

Digitalisation and occupational authenticity. Digital technologies can extend the ways in which occupational learning is prepared, demonstrated and practised. Simulations, augmented and virtual reality, remote laboratories and recorded demonstrations may allow learners to observe processes that are expensive, hazardous or difficult to access. They may also provide opportunities for repeated rehearsal before learners work with actual equipment. Learning factories illustrate how technology-supported environments can contribute to competence development when learning activities resemble meaningful production and problem-solving practices (Roll & Ifenthaler, 2021).

Digital representation, however, does not reproduce every dimension of occupational performance. Some competencies depend on touch, applied force, timing, spatial awareness, tool handling and responses to variation in real materials or equipment. These aspects may be simplified, controlled or absent in a simulated environment. The issue is therefore not whether digital learning should replace physical practice, but which aspects can be represented digitally without weakening the intended occupational outcome. In some circumstances, retaining supervised hands-on activity may reflect more informed digital teaching competence than adopting a newer technology without considering its limitations. Educators must be able to design a meaningful transition from digital preparation or rehearsal to authentic physical performance.

Innovation and physical safety. Discussions of responsible digital practice commonly focus on privacy, cybersecurity, intellectual property, well-being, and appropriate online participation. All remain relevant to TVET, but workshop and laboratory teaching add a direct relationship between digital information and physical action. Learners may use digital instructions to operate equipment, enter machine parameters, conduct tests or follow a technical procedure. Inaccurate information, a misleading animation, an

inappropriate system configuration or delayed remote guidance may consequently affect equipment, materials and people.

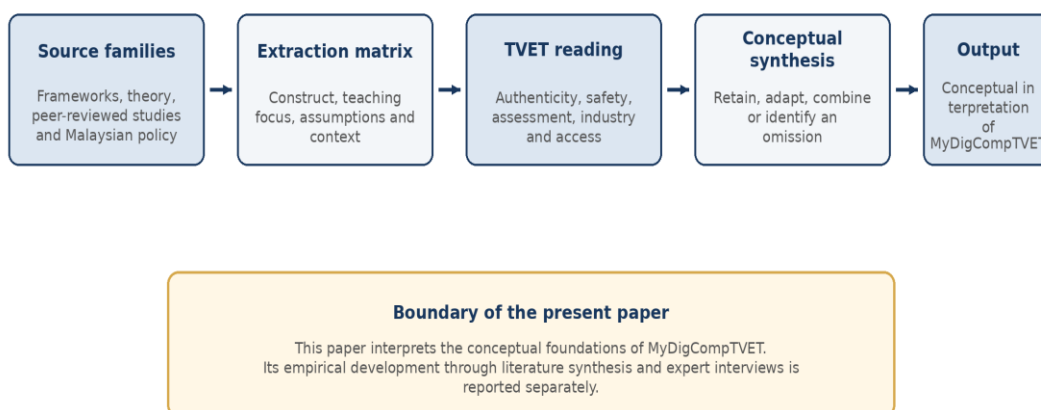
Physical safety should therefore be considered part of digital teaching competence in TVET rather than treated as a separate operational concern. Educators need to verify the technical accuracy of digital resources, control access to equipment and systems, provide appropriate supervision and ensure that technology-supported activities comply with workshop or laboratory procedures. They must also recognise when an activity should be delayed or returned to direct supervision because the available information, equipment or safety controls are insufficient. Innovation is educationally valuable only when it is introduced without weakening the duty of care associated with practical instruction.

Individual capability and institutional readiness. Educators are responsible for their instructional decisions, but their ability to enact them depends in part on the environment in which they work. Reliable connectivity, software licences, compatible equipment, technical assistance, appropriate timetabling, leadership support and access to industry expertise may enable or restrict technology integration. These conditions are especially important in TVET because digital platforms often need to operate alongside specialised machinery, laboratories and safety systems.

A competence framework that overlooks these conditions may attribute an institutional limitation to an individual educator. For example, the inability to conduct a simulation because suitable software or hardware is unavailable is different from an educator's inability to select or design an appropriate simulation when the necessary resources are provided. Assessment should therefore distinguish between capability and opportunity for enactment. Institutional conditions should be documented alongside educator competence, while remaining analytically separate from it. This distinction allows professional-development needs and organisational shortcomings to be addressed at the appropriate level. Assessment connects all three tensions because digital evidence is valuable only when it represents the occupational outcome being assessed. An online quiz may provide evidence of conceptual understanding, but it cannot independently demonstrate safe equipment operation or accurate physical performance. Video recordings, simulation logs, digital portfolios, sensor data and machine-generated records may broaden the available evidence, yet each form requires professional scrutiny. Educators must judge whether the evidence is authentic, attributable to the learner, fair, sufficiently complete and aligned with the relevant competency standard. Digital assessment in TVET is therefore not simply the collection of information; it is the professional interpretation of whether that information provides a defensible account of occupational learning.

Figure 1: Integrative conceptual synthesis used in the paper

Integrative conceptual synthesis



Note. The figure records the analytical sequence used to interpret the conceptual foundations of MyDigCompTVET. The framework-development evidence is reported in the accepted companion article.

Conceptual propositions

The tensions support four propositions. They clarify how the existing MyDigCompTVET domain structure can be interpreted in vocational settings and provide claims that can be examined in later validation and implementation studies.

Table 2: Propositions arising from the TVET tensions

Code	Proposition
P1	TVET digital teaching competence is demonstrated through decisions that preserve occupational authenticity across digital and physical learning, rather than through the amount of technology used.
P2	Responsible technology use in TVET joins digital ethics with the physical safety of equipment, processes, educators and learners.
P3	Digital assessment contributes to TVET competence only when the evidence remains aligned with occupational standards and the performance being assessed.
P4	The enactment of educator competence depends partly on institutional and industry conditions; those conditions should be examined alongside, but not confused with, individual capability.

METHODOLOGY

Research design and scope

This study adopted an integrative conceptual synthesis because its purpose was to interpret and connect existing ideas rather than to measure the prevalence or effectiveness of a particular practice. The design enabled the examination of concepts from educator digital competence frameworks, complementary theories, vocational education research, and policy documents together. Particular attention was given to the assumptions these sources make about teaching environments and to whether those assumptions remain appropriate when learning involves occupational performance, specialised equipment and physical safety.

The analysis combined two related forms of conceptual inquiry: theory synthesis and theory adaptation. Theory synthesis was used to identify relationships among accounts of educator competence, technology integration, professional learning and institutional enablement. Theory adaptation was then used to reconsider those relationships in the context of TVET. Jaakkola (2020) distinguishes these forms of conceptual contribution and emphasises the importance of making the selection of sources and the logic of analysis transparent. In the present study, synthesis established the shared conceptual foundation, while adaptation made explicit the occupational and practical considerations that are often implicit in general frameworks.

The study was not designed as a systematic literature review. It did not seek to retrieve every publication on digital competence, calculate the frequency of particular themes or estimate the prevalence of digital practices among TVET educators. Instead, it used a purposively bounded corpus selected for its relevance to the conceptual problem. Sources were included when they contributed to understanding educator digital competence, technology-pedagogy relationships, vocational teaching practice, institutional readiness or the Malaysian and international policy environment.

This boundary has implications for how the analysis should be interpreted. The selected sources support close comparison and theoretically informed interpretation, but they do not provide a comprehensive map of the entire literature. Consequently, the paper does not claim that all relevant perspectives were captured or that the resulting interpretation represents an empirically validated structure. Its purpose is narrower: to provide a

transparent conceptual reading of MyDigCompTVET through the distinctive conditions of occupational and practice-based education.

Source families and selection

The working corpus consisted of 17 anchor sources selected to represent the main bodies of knowledge required for the conceptual analysis. The sources were organised into four families according to the function they served. The first family comprised DigCompEdu, UNESCO's ICT Competency Framework for Teachers and the ISTE Standards for Educators. These frameworks were included because each offers an established but differently emphasised account of educators' digital competence. Together, they provided a basis for examining teaching, assessment, professional engagement, learner empowerment, educator agency and the institutional dimensions of technology use.

The second family brought together TPACK, Connectivism and scholarship examining digital competence as a professional construct. These sources provided the theoretical language needed to consider relationships among technology, pedagogy, content knowledge and continuing professional learning. The third family consisted of peer-reviewed studies on vocational teachers, technology acceptance, instructional quality, and learning factories. Their role was to connect the broader conceptual discussion with evidence from vocational and technology-supported teaching environments.

The fourth family comprised Malaysian policy documents, UNESCO's strategy for TVET, and a contemporary labour market report. These documents were included to establish the national and international expectations surrounding digital transformation, workforce development and institutional capability. They were treated as statements of policy direction and anticipated change rather than as evidence that the stated objectives had already been implemented or achieved.

Source selection was guided by conceptual relevance rather than publication visibility or bibliometric prominence. A source was retained when it contributed substantively to at least one of five concerns: educator capability, pedagogical use of technology, practical or vocational learning, professional development, or institutional enablement. Sources that addressed more than one concern were particularly useful because they enabled examination of relationships within the emerging interpretation. The resulting corpus was intentionally bounded and should not be understood as a comprehensive review of all literature on digital competence. Its purpose was to provide sufficient conceptual range to examine how established ideas need to be interpreted when applied to occupational teaching in Malaysian technical higher education. All 17 sources are identified in the reference list.

Analytical procedure

Each source was examined using a common conceptual extraction matrix. The matrix provided a consistent structure for recording the unit of competence, principal constructs, intended teaching environment, approach to assessment, treatment of ethical responsibility, role of organisational conditions and references to practical or work-based learning. It was used to organise comparison and make the analytical reasoning traceable; it was not intended to calculate frequencies or assign numerical importance to particular concepts.

Four questions guided the reading of each source: What capability is assigned to the educator? What assumptions are made about the environment in which teaching occurs? Which requirements of TVET remain explicit or implicit? What contextual interpretation is required when the concept is applied to a classroom, laboratory, workshop, simulation or workplace learning? These questions helped maintain attention on the practical meaning of each construct rather than relying only on the terminology used by its original authors.

The analysis proceeded through four passes. The first was descriptive. Constructs were recorded using the terminology of the original source so that their intended meanings were preserved before comparison. This stage reduced the risk of treating differently defined concepts as equivalent simply because they appeared to use similar language.

The second pass was comparative. Concepts were grouped and examined according to the educational functions they served rather than by their labels alone. Professional engagement, lifelong learning and networked learning, for example, were compared in terms of how they enable educators to renew their knowledge and remain responsive to technological and occupational change. Similarly, constructs related to digital resources, instructional design, and assessment were considered based on the decisions they required of educators.

The third pass introduced the TVET-specific lenses developed in Section 2: occupational authenticity, physical and digital safety, evidence of competence, industry alignment and learner access. Each concept was reconsidered in relation to practical and work-based teaching. A construct was retained without substantial modification when it already addressed the relevant TVET concern. Adaptation was considered when its meaning needed to be extended to account for occupational procedures, equipment, physical performance or institutional conditions. A conceptual omission was recorded only when the concern remained substantively unaddressed.

The fourth and final pass connected the three tensions identified in Section 2.3 with the five domains incorporated within MyDigCompTVET. This stage did not attempt to generate a separate set of domains. Instead, it examined how Digital Knowledge, Digital Skills, Professional Development and Lifelong Learning, Digital Ethics and Readiness, and Technology Integration in TVET should be understood when applied to occupational teaching practice. Particular attention was given to distinguishing educator capability from conditions outside the educator's reasonable control. Infrastructure, technical support and organisational provision were therefore treated as contextual influences on the enactment of competence rather than as personal competencies. Figure 1 summarises the four analytical passes and shows how they contributed to the conceptual interpretation presented in this paper.

Researcher position and study boundary

The conceptual problem examined in this paper emerged from the author's doctoral research on digital teaching competence among educators in Malaysian technical universities. This setting drew attention to teaching at the diploma and bachelor levels, where learning commonly moves among classrooms, laboratories, workshops, simulations, and industry-linked environments. It also highlighted a recurring practical concern: educators are expected to make informed decisions about technology, even though their ability to implement them may depend on institutional resources and support beyond their direct control.

Familiarity with Malaysian technical higher education provided a contextual understanding of how digital teaching is enacted within practice-based programmes. It helped the author recognise issues that may receive less attention in general educator frameworks, particularly occupational authenticity, equipment-related safety, assessment of physical performance and the relationship between individual capability and institutional readiness. At the same time, this familiarity may have influenced which issues were considered most significant. The interpretation may therefore place greater emphasis on conditions encountered in technical universities than on those found in polytechnics, community colleges, skills-training institutions, or workplace-based programmes. Making this position explicit is important because conceptual synthesis necessarily involves judgement in selecting, comparing and interpreting ideas.

The scope of the present paper is limited to conceptual analysis. No interview transcripts, survey responses or other participant data were analysed. The five domains discussed in the paper were not produced as new findings from this synthesis; they are the domains incorporated within MyDigCompTVET and are examined here as conceptual categories. Evidence regarding their development, synthesised from the literature and expert interviews, is reported in the accepted companion article.

The wider research programme also includes expert consensus procedures, instrument development, and psychometric evaluation. Findings from those phases, including Fuzzy Delphi, survey, Rasch and principal component analyses, are outside the scope of this paper. Maintaining this boundary distinguishes the present conceptual interpretation from the empirical development and validation of MyDigCompTVET. The

contribution here is to explain how the framework may be understood in terms of the conditions of occupational teaching, not to offer a second account of how its domains and elements were generated.

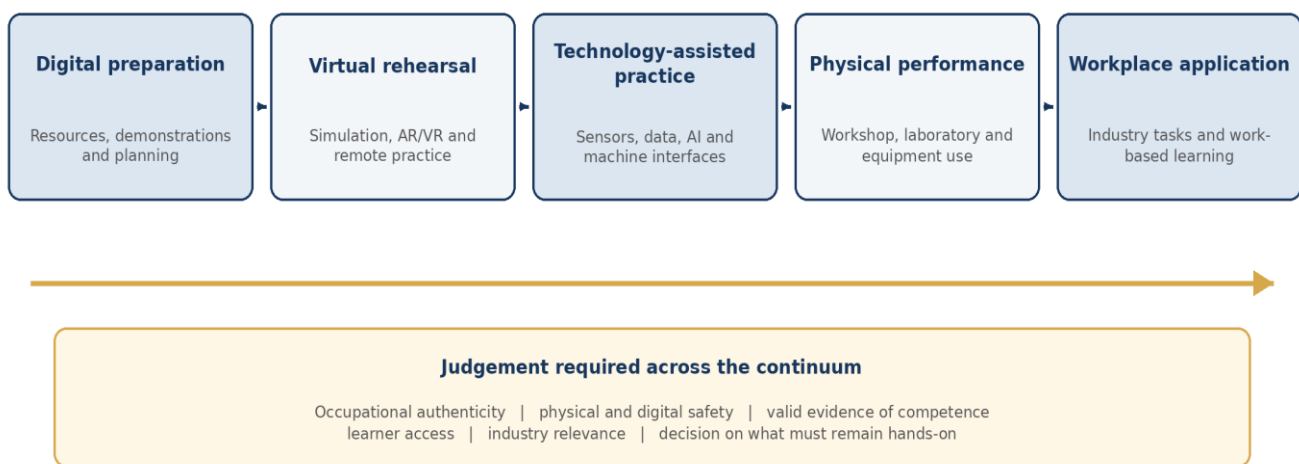
Conceptual Interpretation of MyDigCompTVET

Five domains as conceptual categories

The synthesis interprets TVET digital teaching competence as an educator's capacity to combine digital understanding, pedagogical action, responsible judgement and continuing professional learning when designing and evaluating occupational learning. The five MyDigCompTVET domains are therefore considered through the decisions educators make across the digital-physical continuum shown in Figure 2.

Figure 2 Digital and physical continuum of TVET learning

The digital-physical continuum of TVET learning



Note. The continuum does not imply that every course must pass through all five forms. Educators select and connect them according to the learning outcome, available facilities, safety requirements and occupational standards.

Digital knowledge refers to the understanding that educators need to make defensible decisions about technology-supported occupational learning. It encompasses digital systems, data, artificial intelligence, curriculum requirements, accessibility and relevant forms of governance. Within TVET, this knowledge must extend beyond awareness of how a technology operates. Educators also need to understand how it is changing occupational roles, production processes and industry expectations. They must be able to judge whether the technology available within their institution remains relevant to current practice and whether its limitations affect the accuracy of what learners are taught. Knowledge becomes professionally meaningful when it informs decisions about learning outcomes, teaching methods, assessment evidence and the conditions under which technology should be used.

Digital Skills concern an educator's ability to translate digital understanding into purposeful teaching activity. They include the selection, production and adaptation of digital resources; facilitation of online and blended learning; communication and collaboration; and the use of technology for assessment and feedback. Their meaning in TVET is shaped by the need to represent occupational procedures without removing the conditions that make those procedures valid. An educator may need to break a complex task into learnable stages, decide which stages can be demonstrated or rehearsed digitally and reconnect them with supervised physical practice. Digital skill is therefore demonstrated not simply through successful operation of a platform or application,

but through the design of learning that preserves technical accuracy, practical relevance and alignment with occupational outcomes.

Professional Development and Lifelong Learning. Digital teaching competence cannot remain fixed while industrial technologies, occupational standards and workplace practices continue to change. This domain concerns the processes through which educators maintain and renew their professional capability. These processes may include formal courses, industry attachment, professional certification, engagement with communities of practice, reflective evaluation and participation in modular or self-directed learning. Connectivism is relevant because educators often develop current knowledge through changing networks of colleagues, industry specialists, professional organisations and digital resources rather than through a single institutional programme (Siemens, 2005). Participation in a network, however, does not guarantee the quality of what is learned. Educators must evaluate the credibility, technical accuracy, safety and continuing relevance of knowledge obtained through these connections before incorporating it into teaching.

Digital Ethics and Readiness bring together responsible conduct and the capacity to respond thoughtfully to technological change. The domain includes privacy, cybersecurity, intellectual property, academic integrity, responsible use of artificial intelligence, inclusion, accessibility, well-being, and critical evaluation of digital information. In TVET, ethical responsibility also extends to the physical consequences of digitally mediated decisions. Incorrect parameters, unreliable technical information or inappropriate remote access may expose learners, equipment and facilities to risk. Readiness should therefore not be interpreted as willingness to adopt every available technology. It includes the ability to question a proposed application, recognise its limitations and delay implementation when information, supervision, infrastructure or safety controls are inadequate. Responsible non-adoption may, in some circumstances, demonstrate greater readiness than uncritical adoption.

Technology Integration in TVET represents the enactment of competence within an actual teaching environment. It concerns the educator's ability to select and coordinate appropriate combinations of digital and physical resources across classrooms, laboratories, workshops, simulations and workplaces. Integration is not defined by the number or novelty of technologies used. Its quality depends on whether the selected approach supports the intended occupational outcome, remains feasible within institutional conditions and produces credible evidence of learning. Educators demonstrate this domain by explaining why a technology is appropriate, connecting digital preparation to hands-on performance, managing access and safety constraints, and evaluating the design's effect on learners' competence. Technology integration in TVET is therefore best understood as situated professional judgement rather than as a catalogue of technical tools.

Contextual conditions and outcomes

The five MyDigCompTVET domains are enacted within conditions that may support, restrict or alter educators' use of digital technology. These conditions operate at several related levels. Occupational conditions include industry standards, current technologies and the strength of partnerships with employers. Instructional conditions include the organisation of practical and work-based learning, access to laboratories and workshops, supervision requirements, learner access and the management of physical and digital safety. Institutional conditions include infrastructure, software licences, compatible equipment, leadership, technical assistance, workload and the time available for educators to design and evaluate technology-supported learning.

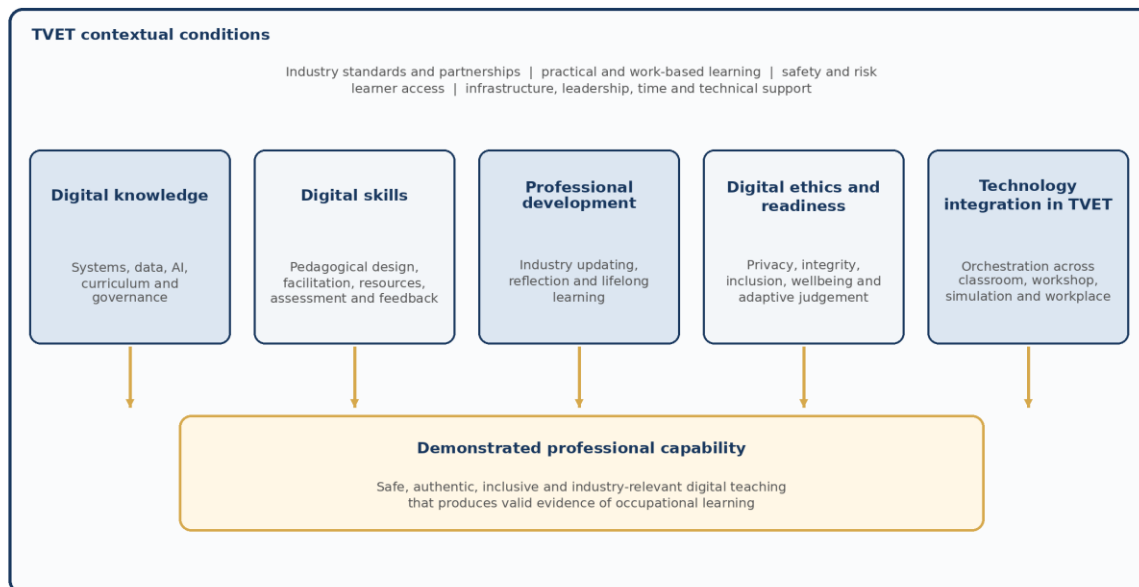
These conditions influence practice, but they should not automatically be classified as individual competencies. A capable educator may design an appropriate simulation-based activity yet be unable to implement it because specialised software, compatible equipment or technical support is unavailable. This situation differs from one in which the necessary resources are available but the educator is unable to select a method aligned with the intended occupational outcome. The first reflects a limitation in the opportunity to enact competence, whereas the second concerns educator capability more directly. Interpreting both situations in the same way would produce an inaccurate account of professional competence.

Context should therefore be documented whenever MyDigCompTVET is used to interpret educator practice. This does not remove individual responsibility or imply that every difficulty can be attributed to the institution. Educators remain responsible for making appropriate decisions within the resources and constraints they encounter. Recording contextual conditions instead allows professional development needs to be distinguished from problems requiring institutional investment, technical support, changes in workload, or stronger industry collaboration.

Figure 3 illustrates this relationship by positioning the five MyDigCompTVET domains within the broader context of TVET teaching. The domains contribute to an intended outcome in which digital teaching is safe, occupationally authentic, inclusive and relevant to industry. Such teaching should also produce evidence that is sufficiently valid to support judgments about learners' occupational competence. The figure does not imply that the domains operate in a fixed sequence or that contextual conditions determine outcomes in a simple causal manner. Nor does it propose a framework separate from MyDigCompTVET. Instead, it offers a conceptual interpretation of how educator capability, conditions of enactment and intended teaching outcomes should be considered together. The relationships shown remain propositions for subsequent examination through implementation and validation research.

Figure 3: Conceptual interpretation of MyDigCompTVET in its TVET context

Conceptual interpretation of MyDigCompTVET



Note. The figure illustrates the relationship among the established MyDigCompTVET domains, contextual conditions, and intended teaching outcomes. It does not propose a separate framework.

Table 3: Interpretive focus of the MyDigCompTVET domains

Domain	Central question	Evidence expected in practice
Digital knowledge	Does the educator understand the technology and its occupational implications?	A reasoned explanation of relevance, limits, data use and curriculum implications.
Digital skills	Can the educator turn that understanding into a sound learning design?	Activities, resources, interaction and assessment aligned with the intended outcome.

Professional development	How is capability renewed as work and technology change?	Reflective improvement, industry updating and purposeful professional learning.
Digital ethics and readiness	Can the educator identify when use is responsible, inclusive and safe?	Decisions that protect data, integrity, well-being, access and physical safety.
Technology integration in TVET	Can the educator orchestrate digital and hands-on learning in the actual setting?	Appropriate selection, implementation and evaluation across TVET environments.

DISCUSSION

Theoretical interpretation

The conceptual interpretation developed in this paper shifts attention from the presence of technology to the professional reasoning that governs its use. This shift is expressed through three related theoretical moves. Together, they explain how MyDigCompTVET may be understood in relation to the purposes, environments and constraints of occupational teaching.

The first move locates digital teaching competence within the primary purpose of TVET: the development of demonstrable occupational competence. From this standpoint, the educational value of technology does not depend on its novelty or frequency of use. It depends on whether the technology supports appropriate practice, improves understanding and produces credible evidence of the intended occupational outcome. This changes the questions that should guide the interpretation of educator competence. Rather than asking only whether or how often an educator uses a digital tool, attention should be directed towards the judgment behind its use: Why was the technology selected? Which occupational outcome did it support? What limitations were considered? What evidence indicates that learning occurred? Digital competence is consequently understood as reasoned professional action rather than observable technology use alone.

The second move concerns the relationship between digital and physical learning. Digital technologies can provide access to complex processes, visualise otherwise hidden operations and allow learners to rehearse before working with specialised or hazardous equipment. These benefits do not mean that every form of occupational learning can be transferred into a digital environment. Some dimensions of performance depend on material interaction, tool handling, timing, sensory judgement and responses to variation under real conditions. Educators must therefore decide which aspects can be prepared or practised digitally and which require supervised physical performance. Choosing to retain hands-on learning should not automatically be interpreted as resistance to innovation. When based on a careful appraisal of learning outcomes, authenticity and risk, it represents an informed exercise of digital teaching competence.

This argument provides a TVET-specific reading of TPACK rather than proposing a replacement for it. TPACK explains the interaction among technology, pedagogy and content in instructional decision-making (Mishra & Koehler, 2006). In occupational education, however, content includes more than formal disciplinary knowledge. It also encompasses practical procedures, tacit judgement, equipment characteristics, technical standards and safety requirements. Occupational authenticity and risk, therefore, influence how technology, pedagogy and content can be combined. A pedagogically attractive technology may still be unsuitable if it distorts the procedure being taught, removes essential physical experience or introduces an unacceptable safety concern.

The third move distinguishes an educator's capability from the opportunity to enact that capability. UNESCO's ICT Competency Framework for Teachers recognises that digital teaching is connected to curriculum, leadership, infrastructure and wider system conditions (UNESCO, 2018). The present analysis applies this systems perspective to the interpretation of individual competence within MyDigCompTVET.

Educators may possess the knowledge and skills required to design effective digital learning but be unable to implement it due to inadequate infrastructure, restricted software access, incompatible equipment, limited technical support, or insufficient time. These constraints should not be concealed by treating every implementation difficulty as an educator's deficit.

Contextual limitations do not, however, remove professional responsibility. Educators must still evaluate what can be implemented safely and educationally within the available resources. The distinction is therefore between capability and opportunity, not between responsibility and exemption. A sound interpretation of MyDigCompTVET should consider what an educator knows and can do, the decisions made under actual conditions, and the extent to which the institution enables those decisions to be enacted.

Although the five MyDigCompTVET domains are analytically distinguishable, they operate as an interconnected account of professional practice. Digital Knowledge informs the educator's understanding of a technology and its occupational implications. Digital Skills translates that understanding into learning activities and assessment. Digital Ethics and Readiness establish the limits of responsible implementation. Professional Development and Lifelong Learning renew capability as technologies and work practices change. Technology Integration in TVET brings these forms of competence together in the actual teaching environment. Strength in one domain cannot automatically compensate for weakness in another. Advanced technical knowledge, for example, does not make an assessment valid, guarantee learner access or justify unsafe supervision. The theoretical value of the domain structure lies in these relationships rather than in viewing each domain as an isolated checklist.

Implications for Malaysian technical higher education

The conceptual interpretation developed in this paper has implications for professional development, institutional leadership, curriculum and assessment, and policy implementation in Malaysian technical higher education. These implications are intended to guide reflection and institutional planning rather than prescribe a uniform approach across disciplines or institutions.

Professional development should extend beyond demonstrations of software features or training in particular digital platforms. A more meaningful approach would involve educators in redesigning a practical learning task from their own discipline. In doing so, they would need to determine which aspects could be supported digitally, which should remain hands-on, what safety and accessibility measures are required, and what evidence would validly demonstrate occupational competence. The resulting design could then be tested and critically reviewed with colleagues, technical personnel and industry partners. Such an approach connects professional learning more directly to the judgments educators make in their teaching practice.

Academic leaders should consider educator capability and institutional readiness as related but distinct areas of responsibility. Educators may possess the knowledge and pedagogical skills needed to implement a technology-supported activity but be unable to do so due to limited infrastructure, incompatible equipment, restricted software licences, insufficient technical support, or workload constraints. Conversely, the availability of advanced facilities does not ensure that they will be used in educationally appropriate ways. Reviewing these dimensions together can help institutional leaders identify whether an improvement requires professional learning, additional resources, organisational change or a combination of these responses. It also reduces the tendency to address systemic limitations solely through further staff training.

For curriculum and assessment, MyDigCompTVET highlights the need for continuity between the intended occupational outcome, the learning activity and the evidence used to judge performance. Digital portfolios, video-recorded performances, simulation logs and machine-generated data may broaden the available evidence, but their value depends on the authenticity of the task and the defensibility of the assessment process. Educators must still consider whether the evidence represents the required performance, whether authorship can be established, whether learners have equitable opportunities to participate, and whether the scoring criteria reflect relevant occupational standards.

The technologies and forms of evidence considered appropriate are also likely to vary across engineering, computing, the built environment and other applied disciplines. MyDigCompTVET should therefore not be interpreted as prescribing a standard set of digital tools. Its value lies instead in providing shared questions through which educators can examine the pedagogical relevance, occupational authenticity, safety and accessibility of their choices. Engagement with industry partners may further support this process by helping institutions assess whether learning activities and technologies remain aligned with current workplace practices and standards.

At the policy level, MyDigCompTVET may help translate broad national aspirations for educational digitalisation into specific capabilities that institutions can develop systematically. Nevertheless, the five domains and their conceptual interpretation should not be used independently as a high-stakes instrument for staff appraisal or promotion. Such applications would require empirically validated indicators, progression levels, scoring procedures and decision rules, together with appropriate consideration of institutional conditions. At its present stage, the framework is more appropriately used as a developmental and diagnostic guide for professional reflection, curriculum planning and institutional capacity building than as a compliance checklist.

LIMITATIONS AND RESEARCH AGENDA

This paper has four principal limitations. First, the source corpus was purposively bounded to support conceptual comparison rather than exhaustive coverage. Relevant frameworks, empirical studies or sector-specific perspectives may therefore have been omitted. Second, the primary synthesis was undertaken by a single researcher. Although the use of a common extraction matrix made the analytical process more transparent, it did not eliminate the possibility of disciplinary or contextual bias in interpreting the sources. Third, the analysis is situated within Malaysian technical higher education. Its interpretation may not transfer directly to polytechnics, community colleges, skills-training institutes or workplace-based training, where educator responsibilities, learner profiles, infrastructure and occupational arrangements may differ. Finally, this paper does not independently establish the number, distinctiveness or relative importance of the five MyDigCompTVET domains. It provides a conceptual interpretation of those domains rather than a separate empirical test of their structure.

Further research should examine whether this interpretation is understood consistently by stakeholders in education, industry and policy. Although the domains were informed by the wider MyDigCompTVET development process, their meaning and enactment should be examined across institutional settings and occupational disciplines. Any competency elements or indicators derived from the framework should be traceable to identifiable teaching responsibilities and practical requirements before expert consensus or measurement testing is undertaken. This traceability is important for preventing general digital practices from being classified as TVET-specific competencies without sufficient justification.

Subsequent instrument development should examine content validity, dimensional structure and measurement performance. It should also determine whether educator capability can be assessed separately from the institutional conditions that affect its enactment. Comparative studies across engineering, computing, the built environment, and other applied fields could establish whether the appropriate balance between digital and hands-on learning varies with equipment, occupational risk, performance requirements, and industry standards. Research involving polytechnics, community colleges, skills institutes and workplace trainers would also help determine which aspects of MyDigCompTVET are transferable and which require further contextual adaptation.

Longitudinal research is particularly important because readiness should reflect a capacity that develops over time rather than a fixed classification assigned at a single point in time. Such research could examine how educators' judgements and practices change following professional development, improvements in institutional provision or changes in industry technology. It could also help distinguish temporary barriers to implementation from more persistent competency-development needs.

Emerging and disruptive technologies require particular caution within this research agenda. Artificial intelligence, immersive environments, blockchain applications and alternative digital credentialling systems may eventually warrant specific indicators, but novelty alone does not demonstrate educational relevance. Their inclusion should depend on evidence that they contribute meaningfully to occupational learning, valid assessment, safety or industry alignment. Validation should therefore preserve the broader capability to evaluate and adapt emerging technologies while allowing individual platforms and tools to change. This approach would help MyDigCompTVET remain responsive to technological development without becoming dependent on technologies that may be temporary, inaccessible or educationally marginal.

CONCLUSION

Digital teaching competence in TVET involves professional decisions that are not always visible in general accounts of educational technology use. Educators must determine whether digital activities preserve occupational authenticity, whether technology-supported instruction can be implemented safely, whether the resulting evidence validly demonstrates practical competence, and whether barriers to implementation arise from individual capability or institutional conditions. These considerations support the contextual interpretation of established frameworks for educator competence in Malaysian technical higher education.

By examining MyDigCompTVET through the tensions between digitalisation and occupational authenticity, innovation and physical safety, and individual capability and institutional readiness, this paper advances a central argument: digital teaching competence is demonstrated through situated professional judgement rather than through the presence, sophistication or frequency of technology use. The five domains—digital knowledge, digital skills, professional development and lifelong learning, digital ethics and readiness, and technology integration in TVET—become meaningful when they collectively contribute to learning that is safe, authentic, inclusive, and aligned with occupational and industry requirements.

The paper, therefore, provides a conceptual basis for interpreting and implementing MyDigCompTVET within practice-based teaching environments. It does not propose an additional framework or claim independent empirical validation of the domain structure. Instead, it clarifies the reasoning that should guide the framework's application and future examination. Until appropriate indicators, progression levels and decision rules have been validated, MyDigCompTVET is best used as a developmental guide for professional reflection, curriculum planning and institutional capacity building rather than as a stand-alone standard for high-stakes assessment.

Declarations

Data availability. No empirical dataset was generated or analysed for this conceptual paper.

Related publication. The accepted companion article, *Developing MyDigCompTVET: A Digital Teaching Competency Framework for TVET Educators in Malaysia Informed by Literature Synthesis and Expert Interviews*, reports on the empirical framework development phase and is forthcoming in the *International Journal of Research and Innovation in Social Science*. The present paper does not reproduce its interview data, coding results or empirical analysis.

Use of generative artificial intelligence. Generative AI tools were used during early drafting and subsequent language and structural support. The author reviewed and substantively revised the conceptual argument, checked the cited sources and factual statements, and accepts responsibility for the final manuscript. No AI tool was used to generate or analyse empirical data.

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