

Blended Learning and the Development of Tacit Knowledge, Problem-Solving Skills, and Professional Judgment in TVET Students: A Narrative Review

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 DOI: <https://doi.org/10.30880/jttr.2026.04.01.004>

Article Info

Received: 13 May 2026
 Accepted: 22 June 2026
 Available online: 30 June 2026

Keywords

Blended learning, Technical and Vocational Education and Training (TVET), tacit knowledge, problem-solving skills, professional judgment

Abstract

This narrative review examines the impact of blended learning that integrates online theory and on-site practice in developing the tacit knowledge, problem-solving skills, and professional judgment of TVET students. It frames vocational competence as a multi-faceted concept characterized by technical-conceptual skills, embodied tacit knowledge, high order problem solving and value informed judgment. Building on research into TVET and cognate fields of practice-based learning, the review synthesises evidence about how some blended designs like flipped classrooms, simulation supported practical experiences, project based/purposeful activities and structured reflection, can deepen and expand around authentic tasks. The analysis shows that blended learning can improve vocational expertise when online and on-site components are tightly aligned with real work processes, sustain significant hands-on experience, and provide systematic opportunities for reflection, feedback and moral discussion. In contrast, blended approaches that are primarily intended for content delivery or to minimize physical exposure will have less of an effect on the deeper levels of expertise. The ambivalence of the review ends with a strong premise for blended learning as high promise to TVET, however, the latter is premised upon effective pedagogical and institutional design. It also recommends more longitudinal and design-based research into how certain blended models influence the

1. Introduction

Technical and vocational education and training (TVET), for a long time, has been seen as one of the main instruments to ensure that work ready graduates are produced who can effectively adapt to economies and labour markets which are evolving at a very fast pace (Kanwar et al., 2019). Across the globe, TVET systems are increasingly under pressure to deliver not only well-trained workers with strong technical skills but also those who demonstrate complex problem-solving and good professional judgement, as well as the ability to learn continuously throughout their working lives (Riyanda et al., 2021). These expectations have developed further in the context of technological change, Industry 4.0 and changing workplace practices, which are placing increased demands on workers to mobilize both explicit knowledge as well as less visible; experience based forms of expertise in authentic settings (Vashishth et al., 2024). In the context of this, blended learning, as most commonly defined as a deliberate mix of face to face and online learning (eLearning activities) has emerged in recent years as a viable model for TVET institutions that wish to retool pedagogy while retaining the importance of hands on practice (Hashim & Hamidon, 2022; Manditereza & Chamboko-Mpotaringa, 2024).

In TVET, blended learning usually involves theory being delivered online in tandem with practice in workshops, laboratories or workplaces (Owo, 2025). For example, recent work in a diploma electrician programme describes a blended delivery model where learning management systems, multimedia resources and digital assessments are used to conceptually prepare learners before completing practical tasks on the actual equipment (Toney, 2025). For vocational tourism and hospitality education, recent work also shows increasing use of blended, flipped-classroom, AI-supported, and digital-pedagogy approaches, while still recognizing the challenges of maintaining practical, industry-ready training (Kamble & Dandge, 2025). Concurrently, TVET lecturers and students repeatedly attest to the claim that while online elements may help broaden access and opportunities for flexibility, direct contact with tools, materials and work environments is an essential component for impactful skills development (David, 2023).

One of the main open questions in these discussions is whether blended learning can offer more than a simple and efficacious transfer of theoretical knowledge. For instance, much of what separates novice performance from vocational expertise is tacit knowledge, adaptive problem-solving and context-sensitive judgement deeply rooted in practice but often difficult to articulate (Venkatesh, 2021; Zheyu et al., 2021). Tacit knowledge specifically is often characterized as embodied, experiential and context dependent; it becomes part of the action by engaging in real or simulated activities facilitated by more experienced practitioners rather than via formal instruction (Waykar, 2023). Similarly, problem solving in vocational contexts requires not just executing known procedures but diagnosing unfamiliar faults, balancing options against constraints (systematic and bounded choices) and tapping previous experiences to create makeshift solutions. The last point extends to particular professional judgment and ethical choices, safety decisions and trade-offs, which written rules can never cover completely (Oviawe, 2020).

There is a well-established literature indicating that blended learning in higher and professional education has positive effects on knowledge acquisition, skills proficiency and learner satisfaction notwithstanding there are less studies examining how these models shape even deeper but less visible dimensions of vocational expertise particularly in TVET (Castro-Gil & Correa, 2021; Lockey et al., 2022). Existing studies within TVET are more likely to pay attention to the easily quantifiable results of academic performance, basic skills and perceptions of flexible or transferable skills (Mohamed & Ghani, 2025; Tshong & Yasin, 2023). Blended, case based and flipped classroom designs have been associated with better problem-solving skills and complex task performance for some experimental and quasi experimental work, therefore leveraged advancements in competence (Mariani et al., 2025). Similarly, design studies show that online peer feedback and reflection in blended environments support articulating tacit knowledge even when working on practice based fields such as medicine (Fleischmann, 2025). Yet, these perspectives have not been systematically reviewed with regard to how they inform TVET students' tacit knowledge, problem solving skills and professional judgement development under blended models of online theory and on-site practice integration.

The current narrative review fills this gap by investigating the influence of blended learning activities incorporating online theoretical components and on-site practical experiences in building tacit knowledge, problem solving skills, and professional judgment among TVET students. In so doing the review synthesises evidence from blended learning studies in the TVET field and works across related practice-based disciplines to investigate the ways in which blended designs can amplify or, conversely, obfuscate vocational expertise. This focus frames the review in three interconnected questions: (a) How is tacit knowledge conceptualised and supported in blended TVET and related environments? (b) How do blended learning activities influence students' problem-solving processes and capacities? and (c) What role could blended models play in developing professional judgement in vocational practice?

To clarify the conceptual direction of this review, Figure 1 presents the proposed relationship between online theory, on-site practice, reflection and feedback in supporting the development of tacit knowledge, problem-solving skills and professional judgment. The framework positions blended learning not as a simple combination of online and face-to-face delivery, but as an integrated learning process in which digital preparation, situated practice and reflective feedback work together to strengthen vocational expertise.

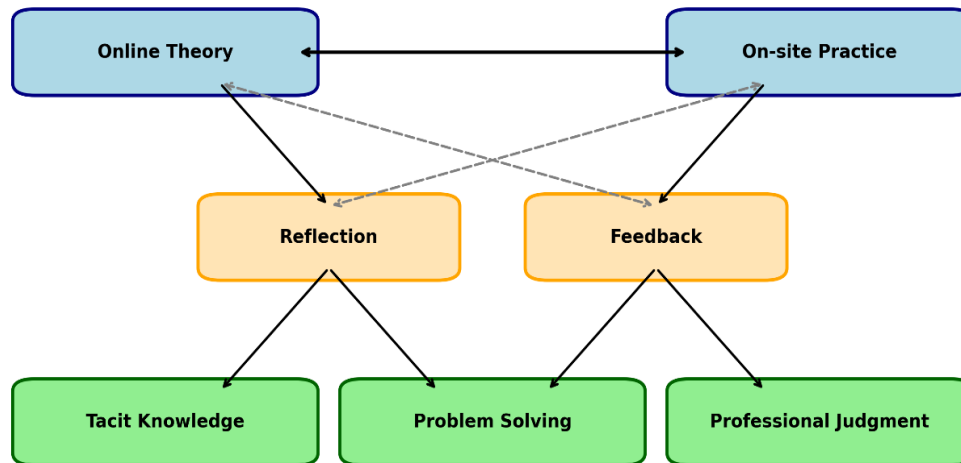


Fig. 1 Conceptual framework linking online theory, on-site practice and expertise via reflection and feedback

Because blended learning is a multifaceted and evolving subject, this review takes a narrative rather than a strictly systematic protocol approach to synthesizing a range of evidence, including empirical studies, conceptual papers, and design-oriented accounts from diverse TVET contexts and allied disciplines. More specifically, we've limited the neglect to programmes and studies in which online learning is framed around augmenting (rather than displacing) hands-on involvement in workshops, laboratories or workplaces, a configuration that is arguably most pertinent for linking conceptual behaviour with real-world situated tasks (Sarimah et al., 2023). In this sense, the review aims to provide a conceptual map of where blended learning intersects with tacit knowledge, problem-solving and professional judgement in TVET, and some practical insights for educators and policymakers grappling with how to design blended programmes that can enhance rather than dilute vocational expertise. Table 1 summarizes selected blended learning models relevant to TVET contexts. The table is included to show the diversity of blended approaches reported in the literature, particularly in terms of instructional design, balance between online and face-to-face components, technologies used and outcome measures. This overview helps establish the basis for the subsequent narrative synthesis.

Table 1 Key characteristics of blended learning models in TVET

Blended Model Characteristics	Online vs Face-to-Face Ratio	Types of Technologies Used	Main Outcome Measures	Reference
ADDIE model with technology-enhanced workshops	ADDIE model with technology-enhanced workshops	ADDIE model with technology-enhanced workshops	ADDIE model with technology-enhanced workshops	Hashim & Hamidon, 2022
Integration of distance learning with on-the-job training	Varied ratio focusing on distance and workplace combination	Digital distance learning tools, workplace simulations	Improvement in educational experience and engagement	Ajani & Dlomo, 2025
Classroom and workshop learning enhanced with technology	Classroom and workshop learning enhanced with technology	Classroom and workshop learning enhanced with technology	Classroom and workshop learning enhanced with technology	Shariful Islam Shakeel et al., 2023

2. Methodology of the Narrative Review

Utilizing a narrative review approach, this paper examines the influence of a blended learning mode that combines online theoretical components with on-site practical experiences in relation to tacit knowledge, problem solving skills and professional judgment among TVET students. A narrative review is especially appropriate for topics where the literature is conceptually diverse, methodologically heterogeneous and fragmented across fields, as it permits the synthesis of empirical findings with theoretical arguments and design oriented accounts into a coherent internal interpretative logic instead of an external aggregative report (Castro-Gil & Correa, 2021; Lockey et al., 2022). Unlike systematic reviews that are guided primarily by protocol, this approach prioritises in-depth interpretation and building conceptual connections with the aim of informing context relevant educational practice and policy.

This orientation led the review to progress through an iterative process. Key constructs were clarified and delimited as follows: "blended learning" was understood as the design of a coherent learning process deploying online on-the-job or work integrated learning (WIL) activities; "TVET" referred to programs that overlie technical occupations, for example, industry skills acquisition programs; and "vocational expertise" was framed to include tacit knowledge-situated knowledge - problem-solving skills - professional judgment within interrelated aspects of practice commitments (Kanwar et al., 2019; Oviawe, 2020). These working definitions helped identify and select studies of relevance for inclusion, while also serving to provide a conceptual framing for the interpretation of how learning outcomes were described and measured by different authors in relation to blended environments.

Second, the narrative review has selectively included empirical and conceptual literature from both TVET and fields in practice-based domains closely related to TLE, such as design education and health professions education, where blended and technology enhanced learning have traditionally been used to support authentic, practice-oriented learning. Exhaustive, census-style coverage of all publications was not the aim; rather, sources were provided with rich descriptions of blended learning designs or on theoretical-practical integration and details how learners develop complex capabilities (e.g., problem solving and judgment) in situated contexts. This purposeful and iterative sampling strategy adheres to narrative review customs that value conceptual saturation and theoretical depth over exhaustiveness.

Third, the analysis and synthesis employed a thematic and interpretive logic. The studies were read for (a) design and enactment descriptions of the blended learning, (b) the types of knowledge-knowledge that was foregrounded-the skills foregrounded in relation to the knowledge, and (c) substantive references to tacit knowledge and professional judgment, either implicitly or explicitly. Having read the articles repeatedly and compared introductory and concluding passages for recurrent themes, we identified that alignment of online-and on-site components is crucial to student satisfaction, but reflection and feedback are also essential intermediate processes that help or hinder deeper forms of vocational learning. The themes were subsequently mapped onto the three main analytical strands of the review—tacit knowledge, problem solving and professional judgement, while also identifying cross-cutting mechanisms linking blended learning to broader questions of vocational expertise.

Lastly, the entire process was characterized by reflexivity. Because narrative reviews are by nature based on the author's subjective interpretation, efforts were made to: (i) be specific about underlying assumptions, (ii) acknowledge areas of little or conflicting evidence, and (iii) not overstate causal claims based purely on correlational or perception studies in prior literatures (Castro-Gil & Correa, 2021). To this end, the synthesis is thus presented as an informed theoretically based reading of a heterogeneous body of work rather than as a final verdict on the effectiveness of blended learning across all TVET settings. This strategy corresponds with the general aim of the paper, which is to offer a rich (and uniquely conceptual) framework for understanding how blended learning could influence tacit knowledge, problem solving and professional judgement by sign-posting potential avenues for investigation.'

3. Result

3.1 Blended Learning and Tacit Knowledge on TVET

One of the most interesting emerging patterns that we see when zooming in on blended learning uses for vocational purposes is how online and on-site elements can be orchestrated to flow into each other in a manner supporting near incremental building of tacit knowledge. Instead of attempting to directly "teach" tacit knowledge, many blended designs engage in iterative cycles where students first experience exposure to expert performance and/or core concepts online, then engage in application tasks on site and eventually revisit some form of reflection or discussion. In these cycles, online materials, demonstration videos, annotated case examples, or interactive scenarios prime learners to see specific cues, relationships and/or signs as they engage in hands-on work that may not occur otherwise. The on-site component subsequently provides opportunities for students to engage in authentic or simulated workplace settings, where learning extends beyond theoretical understanding to encompass sensory perception, tool manipulation, timing, and contextual environmental factors. Continuous

participation in these situated learning experiences facilitates the development of tacit knowledge, enabling students to internalize professional practices through observation, repetition, and reflection. Over time, this experiential process fosters an intuitive mastery of their trade, allowing them to make informed decisions and perform effectively even when they cannot fully verbalize the knowledge underpinning their actions.

Many of the vocational studies and design reports point out that rich representations of practice are particularly effective in this respect. Committed quality videos of expert practitioners, slow motion replays of critical steps that can be performed, close up shots of equipment behaviour and virtual simulations of fault conditions all provide a “window” into aspects that would be difficult to describe well in written form. Because of the nature of these resources in an online environment, students can pause, replay and compare examples at their own speed, which encourages a more meaningful internalisation of what expert performance looks like/feels like. Those prior images and explanations then become anchors, so in the workshop or lab students see recognisable patterns or “triggers” into all their senses that lead them to modify their own behaviours. To be sure, the tacit knowledge remains embodied, and situational; however, the blended format amplifies exposure to expert ways of seeing and doing (the magic ingredient in crossing from novice to more experienced performance).

With blended learning, the more practical side of tacit knowledge is not fully stripped away but rather made available for discussion. Examples include online forums, concise reflective writing tasks and digital portfolios in which students explain what they did, what they observed and why they chose certain methods. Little of this process of articulation is ever seamless students are, often, juggling the ability to communicate each nugget of insight. Even half-hearted efforts can be worthwhile, however. They open space for peers and instructors to probe, question, and add their voices: What are you thinking? How does that relate to X? Would it be even better if you tried Y? This transforms what may have started as a purely internal gut check into something that is expressed, compared and refined. This is something instructors can model, talking through their own decision making when completing a task during the workshop via live commentary, or in recorded materials with voice over. In a hybrid design, such narrated demonstrations can be repeatedly accessed online, and the learners can relate what they see in practice with conceptual frameworks they are studying.

At the same time, both literature and practitioner examples warn against assuming any use of technology will enhance tacit learning. If the online component is poorly aligned with the on-site practice for example, students complete generic quizzes or theory modules loosely related to what they are doing with tools and materials the experience can feel fragmented. It is possible to teach people how to pass online assessments without ever causing them to learn the embodied sensitivity and situational judgement that real work requires. Likewise, if blended learning is primarily implemented by institutions to minimize contact hours or to replace practical sessions, those conditions for tacit knowledge development are undermined. Without at least a reasonable slice of time on actual equipment, access to numerous cases, or practice under varying conditions with guidance, students have little chance to develop the kind of “feel” that separates the seasoned worker. All these risks underscore that blended learning is at its best in support of tacit knowledge when it assists but does not replace or dilutes the practice core of TVET. The relationship between online preparation, on-site guided practice, reflection and repeated application can be understood as a cyclical process. As shown in Figure 2, tacit knowledge development in blended TVET depends on repeated movement between exposure to expert practice, practical engagement, reflective articulation and consolidation through varied practice.

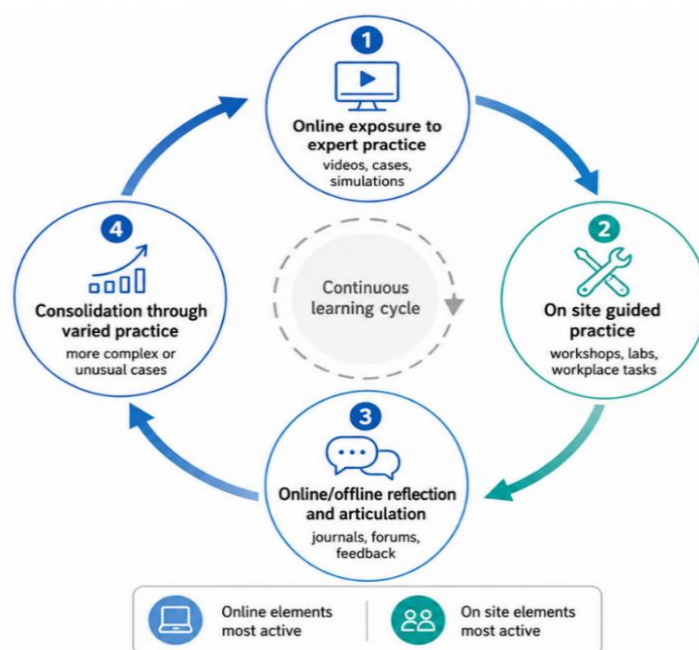


Fig. 2 Blended learning cycle for tacit knowledge development

In conclusion, under three conditions blended learning stands as a strong ally of tacit knowledge formation in vocational education. In other words, online events need to be explicitly and clearly tied back to concrete assignments, even if they take place before or afterwards so that learners view them as preparatory for or reflective of “real work,” instead of theory-oriented assignments. Second, on-site elements must be rich and diverse enough to allow for students to wrestle with the messy ambiguities of practice that drives tacit learning. Third, it must provide for regular reflection and dialogue built into a design process that utilizes digital tools not simply to provide content, but to facilitate conversation around aspects of the workshop that typically remain unsaid between students and teachers. In these conditions, the blended environment can reach out to apprenticeship like learning by showing some features of vocational knowledge more visible with respect to their highly situated and experiential nature. While Figure 2 presents the overall cycle of tacit knowledge development, Table 2 translates this cycle into practical blended learning activities. The table illustrates how specific online, on-site and post-practice activities can support students in noticing subtle cues, developing embodied understanding and articulating practice-based insights.

Table 2 Examples of blended activities that support tacit knowledge in TVET

Phase in learning cycle	Example activity	How it supports tacit knowledge
Online pre-practice	Expert demonstration video with commentary	Highlights subtle cues and decision points to notice
Online pre-practice	Interactive fault-finding simulation	Safely exposes students to varied problem situations
On-site guided practice	Instructor-led practice on real equipment	Builds embodied feel for tools, timing, and conditions
On-site guided practice	Peer observation checklist	Focuses attention on normally overlooked actions
Online/post-practice reflection	Short reflective journal entry	Encourages articulation of “what I noticed and did”

3.2 Blended Learning and Problem-Solving Skills in Technical and Vocational Education and Training

Blended learning allows TVET educators to transition from routine practice and expose learners to the complex problem solving they will face in real workplaces. When the online and on-site elements are intentionally designed, students do more than learn information; they are tasked with diagnosing problems, evaluating alternatives, and making decisions in a setting that mimics real work situations.” In various blended models, a

prep online activity such as case analyses, scenario based quizzes, or interactive simulations present students with a realistic problem before the workshop/ workplace experience (e.g. add studies) This sequencing tells us that learners will have practised the reasoning steps by the time they reach working with actual tools and actual materials, which means they can concentrate on applying and adapting what they know rather than just obeying instructions.

Vocational programmes have a common design pattern by which they leverage online environments to design ill structured problems where there is no one right answer, or key information can be absent or ambiguous. Students, for instance, might be presented with a description of a system that is not functioning correctly, partial data from measurements and a list of potential causes for faults and asked to formulate a plan to diagnose the problem. By working through these kinds of things online (usually in small groups), they are prompted to articulate assumptions, contrast alternative explanations and engage in systematic reasoning about the tasks of scientific research. So, when they later do practical, these experiences allow them to look at real world situations through a problem-solving lens: rather than waiting for a step-by-step guide, they will formulate hypotheses and test those, adjusting based on feedback from the equipment/process. Through the online component, students are conditioned to be problem solvers as opposed to passive operators.

On site, blended models can enhance problem solving by portraying the real tasks as increasingly complex problems instead of repeating simple actions. They may start with relatively straightforward exercises that rehearse procedural fundamentals and then quickly go to practice tasks that include intentional failure modes or constraints, unanticipated factors for which methods must be adapted, such as time pressure, safety concerns, or resource access limits. Importantly, these tasks that have been assigned are directly traceable to the scenarios and concepts that they have experienced online. Some teachers may want students to come back online after a lab or workshop session to describe how they approached the problem, what worked, what didn't and how they would approach it differently next time. Repetition of this cycle helps them to improve not only their technical moves but also their planning, modelling and evaluation - the fundamentals of good problem solving.

It's also finding a perfect fit for collaborative problem solving an ability becoming far more highly valued in the workplace. Group work, collaborative documents or peer feedback tasks where learners collaboratively plan how to approach a task, break down roles and evaluate each other's reasoning can occur online. The same groups can then execute their plans in the workshop, experiencing the challenge of collaboration in physical time and space. They can subsequently regroup online and be presented with videos, photographs or logbooks of their work, which they can use as artefacts to reconstruct communications or strategy breakdowns. By practicing through these cycles, learners start to realize problem solving does not simply represent an individual cognitive skill; rather it is a social process that involves negotiation, leadership, listening and mutual support, all aspects that are critical for effective working in multi skilled teams on the job. The development of problem-solving skills in blended TVET can be represented as a loop rather than a linear process. Figure 3 shows how students may move from online problem framing and planning to on-site enactment and observation, followed by online or offline debriefing. This loop emphasizes that problem solving develops through repeated cycles of planning, action, feedback and revision.

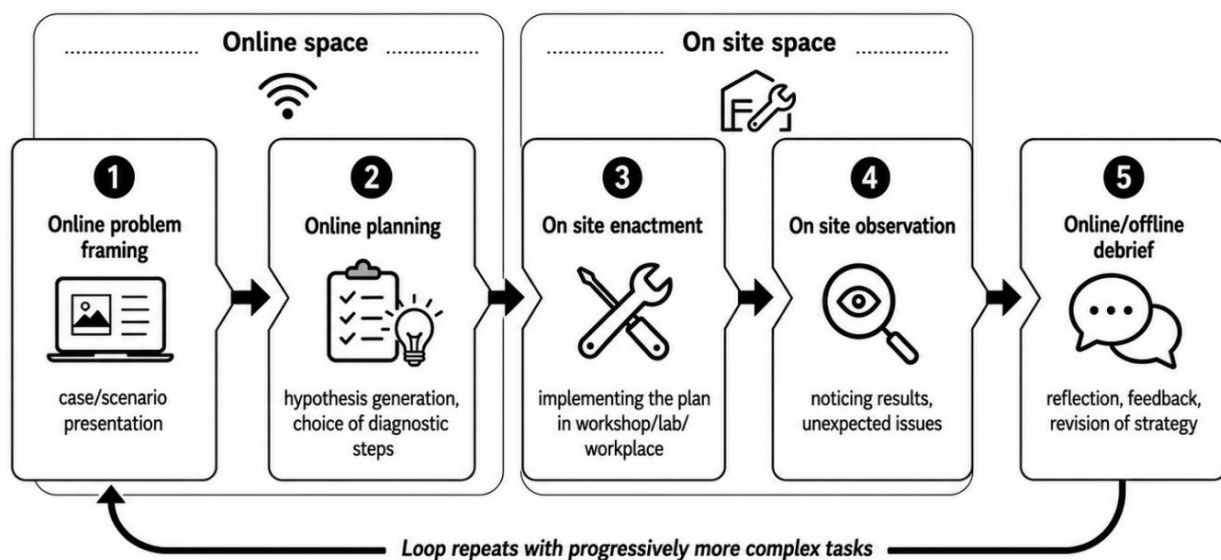


Fig. 3 Problem solving loop in blended TVET

However, blended learning influences problem solving in TVET positively, but this is entirely dependent on task-tool- assessment design. But online activities that rely heavily on recall and procedural practice can lead students to become adept at passing quizzes without substantial improvements in their diagnostic or strategic abilities. Conversely, if practical is overly scripted with few opportunities for choice and exploration, then the ability to undertake authentic problem solving is compromised regardless of how clever the online element is. Good, blended designs thus make an intentional turn in how assessments and feedback are conducted: they avoid tracking speed or even punching out correctness on regular assignments instead rewarding the quality of reasoning, at the intersection with justification for choices made, as well as learning from mistakes. This way, when students enter their online or on-site environment, they consistently hear one message: it is not enough to do the job; understanding how you are doing that job and why that makes a difference in how adaptable you can be as conditions change.

To summarize, blended learning can be a powerful catalyst for practising problem solving skills in TVET by bringing together the following three elements: (a) exposure to rich, realistic problems online, (b) opportunities to enact and test solutions against authentic practical contexts and related challenges, and finally (c) guided reflection and dialogue about both successful attempts as well as encounters with failure. With all these ingredients, the learner will start creating an arsenal of strategies and experiences to use when certain novel challenges arise. This repertoire acts over time as an important conduit between formal training and the ambiguous, developing challenges typical of authentic work. To further illustrate how the problem-solving loop can be operationalized in teaching practice, Table 3 aligns each stage of problem solving with possible blended learning activities. These activities show how online and on-site components can be deliberately sequenced to support students' reasoning, planning, implementation, monitoring and reflection.

Table 3 *Blended activities aligned with stages of problem-solving*

Understanding the problem	Online scenario reading + guided questions	Clarifies key facts, constraints, and unknowns
Generating hypotheses	Small-group online discussion forum	Encourages multiple perspectives and explicit reasoning
Planning	Digital worksheet to design diagnostic steps	Structures thinking about sequence and feasibility
Implementing	Workshop task with partial instructor guidance	Provides real-world feedback on chosen plan
Monitoring and adjusting	Live note-taking or checklists during practice	Fosters awareness of when and how to modify approach
Reflecting	Post-task online journal or video debrief	Consolidates lessons learned, links experience to concepts

3.3 Blended Learning Blended into Professional Judgement in TVET

The most difficult area of expertise to develop intentionally, however, is professional judgment itself, which lies at the centre of all vocational work. In TVET contexts, this is about making decisions between principles of safety and quality against things like cost or time when applied in a client directed situation; interpreting regulations for what they are intended to mean in terms of specific LV situations; and striking an appropriate balance between adherence to rules and standard internal procedures contra socially responsible variations from the rule. It expands beyond technical prowess and problem solving, to encompass values, ethics and consideration of impact on others. In blended learning contexts, this type of judgement is informed not only by events occurring in workshops and workplaces but also the ways online activities illustrate decision-making, present dilemmas and encourage reflections on practice.

Two things blended designs that support professional judgment do well. They make students engage with rich decision scenarios that closely reflect the complexity of actual work. These are online places where cases with conflicting priorities are shown for example: some task needs to be done quickly, but safely as well, or a client request that collides with compliance or quality standards. Instead of asking learners simply "What would you do?" ask "Why do you even bother? What risks or trade-offs are an issue?" These cases can then be revisited following on-site practice again; students can compare what they thought they would do with what happened when they confronted the same conditions as those encountered in sterilised labs, workshops and workplaces. The reciprocal engagement between hypothetical learning experiences and authentic workplace practice creates an iterative process through which students continuously evaluate and refine their decisions. This ongoing cycle not only strengthens their capacity for critical reflection but also facilitates the transformation of intuitive judgements into explicit, reasoned, and professionally defensible decision-making.

Second, blended learning may provide more space and structure for the kinds of value-based reflection and dialogue that are critical to the ethical side of professional judgement. Informal transmission of values and norms is crucial in vocational settings, where a great part of the “hidden curriculum” occurs via interactions with teachers, supervisors and peers. For this process to be more explicit, the use of online forums, synchronous discussions, and collaborative tasks can be implemented in a blended context. For instance, students might watch a snippet of a video depicting an incident at work and discuss: Who was responsible? What should have been done differently? How did organisational culture impact the outcome? As well as acknowledging the grey areas practitioners inhabit, teachers can then facilitate these discussions towards larger principles: respect for safety protocols, honesty in reporting errors, fairness in teamwork, etc. The principles of value-based education and ethical standards in blended vocational education highlight that the structured interaction helps students identify with professional norms and practices, guiding how they are applied in everyday decisions.

From a practical perspective, blended learning also affects professional judgement through the structure of feedback and supervision. Most of the formative feedback around students' decisions in traditional models is informal and happens on a real-time basis at the workplace or in the workshop. Blended approaches can provide this as well, but deeper feedback online. Some students may turn in written explanations; others may provide an annotated photograph or video of their work; while still others might write a short incident report on some difficult moment they navigated. You might have mentors who can comment on what students did, and in some cases how they reasoned about the situation. Feedback shifts from “right-or-wrong” to questions like “What options did you consider?” or, for short, “What facts did you rely on?” questions that are essential to developing a more sophisticated professional judgement. Research related to project based and problem based blended learning designs in vocational education indicates that when this kind of multi-layered feedback is offered, students are more likely to take responsibility for their choices and to link the decisions made back to an overarching professional standard.

Professional judgment in TVET involves more than the selection of correct technical procedures. As illustrated in Figure 4, students' decisions are shaped by several layers, including technical choices, contextual constraints, and broader ethical and value-based considerations. The figure also shows how online cases, on-site practice and feedback activities can interact to support the development of responsible professional judgment.

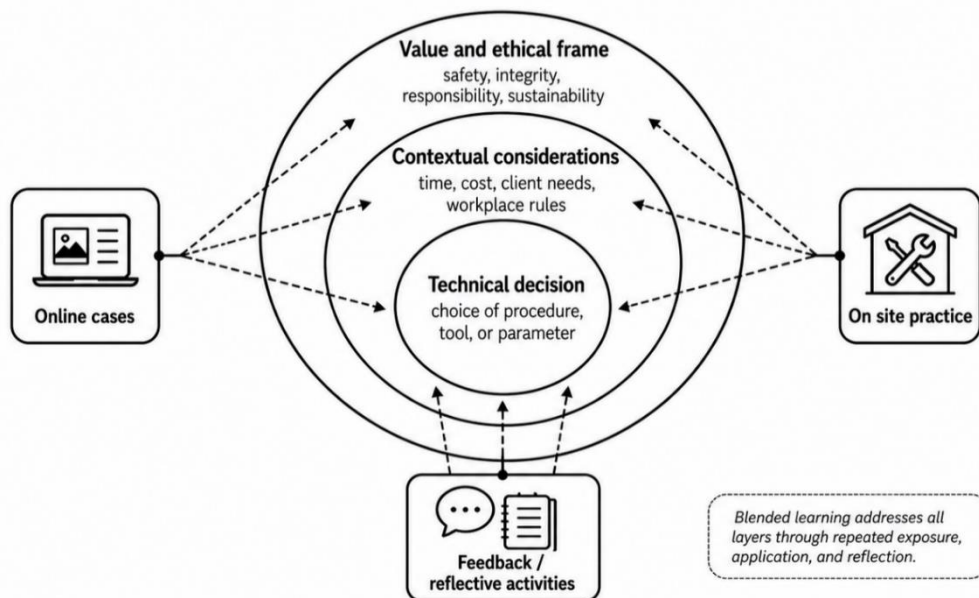


Fig. 4 Layers of professional judgment in blended TVET

But there are evident tensions and pitfalls at the same time. When blended learning is used in an institution primarily to deliver content and conduct assessments, but less to assist supervision and mentoring, students will have fewer opportunities to see and discuss the real time judgments of experienced practitioners. And there is evidence from some comparative studies that reducing practical exposure or controlling it too much in the name of efficiency and safety leads to experts who are technically well qualified, but reluctant and inconsistent in their reactions to surprises as they arise in the workplace. For example, even with excellent online case materials, little can come close to replicating genuine experiences of making high-stakes decisions. The problem, therefore, is not merely to place ethics or professionalism modules online but for questions of judgment to run throughout the blended experience connecting what they read and discuss on screen with what they do and decide in practice.

Broadly speaking, emerging evidence and experience suggest that blended learning can nurture professional judgment in TVET if it intentionally integrates three elements: authentic decision-making scenarios that highlight trade-offs and consequences; value-based deliberation that identifies and negotiates ethical standards; and feedback loops that emphasize reasoning as well as results. If these strands are part of those practicum placements and closely tied to significant practical engagement, students are more readily able to transition from rule following toward reflective, responsible practice. Without these touchpoints, blended learning stands the risk of relegating focus to procedures and tests and leaving the deep, judgmental dimension of vocational expertise in a disadvantaged state. Table 4 provides examples of blended activities that can be used to develop professional judgment in TVET students. The activities are organized according to judgment-related concerns such as safety, quality, ethical considerations, accountability and team-based decision making. This table demonstrates how professional judgment can be embedded across both online and on-site learning experiences rather than treated as a separate theoretical topic.

Table 4 *Blended activities targeting professional judgement*

Judgment focus	Example blended activity	Intended effect on students' judgment
Safety and risk assessment	Online incident case + workshop simulation	Links rules to real consequences and situational factors
Quality vs time trade-offs	Scenario discussion forum followed by timed lab task	Highlights managing pressure without cutting corners
Client/ethical considerations	Video case + online debate on "what should be done"	Encourages justification of actions using shared values
Accountability and reporting	Online reflection on error + instructor feedback	Normalises honest reporting and learning from mistakes
Team-based decisions	Project-based blended assignment with shared logbook	Develops negotiation and collective responsibility

4. Discussion

4.1 Incorporating Tacit Knowledge and Problem Solving with the Professional Judgement in Blended TVET

In short, the collective strands of literature about tacit knowledge, problem solving, and professional judgement suggest a single synthesis: blended learning does have genuine promise for deepening vocational expertise provided that online and on-site components are appropriately interwoven into a purposeful whole. Online environments in effective education do not simply provide content; they draw appropriate boundaries around authentic problems and, indeed, frame them up to give a context for expert performance, structured spaces for reflection and for dialogue with peers. On-site environments then represent the main stage where students test, practise and hone what they have found online, in a context that incorporates noise, variability and pressures of real-world labour. It is in these conditions that the three key dimensions of expertise this review considers grow not in isolation. They develop together through learners looping through conceptual understanding, situated action, and reflective sense making repeatedly.

In this view, tacit knowledge can be thought of as the material scaffold upon which procedures for more explicit problem solving and making judgments rest on. When blended learning extends learners' exposure to expert practice and helps them notice patterns that would be invisible otherwise, it strengthens this substrate. Students experience multiple "looks" at skilled performance before and after hands on tasks through demonstration videos, simulations, and annotated cases, while reflective tools allow them to articulate some of what they are starting to feel and see. Students passing through these cycles become increasingly adept at sensing the feel of "what is normal," "what feels wrong," or "what works here." This growing tacit base is then directly relevant for problem solving; accumulated experience provides learners with a more nuanced and robust sense of how systems and processes behave in practice, enabling them to produce plausible hypotheses, select efficient diagnostic steps and recognise when the chosen strategy does not work.

Problem solving, in turn, may translate into an intermediate between tacit know how and professional judgement. When blended designs continuously deliver non routine tasks to learners both online and on-site that compel them to reason across restrictions, simulate alternatives and reformulate their tactics, they are practicing the moves that form the basis of wise decision making. They form a practice of negotiating conflicting demands, to dealing with imperfect information, and the position that mistakes are learning opportunities rather than

failures. When combined with structured debriefings, written justifications, or peer discussions, these experiences help students notice regularities in their thinking: where they typically move too fast, where they are risk-averse, how they behave under stress. Gradually, this meta-awareness helps to move from purely solving the immediate technical problem towards more overarching questions of safety, ethics and long-term implications that sit at the core of professional judgment.

Simultaneously, the review emphasises that such processes are unstable and precarious. The extent to which it helps develop vocational skills is limited if blended learning applies mainly as a delivery mechanism for theoretical content with little change in the way practical teaching or assessment occurs. Shallowness in tacit knowledge can result from too little, or too scripted, hands-on engagement of students. Realistic situations, which are the basis for problem solving, may be restricted or eliminated, if online tasks include recall rather than authentic questions. If value laden dilemmas and reasoning feedback are peripheral or absent, professional judgment may be stunted. Instead, the promise of blended learning is diminishing to convenience and productivity while integrative practice continues to be learnt informally in the workplace after graduation.

The evidence and arguments examined here thus support your thesis in a qualified, but significant way. Well-designed blended learning activities that combine online theory with on-site practice can help TVET students strengthen tacit understanding, problem solving competency and professional judgment provided those activities (a) directly relate to authentic tasks; (b) maintain purposeful high dosage practical engagement; and (c) offer routine opportunities for reflection, provide feedback and participate in value based dialogue. In these circumstances, blended learning is not just an augmentation of existing practice with the introduction of technology; Blended learning reconceives of the environment in which people conceive understandings so that conceptual understanding, situated experience and reflective judgment are mutually informing all the time. In contrast, where these conditions are weak or unavailable, blended models simply replicate the constraints of traditional teaching in a more digitized format with limited additional input to produce vocational expertise.

That integrative view implies that for TVET educators and policymakers, maximisation should lead to this key design question: "How much should be online? I barely scratched the surface considering the documents I read, and I am still working with this idea of 'How do online and on-site elements work together, enabling seamless progression through the full arc of expertise from tacit knowing, over problem solving to responsible judgment?'" Those programmes which maintain the focus on this question are more likely to use blended learning as a genuine vehicle for deep, work ready competence rather than simply an illusory updating. Implications for researchers with it general, we point to the need for more direct fine-grained studies of how particular blended designs may shape these three dimensions over time (including longitudinal and workplace based follow up research tracking how graduates actually perform and decide in their trades).

The preceding analysis suggests that tacit knowledge, problem-solving skills and professional judgment should not be viewed as separate learning outcomes. Instead, they develop through overlapping blended learning mechanisms that connect conceptual preparation, situated practice and reflective dialogue. Table 5 summarises how each dimension of vocational expertise may be supported through specific blended learning mechanisms and activities.

Table 5 Summary of how blended learning supports key dimensions of vocational expertise

Dimension of vocational expertise	Main blended learning mechanism	Example learning activity	Expected developmental outcome
Tacit knowledge	Online exposure, on-site practice and reflection	Expert demonstration video followed by guided workshop practice	Improved ability to notice subtle cues and develop embodied know-how
Problem-solving skills	Scenario-based planning, practical enactment and debriefing	Online case analysis followed by workshop troubleshooting	Improved diagnostic reasoning and adaptive decision making
Professional judgment	Ethical scenarios, value-based dialogue and feedback	Online incident case followed by reflective discussion	Stronger ability to justify decisions based on safety, quality and responsibility

4.2 Implications for Curriculum Design

Blended TVET programs should be built "from the workshop outward," not "from the platform inward"; trained on data up to 10/2023. Learning outcomes should not just refer to technical procedures or testable theory but must specifically incorporate tacit knowledge, problem solving and professional judgment. Then, online and on-site elements can be plotted to support those outcomes in the following way: online spaces can be used to present concepts, model expert practice and offer authentic cases; on-site sessions provide the situated, sensory rich experiences where those ideas are trialed and adjusted. Sequencing is critical. When units are designed around

cycles of “prepare online, act on-site reflect and document online” this keeps the connection between theory and practice together rather than allowing them to drift off into parallel tracks. Because of this integration, assessments must also include tasks that allow students to explain decisions, cope with non-routine situations and explain their reasoning as much as they can follow a fixed procedure.

And from a curriculum perspective, protecting the practical time against further inefficient erosion. When everything goes online, there might be institutional demand for shortening workshops or limiting workplace exposure. The evidence on which we base this claim specifies that it is a false economy: students cannot acquire the tacit base and situational repertoire necessary for problem solving and judgment without extensive, diverse practice. Consequently, curriculum policies should require an established minimum standard of practical work such that when online elements are used, they supplement and extend authentic practice rather than replace it. Finally, the design should accommodate explicit reflection and ethics related work across modules, for example by embedding in various subjects short, recurring judgment scenarios, followed by reflective exercises so that professional judgment is nurtured continuously and holistically rather than concentrated in one “professionalism” course.

4.3 Implications for Teaching Practice

For teachers, this change in TVET curriculum towards blended learning is not so much about learning tools but redesigning themselves as experience designers. In practice, this means using online platforms not just to share notes or quizzes but deliberately constructing problems in a way that highlights their own and peers’ thinking and providing a place for students to articulate what they otherwise only “feel.” Even the simplest tricks (recording brief, targeted demonstrations with narration; student practice videotapes; and discussion boards for post-workshop debriefs) add dramatically to how tacit knowledge and problem solving are developed. Teachers might also usefully model good professional judgment (also in my mind) by talking their way through examples (live with them), weighing safety, time and quality, as well as inviting students to evaluate methods of performing online before going about it in the workshop.

Concurrently, this review indicates the value of professional development and collegial support. Most teachers in TVET come from the industry and may feel apprehensive at first if coupled with expectations of “going blended” adjacent to existing demands. Instead of letting teachers reinvent the wheel on their own, though, institutions can help alleviate that burden by allowing time and support for collaborative course design, peer observation, and resource-sharing. Small, incremental changes redesigning one unit according to a blended problem-solving cycle in each class are often more sustainable than radical change. In time, as students unpack their thinking and beliefs in more detail with teachers on blended approaches they will begin to trust it more. Teacher learning about blended pedagogy is thus (in this sense at least) itself a progressive practice-based process, much the same as students acquire vocational expertise.

4.4 Policy and Institutional Support Implications

Micro-level innovations, at the policy and institutional level, illustrate a demand for further investigation into what constitutes “successful” blended TVET. Metrics as simple as the percentage of content delivered online or a count of logins do little to indicate whether tacit knowledge, problem solving or judgment is being set. Accordingly, quality assurance frameworks and funding models need to include indicators that capture integration and depth, for example, evidence of real-world authentic practical tasks connected to online preparation and reflection or graduate feedback on readiness for a complex workplace situation. Any policy option that inadvertently incentivizes minimizing effective exposure, or quasi-overspecification of instructional practice in the name of scale, can be unconsciously counterproductive to the quality of expertise that TVET seeks to build.

Institutions too, play an important role in providing the infrastructure and cultures necessary for meaningful blended learning to be a reality. And beyond the baseline access to devices and connectivity, we need scheduling practices that allow enough uninterrupted time for meaningful workshops (possibly reconfigured), and workload models that acknowledge the additional design and feedback work required by blended teaching. Industry partnerships can be used to develop not only equipment and placements, but they are valuable co developers of realistic cases, incident scenarios and judgment dilemmas that populate online and on-site activities. Blended learning can go from being a passing phenomenon in TVET systems to a strategic asset when it is approached to achieving aligned policies and resources, effective leadership messages and deep contextualised vocational expertise beyond digital modernisation.

5. Conclusion

This narrative review aimed to explore the impact of participating in blended learning interventions on TVET students and investigate how tacit knowledge, problem solving skills and professional judgement can be developed through online theory coupled with onsite practice. The review built on work from TVET and related

practice fields and argued that Blended Learning has a far broader scope than just upgrading the delivery of content. Designed intelligently, it has the potential to rearrange learning space such that conceptual understanding, situated experience and reflexive dialogue continuously inform one another. It is under such conditions that learners may more readily construct the embodied know how, strategic flexibility and value informed decision making that characterises contemporary workplace vocational expertise.

Three core insights emerged. As a first example, the support of tacit knowledge by blended learning may be accomplished through a mixture of rich representations of expert performance and opportunities for articulation and reflection surrounding hands on practice, but only if substantial heterogeneous practical engagement remains at the centre. Second, it can promote problem solving in situ and online when tasks revolve around authentic and progressively more complicated challenges that engage idea generation, planning, enactment followed by structured debriefing instead of simply repeating sequences of activities. Third, it can nurture professional judgement by providing students with the opportunity for repeated exposure to value laden decision situations, facilitating structured ethical deliberation and feedback that is focused on reasoning as well as behaviour. There are caveats, too, as the review made clear: blended learning will make a limited contribution to deep vocational expertise whenever it is primarily used as a mechanism for content delivery or cost savings where deeper forms of practice, and opportunities for reflection and mentoring are thinned out.

The high-level implication for curriculum, teaching and policy is that the key design question is not how much learning should be online but how do we combine things online and on site to achieve the entire arc of developing expertise. Blended learning is much more likely to be a true vehicle for work ready competence by keeping tacit knowledge, problem solving and judgement explicitly in view through aligning outcomes, activities and assessments accordingly. It is therefore far more likely that institutions which invest in teacher development, retain a strong practical component and establish authentic industry partnerships will successfully capitalise on this opportunity over those who define “blended” as simply another platform added to existing practice.

There is a need for more fine-grained empirical research to understand how specific blended learning designs influence these three dimensions of expertise over time and across different trades. Our understanding could be extended through longitudinal studies that track TVET graduates into the workplace, design-based research that co-creates blended learning models with practitioners, and mixed-methods research that connects performance data with rich accounts of learner and teacher experiences. Such studies could also help clarify not only the conditions and learning environments under which blended learning supports the development of tacit knowledge, problem-solving, and professional judgement, but also how it does so in more concrete terms. Specifically, they could identify the precise blend of learning experiences that best facilitates this development and inform the provision of models that contribute to a more reality-informed TVET system, better preparing learners for the complexities of the modern workplace.

Acknowledgement

The authors would like to acknowledge Universiti Kuala Lumpur, Malaysian Institute of Chemical and Bioengineering Technology (UniKL MICET), and SMK Dato Dol Said for their institutional support in the preparation of this manuscript. The authors also express their appreciation to colleagues and reviewers who provided constructive comments and academic input during the development of this narrative review.

Conflict of Interest

Authors declare that there is no conflict of interest regarding the publication of the paper.

Author Contribution

*The authors confirm contribution to the paper as follows: **study conception and design:** Mohd Edyazuan Azni, Syahirah Rosli, and Mohamad Zulkeflee Sabri; **literature search and source selection:** Mohd Edyazuan Azni, Syahirah Rosli, M.S. M. Ghazali, and M. Mupit; **analysis and interpretation of literature:** Mohd Edyazuan Azni, Syahirah Rosli, Zaihar Yaacob, Mohd Nizam Zahari, and A.A. Hamzah; **draft manuscript preparation:** Mohd Edyazuan Azni, Syahirah Rosli, M.S. M. Ghazali; **critical review and intellectual input:** M. Mupit, Zaihar Yaacob, Mohamad Zulkeflee Sabri, Mohd Nizam Zahari, and A.A. Hamzah. All authors reviewed the results and approved the final version of the manuscript.*

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