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TPACK-integrated experiential performance learning model to enhance learners' digital competency

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Abstract

This study introduces and validates the Technological Pedagogical Content Knowledge–Integrated Experiential Performance Learning (TPACK-EPL) Model, designed to enhance learners' digital competency through a structured instructional design framework. The model integrates the TPACK framework with experiential and performance-based learning, resulting in a six-phase cycle that connects technological, pedagogical, and content knowledge to authentic and reflective learning experiences. Development involved a systematic literature review, theoretical synthesis, and validation by five experts in educational technology and instructional design. Each phase of the model maps TPACK dimensions to experiential performance learning processes, specifying the roles of both instructors and learners. To evaluate the model, a 34-item expert rubric was developed covering principles, conceptual clarity, pedagogical relevance, technological appropriateness, and alignment with digital competency outcomes. Experts rated the model highly across all dimensions, with an overall mean score of 4.82 (SD = 0.20). Findings suggest that the TPACK-EPL Model provides both theoretical strength and practical applicability, offering educators and instructional designers a robust framework for cultivating digital knowledge, skills, and attitudes. Future research should test its implementation in classroom settings and conduct longitudinal studies to assess sustained impact across diverse educational contexts.

Keywords: Digital competency, Experiential learning, Instructional design model, Performance-based learning, TPACK, Technology integration, Digital literacy, Learner-centered instruction, Competency-based education, Teacher education, Instructional design framework.

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Contents

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Contribution of this paper to the literature
This study introduces the TPACK-EPL Model, which integrates TPACK, experiential learning, and performance-based learning into a unified instructional design. The model provides a validated, theory-driven framework to enhance learners' digital competencies, offering practical guidance for educators to design authentic, learner-centered activities aligned with technological, pedagogical, and content knowledge dimensions.

1. Introduction

The rapid advancement of digital technologies has fundamentally reshaped the educational landscape, necessitating the development of learners' digital competencies to navigate and thrive in the 21st century (Gan, Zhang, Wang, Deng, & Li, 2020; Kim, Xie, & Cheng, 2017). Digital competency, a multidimensional construct encompassing the knowledge, skills, and attitudes required for effective and responsible technology use (Naumeca & Āboliņa, 2023; Oberländer, Beinicke, & Bipp, 2020) has emerged as a critical learning outcome across educational levels and disciplines (Chiecher, 2020; González Fernández, 2021). To foster learners' digital competency, educators must possess the requisite technological, pedagogical, and content knowledge (TPACK) to design and facilitate technology-enhanced learning experiences (Ercan & Özdemir, 2020; Qasem & Viswanathappa, 2016). The TPACK framework, proposed by Mishra and Koehler (2006), describes the complex interplay of teachers' knowledge domains essential for effective technology integration. Numerous studies have applied TPACK to guide the development of pre- and in-service teachers' technology-enhanced teaching competencies (Albeta, Firdaus, Copriady, & Alimin, 2023; Chao & Fang, 2023; Zhou et al., 2022). While TPACK has been extensively applied in teacher education, its translation into student-centered digital competency development remains insufficiently addressed in instructional design literature.

However, while TPACK provides a valuable framework for teacher knowledge, its application to learner-centered, competency-oriented instructional design remains underexplored. Experiential learning theory, which posits that knowledge is created through the transformation of experience, emphasizes the importance of active engagement and reflection in the learning process (Kolb & Kolb, 2005) offers a promising lens for designing TPACK-grounded learning activities that engage learners in authentic, reflective practice. Similarly, performance-based learning, which focuses on applying knowledge and skills to real-world tasks (Shute, 2008; Woelk & Lefrere, 2002), aligns with the competency-based aims of digital literacy education. The present study proposes the TPACK-Integrated Experiential Performance Learning (TPACK-EPL) Model, synthesizing principles of TPACK, experiential learning, and performance-based learning to foster learners' digital competency development. By mapping TPACK dimensions to a six-phase experiential performance learning cycle and delineating instructor and learner roles, the model provides a systematic framework for designing and implementing technology-enhanced, competency-oriented learning experiences.

The TPACK-EPL Model builds upon prior research examining the integration of TPACK with experiential learning (Jiang & Liang, 2017; Maharsi, 2017) and performance-based assessment (Crespo Hernández, 2023; Li et al., 2022) while extending these approaches to target learners' holistic growth in digital competency. The model's synthesis of established instructional design principles and learning theories, contextualized for the demands of the digital age, contributes to the growing body of literature on technology-enhanced, competency-based education. To validate the proposed model, a systematic literature review was conducted to identify key principles and components of TPACK, experiential learning, performance-based learning, and digital competency development. The identified elements were synthesized into an integrated model, which was subsequently evaluated by a panel of experts using a quantitative rubric. The results of the expert evaluation affirm the model's appropriateness, relevance, and applicability.

The TPACK-EPL Model holds significant implications for educators, instructional designers, and educational researchers seeking to cultivate learners' digital competencies through theory-grounded, evidence-based practice. By providing a structured framework for aligning technology, pedagogy, and content with authentic, reflective learning experiences, the model supports the design and implementation of effective digital literacy interventions across diverse educational contexts.

The following sections detail the study's methodology, including the literature review, model synthesis, and expert evaluation procedures (Sections 2, 3); present the results of the model development and validation process (Section 4); and discuss the implications, limitations, and future directions for research and practice (Section 5).

2. Literature Review

2.1. Technological Pedagogical Content Knowledge (TPACK)

The Technological Pedagogical Content Knowledge (TPACK) framework, introduced by Mishra and Koehler (2006) provides a structured perspective for examining the dynamic relationship among three fundamental domains of teacher knowledge: Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK). Effective technology integration in education requires more than separate expertise in each domain. It also demands the ability to combine these domains into a cohesive body of knowledge known as TPACK, as described by Koehler and Mishra (2009). Over the past decade, the framework has been widely applied in teacher education to strengthen the digital teaching competencies of both pre-service and in-service educators (Albeta et al., 2023; Chao & Fang, 2023; Zhou et al., 2022). Although its role in preparing teachers is well established, the application of TPACK within student-centered instructional design, particularly as a strategy for enhancing learners' own digital competence, has not been extensively investigated.

2.2. Experiential Learning

Experiential learning theory, as articulated by Kolb and Kolb (2005) highlights the importance of acquiring knowledge through direct experience accompanied by systematic reflection. The experiential learning cycle comprises four interconnected stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Empirical research, including the work of Morris (2020) and Vargas-Merino, Rios-Lama,

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Bello-Mamani, and Panez-Bendezú (2025) has reinforced the value of reflection and iterative practice in promoting deep and sustained learning. Despite this recognition, many instructional models still lack well-defined frameworks for designing experience-based learning activities that are explicitly aligned with targeted competency outcomes.

2.3. Performance-Based Learning

Performance-based learning emphasizes the demonstration of knowledge and skills through authentic, contextually relevant tasks (Shute, 2008; Woelk & Lefrere, 2002). Its key features include clearly defined learning objectives, opportunities for real-world application, ongoing feedback, and assessment based on explicit criteria (Hattie, 2008; Nicol & Macfarlane-Dick, 2006). This approach views learning as a process of continuous refinement, frequently supported by formative assessment practices and the cultivation of learner self-regulation. Although it aligns closely with the principles of competency-based education, its direct integration with digital competency frameworks and the Technological Pedagogical Content Knowledge (TPACK) model has received limited attention in existing research.

2.4. Digital Competency

Digital competency is widely acknowledged as a multidimensional construct that includes the knowledge, skills, and attitudes required for the effective and ethical use of digital technologies (Naumeca & Āboliņa, 2023; Oberländer et al., 2020). Although many frameworks define digital literacy through these three components, educational initiatives often place a disproportionate emphasis on technical skills alone. Recent scholarship (Chiecher, 2020; González Fernández, 2021) advocates for more comprehensive approaches that embed not only practical abilities but also digital knowledge and ethical considerations within instructional design.

2.5. Identified Gaps in the Literature

Although TPACK has been extensively applied in teacher preparation, and the benefits of experiential and performance-based learning are well documented, few models explicitly integrate these frameworks to support the development of learners' digital competence. Many existing approaches either treat technology as an optional addition or emphasize a single dimension, such as pedagogy, without achieving a balanced integration of all components. In addition, the roles and responsibilities of learners within TPACK-oriented environments are often insufficiently defined, and the connections between stages of experiential learning and specific digital competence outcomes remain unclear in much of the literature.

2.6. Conceptual Foundation of the TPACK-EPL Model

The proposed Technological Pedagogical Content Knowledge–Integrated Experiential Performance Learning (TPACK-EPL) model responds to these gaps by combining the TPACK framework with principles of experiential and performance-based learning. It maps the domains of TPACK onto a six-phase experiential learning cycle, incorporating authentic tasks and structured opportunities for reflection at each stage. The model defines clear roles for both instructors and learners and explicitly links every phase to the three domains of digital competence: knowledge, skills, and attitudes. By positioning TPACK as the central organizing structure, the model provides a systematic, theory-informed approach for cultivating learners' comprehensive digital competence within technology-enhanced learning environments.

3. Research Methodology

This study employed a multi-phase approach to develop and validate the TPACK-EPL Model, combining systematic literature review, model synthesis, and expert evaluation.

3.1. The Approach

3.1.1. Model Development

1. A systematic review was conducted to identify key principles and components of performance-based learning, experiential learning, the TPACK framework, and digital competency development.
2. The identified elements were synthesized into an integrated model that maps TPACK dimensions to a six-phase experiential performance learning cycle.
3. Instructor and learner roles, along with expected learning outcomes, were defined for each phase of the model.
4. The synthesized model was visualized as a double-loop diagram depicting the alignment of TPACK elements with the experiential performance learning cycle and digital competency domains.

3.1.2. Expert Evaluation

Five experts were purposively selected based on their expertise in educational technology, teacher education, and instructional design, as evidenced by relevant publications and professional experience. The experts were affiliated with the following institutions:

- Faculty of Science and Technology, Phetchaburi Rajabhat University, Thailand.
- Faculty of Education, Vongchavalitkul University, Thailand.
- Faculty of Education, Suan Dusit University (Suphanburi Campus), Thailand.
- Faculty of Industrial Technology, Songkhla Rajabhat University, Thailand.
- Faculty of Management Science, Chandrakasem Rajabhat University, Thailand.

A 34-item evaluation rubric was developed to assess the model's appropriateness, relevance, clarity, coherence, and applicability. Experts independently rated each rubric item on a five-point Likert scale, ranging from 1 (Poor) to 5 (Excellent).

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3.2. Database, Keyword Selection, and Date of Search

A systematic literature review was conducted using Google Scholar, ERIC, and IEEE Xplore databases to identify peer-reviewed articles published in English between 2002 and 2025. The search employed a combination of the following keywords: "Performance-based learning," "experiential learning," "TPACK," "technological pedagogical content knowledge," "digital competency," "digital literacy," "technology integration," "teacher education," and "instructional design."

3.3. Inclusion and Exclusion Criteria

Articles were included if they met the following criteria: (a) they were empirical studies, conceptual papers, or research reviews; (b) they addressed at least one of the key constructs of interest; and (c) they were published in English. Studies were excluded if they were (a) editorials or opinion pieces without a substantial foundation in the literature or (b) focused on topics unrelated to the scope of this review.

4. Results

4.1. Synthesis of TPACK-EPL Model

4.1.1. Synthesis of Performance-Based Learning

Nine seminal sources converge on six fundamental design principles for performance-based learning: (1) defining clear learning outcomes, (2) designing practice-oriented activities, (3) engaging learners in authentic practice, (4) assessing performance against transparent criteria, (5) providing formative feedback, and (6) supporting continuous improvement (As summarized in Table 1). Most authors emphasize the cyclical nature of feedback and improvement, which appears in more than 75% of the reviewed studies (e.g., (Hattie, 2008; Nicol & Macfarlane-Dick, 2006; Woelk & Lefrere, 2002)). Conversely, "learning through authentic practice" is mentioned less frequently, indicating a potential gap that the present model addresses by incorporating real-world tasks into every learning cycle.

Table 1. Performance-based learning process synthesis.

References	Defining the desired learning outcomes	Designing practice-oriented activities	Through authentic practice	Assessment based on established criteria	Providing feedback	Improvement and development
Woelk and Lefrere (2002)	x	x	x	x	x	x
Hattie (2008)	x	x	x	x	x	
Black and Wiliam (2009)	x	x			x	x
Shute (2008)	x		x	x		x
Yan (2020)	x				x	x
Moore (2008)		x		x		x
Nickel and Osborn (2009)	x		x	x		x
Nicol and Macfarlane-Dick (2006)	x	x	x			x

4.1.2. Synthesis of Experiential Learning

An examination of eight key publications revealed a set of five phases that tend to appear in sequence: experience design, authentic engagement, reflective observation, abstract conceptualization, and active experimentation (see Table 2). Reflection and active experimentation were present in nearly every source reviewed (Kolb & Kolb, 2005; Morris, 2020), reinforcing the idea that looking back on an experience is the step that transforms it into knowledge that can be applied elsewhere. By contrast, only around two-thirds of the studies described the experience design stage in detail. This suggests that careful planning of learning activities is not always given equal attention in the literature. Insights from this finding played a role in shaping the TPACK-EPL model, where the design phase is intentionally placed at the start of the cycle to ensure that learning experiences are planned with purpose from the outset.

Table 2. Synthesis table of experiential learning process.

References	Experience design	Authentic experience engagement	Reflective observation	Abstract conceptualization	Active experimentation
Morris (2020)	x	x	x	x	
Kolb and Kolb (2005)	x		x		x
Vargas-Merino et al. (2025)		x	x	x	x
Burgess (2025)	x	x	x	x	
Maharsi (2017)	x	x		x	x
Leary and Sherlock (2020)	x		x	x	x
Ningrum, Sari, and Kustiyah (2024)		x	x	x	x

4.1.3. Synthesis of TPACK Integrated with Performance-based Learning and Experiential Learning

The integration of the Technological Pedagogical Content Knowledge (TPACK) framework with performance-based and experiential learning represents a significant advancement in instructional design for technology-enhanced learning environments. This combination creates a comprehensive pedagogical approach that leverages the strengths of each framework to deepen learning experiences and support the development of digital competence.

The TPACK framework, first proposed by Mishra and Koehler (2006), highlights the intricate relationships among three core domains of teacher knowledge: Content Knowledge (CK), Pedagogical Knowledge (PK), and

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Technological Knowledge (TK). It asserts that effective technology integration requires not only proficiency in these individual domains but also mastery of their intersections: Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and ultimately, the fully integrated Technological Pedagogical Content Knowledge (TPACK) (Chai, Koh, & Tsai, 2013; Koehler & Mishra, 2009).

Performance-based learning, which focuses on the authentic demonstration of knowledge and skills, offers a practical structure for designing learning activities that lead to the meaningful application of what has been learned (Shute, 2008; Woelk & Lefrere, 2002). In parallel, experiential learning provides a theoretical foundation for explaining how concrete experiences are transformed into abstract conceptualizations through reflection and active experimentation (Kolb & Kolb, 2005; Morris, 2020).

Analysis of Table 3: Synthesis of TPACK with Performance-Based and Experiential Learning.

Table 3 maps the three TPACK knowledge domains, Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK) against the processes drawn from performance-based, blended, and experiential learning. The mapping produces several noteworthy insights.

Universal Knowledge Domain Integration. Every cell in the table contains an "x," indicating that each knowledge domain is essential to every learning process component (Jiang & Liang, 2017; Li et al., 2022). Unlike sequential models that emphasize certain domains at specific stages, this mapping underscores the constant interplay of CK, PK, and TK.

Co-equal Enablement. The even distribution of relevance suggests that technological, pedagogical, and content knowledge act as co-equal enablers rather than a hierarchy (Chao & Fang, 2023; Rahman & Ismail, 2023). For example, when designing practice-oriented activities, instructors must simultaneously align disciplinary content standards (CK), teaching strategies (PK), and technological affordances (TK).

Holistic TPACK orchestration. Full alignment across all thirteen activities affirms that effective experiential performance learning requires continuous orchestration of all TPACK domains (Hu, Zheng, & Fang, 2023; Zhou et al., 2022). For instance, in "assessment based on established criteria," CK defines the standards, PK shapes the instruments, and TK facilitates digital delivery.

Blended Learning Integration. The inclusion of both face-to-face and online components reflects the multimodal nature of modern education, with TPACK guiding transitions between physical and virtual spaces (Bose, Wang, Aliyah, Melati, & Susanto, 2022; Qasem & Viswanathappa, 2016).

Cyclical Process and Interdomain Synergies. The arrangement suggests a cyclical learning process, consistent with iterative improvement in both experiential and performance-based learning (Morris, 2020; Nicol & Macfarlane-Dick, 2006). Each phase demonstrates synergies at TPACK intersections for example, in reflective observation, TK supports digital tools, PK informs prompts, and CK ensures disciplinary focus (Leary & Sherlock, 2020; Maharsi, 2017).

Overall, Table 3 establishes the theoretical foundation for the TPACK-EPL Model, demonstrating that integrating all domains across every phase creates a coherent instructional design that fosters comprehensive digital competence (De Santiago & Martínez, 2022; Fang, Chen, & Li, 2024).

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Table 3. Synthesis table of TPACK combined with performance-based learning and Experiential Learning.

TPACK	Performance-based learning						Blended Learning		Experiential Learning				
	Defining the desired learning outcomes	**Designing practice-oriented activities**	**Learning through authentic practice**	**Assessment based on established criteria**	**Providing feedback**	**Improvement and development**	**Face-to-Face Learning**	**Online Learning**	**Experience design**	**Authentic experience engagement**	**Reflective observation**	**Abstract conceptualization**	**Active experimentation**
CK	x	x	x	x	x	x	x	x	x	x	x	x	x
PK	x	x	x	x	x	x	x	x	x	x	x	x	x
TK	x	x	x	x	x	x	x	x	x	x	x	x	x

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4.1.4. Synthesis of Learning Outcome

Digital competency is consistently conceptualized as a triad of knowledge, skills, and Attitudes (Chiecher, 2020; González Fernández, 2021; Kim et al., 2017; Oberländer et al., 2020). All four studies concur that balanced development across these domains is essential; none advocate skills-only or knowledge-only approaches (see Table 4). The TPACK-EPL Model, therefore, embeds tasks that elicit factual understanding (knowledge), tool manipulation (skills), and dispositions such as creativity and ethical awareness (attitudes), ensuring holistic competency growth aligned with international frameworks.

Table 4. Synthesis table of digital competency components.

References	Knowledge	Skills	Attitudes
Chiecher (2020)	x	x	x
González Fernández (2021)	x	x	x
Kim et al. (2017)	x	x	x
Oberländer et al. (2020)	x	x	x

Table 5. Synthesis table of the Performance Experiential Learning.

Performance-based learning	Experiential learning	Experiential Performance learning
1. Defining the desired learning outcomes	1. Experience design	1. Establishing Learning Goals and Experiences
2. Designing practice-oriented activities	2. Authentic experience engagement	2. Designing Activities Connected to Authentic Experiences
3. Learning through authentic practice	3. Reflective observation	3. Implementation and Reflection on Learning
4. Assessment based on established criteria	4. Abstract conceptualization	4. Concept Formation and Assessment
5. Providing feedback	5. Active experimentation	5. Feedback and Repeated Practice
6. Improvement and development		6. Extension and Application of Learning

4.1.5. Learning Process Using Performance Experiential Learning

Table 5 merges the steps in Tables 1 and 2 into a six-stage Experiential Performance Learning (EPL) cycle:

1. Establishing Learning Goals and Experiences (Outcome-driven design).
2. Designing Activities Connected to Authentic Experiences (Contextualization).
3. Implementation and Reflection on Learning (Guided practice + reflection).
4. Concept Formation and Assessment (Theorization + measurement).
5. Feedback and Repeated Practice (Iterative refinement).
6. Extension and Application of Learning (transfer).

Each stage is explicitly tethered to relevant TK, PK, and CK elements, operationalizing TPACK as the organizing framework of the entire cycle.

4.1.6. Instructor and Learner's Role in Experiential Performance Learning

Roles are distributed across the six EPL stages. Instructors act as designers, facilitators, diagnosticians, and coaches, while learners function as co-designers, active performers, reflective analysts, and self-directed improvers (see Table 6). The table also maps the tangible learning outcomes expected at each stage (e.g., learning logs, concept maps, portfolios). This role matrix ensures aligned responsibilities, supports shared accountability, and fosters learner autonomy, cornerstones of TPACK-grounded experiential pedagogy.

Table 6. Instructor and Learner's Role in Experiential performance learning.

Experiential performance learning	Instructor's Role	Learner's Role	Learning Outcomes
1. Establishing Learning Goals and Experiences	- Analyze curriculum and learning standards - Define clear and measurable learning outcomes - Design learning experiences aligned with goals - Analyze learners' prior knowledge and context	- Participate in establishing learning goals - Share relevant prior experiences - Express interests and learning needs	- Learning plans with explicit objectives - Assessment frameworks aligned with goals - Shared understanding between instructors and learners - Connection between content and real-world contexts
2. Designing Activities Connected to Authentic Experiences	- Create activities linked to real-world situations - Prepare learning media and resources - Design simulations or case studies - Prepare technological requirements and learning environments	- Participate in selecting or customizing activities - Prepare for learning - Study essential background information - Develop foundational skills necessary for activities	- Meaningful and challenging learning activities - Diverse and accessible learning materials - Learning environments conducive to practice - Clear activity implementation guidelines
3. Implementation and Reflection on Learning	- Facilitate activity implementation - Observe and document learning behaviors - Provide guidance and support as needed - Stimulate critical thinking and reflection	- Engage in planned activities - Document outcomes and experiences - Reflect during and after implementation - Share experiences with peers	- Concrete learning experiences - Learning logs and reflections - New insights and understandings - Developed practical skills
4. Concept Formation and	- Assist learners in	- Synthesize knowledge	- Conceptual

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Experiential performance learning	Instructor's Role	Learner's Role	Learning Outcomes
Assessment	connecting experiences to theory - Organize activities for knowledge synthesis - Assess learning according to established criteria - Analyze learners' strengths and areas for improvement	from acquired experiences - Create concept maps or understanding models - Present conceptual understanding - Self-assess according to established criteria	understanding and explanatory models - Products or artifacts demonstrating learning - Quantitative and qualitative assessment results - Deep understanding of content
5. Feedback and Repeated Practice	- Provide specific and constructive feedback - Suggest improvement and development approaches - Support learners in repeated practice - Organize peer feedback exchange	- Consider and analyze feedback - Improve performance based on suggestions - Engage in repeated practice to develop skills - Provide feedback to peers	- High-quality and beneficial feedback - Clear improvement and development plans - Continuously developed skills - Culture of collaborative learning
6. Extension and Application of Learning	- Support knowledge application in new situations - Guide future learning pathways	- Apply knowledge in new contexts - Plan self-directed extended learning	- Knowledge application in diverse contexts - Portfolios or artifacts demonstrating development - Long-term personal learning plans - Sustainable learning networks

4.2. Results of Development TPACK- EPL Model

The TPACK-EPL Model represents a comprehensive instructional framework synthesizing technological, pedagogical, and content knowledge with experiential and performance-based learning principles to enhance learners' digital competency development (Fang et al., 2024; Jiang & Liang, 2017). As illustrated in Figure 1, the model is conceptualized as an iterative double-loop structure that places the learner at the center of the educational experience, emphasizing the learner-centered approach advocated by contemporary educational theories (Kolb & Kolb, 2005; Morris, 2020).

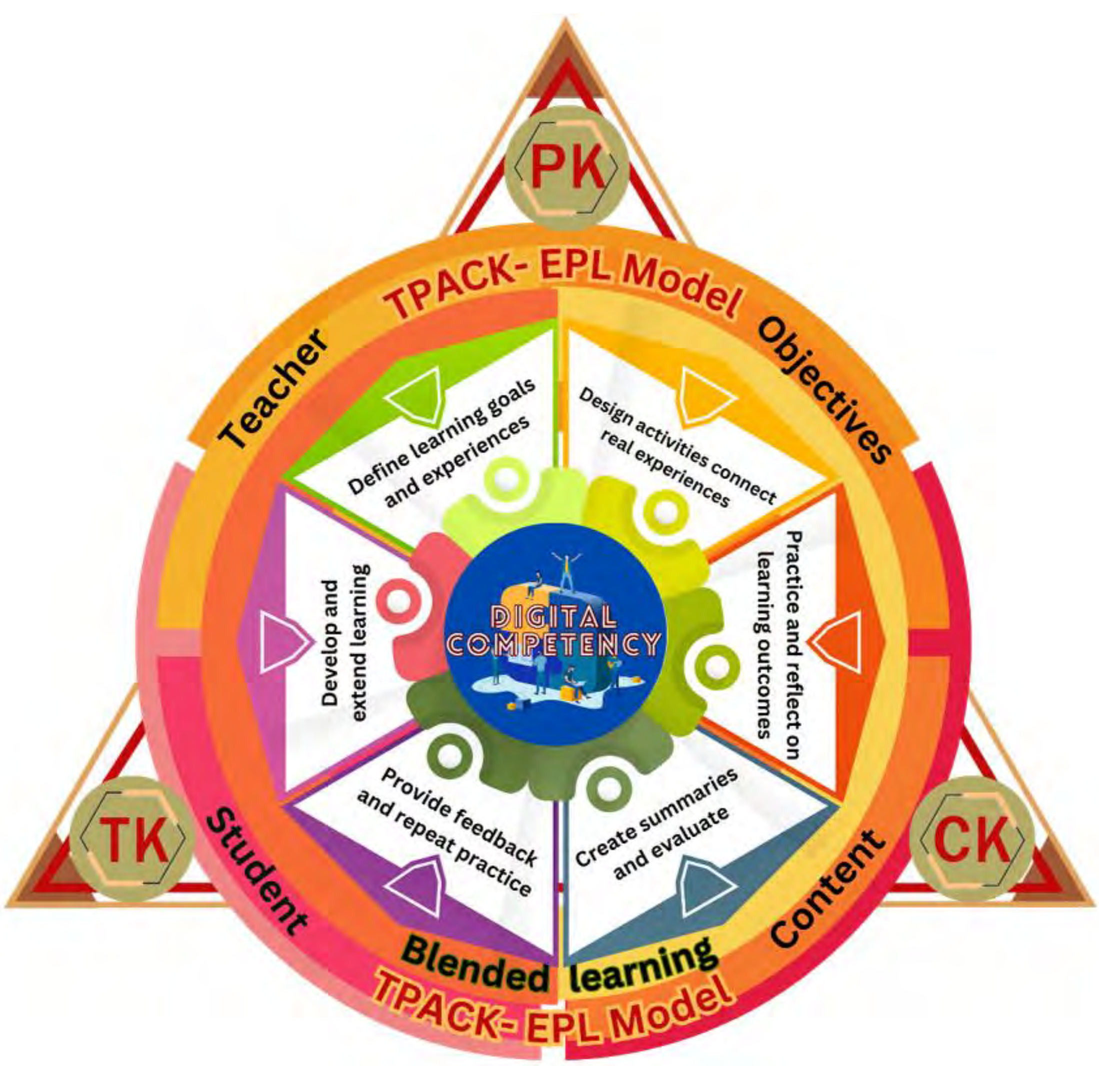

Figure 1. TPACK- EPL model.

4.2.1. TPACK-EPL Model Structure and Components

Figure 1 illustrates the Technological Pedagogical Content Knowledge–Integrated Experiential Performance Learning (TPACK-EPL) model, a learner-centered instructional framework that integrates

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technological, pedagogical, and content knowledge with experiential and performance-based learning principles to enhance digital competency development (Fang et al., 2024; Jiang & Liang, 2017). The model is depicted as an iterative double-loop structure in which the inner loop represents the six sequential stages of the Experiential Performance Learning (EPL) cycle, and the outer loop embodies the TPACK framework as three interlocking gears technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK) that drive each stage of the learning process (Chao & Fang, 2023; Mishra & Koehler, 2006; Zhou et al., 2022).

The inner EPL loop comprises six interconnected stages: (1) defining learning goals and experiences, (2) designing activities that connect to real-world contexts, (3) practicing and reflecting on learning outcomes, (4) creating summaries and conducting evaluations, (5) providing feedback and engaging in repeated practice, and (6) developing and extending learning. This cyclical process enables learners to build progressively advanced digital competencies by integrating authentic tasks, structured reflection, and iterative improvement (Hattie, 2008; Nicol & Macfarlane-Dick, 2006; Shute, 2008; Woelk & Lefrere, 2002).

The outer TPACK loop underscores that technological, pedagogical, and content knowledge operate simultaneously at every stage of the EPL cycle rather than functioning in isolation. For example, during the "practice and reflection" stage, TK supports the selection and application of appropriate digital tools, PK informs the design of reflection activities, and CK ensures disciplinary accuracy (Ercan & Özdemir, 2020).

Radiating arrows connect each EPL stage to the three dimensions of digital competency: knowledge, skills, and attitudes, demonstrating that each learning activity contributes holistically to cognitive understanding, practical capabilities, and ethical dispositions (Chiecher, 2020; Oberländer et al., 2020). This integrated design ensures that digital competency development is embedded throughout the instructional process, supporting learners in becoming adaptive and responsible participants in technology-enhanced environments.

4.2.2. Operational Dynamics of the TPACK-EPL Model

The TPACK-Integrated Experiential Performance Learning (TPACK-EPL) Model operates on the principle that technology-enhanced instruction should be both theoretically grounded and dynamically adaptive. At its core, the model establishes a two-way exchange between the TPACK framework and the Experiential Performance Learning (EPL) cycle, allowing insights from instructional design to directly inform classroom practice, while feedback from the learning process shapes subsequent design decisions (Hu et al., 2023; Kavitha & Anitha, 2024). In the initial design stages, TPACK provides a lens for crafting learning experiences in which technology, pedagogy, and content are deliberately interwoven to foster digital competency (Crespo Hernández, 2023; Rahman & Ismail, 2023). Once these experiences are implemented, evidence drawn from learner engagement and assessment becomes a resource for refining TPACK-related instructional strategies, reflecting the evidence-informed approach recommended by Hernández and Pérez (2019) and Suharyat, Ichsan, Santosa, Yulianti, and Amalia (2022).

The cycle begins with Stage 1: Establishing Learning Goals and Experiences. Here, instructors review curriculum requirements alongside an analysis of students' prior knowledge to identify clear, measurable objectives. These objectives are explicitly aligned with recognized digital competency frameworks (Black & Wiliam, 2009; Woelk & Lefrere, 2002). Importantly, this stage invites students to take an active role in the goal-setting process, drawing on their own experiences and expectations. Such involvement helps cultivate a sense of ownership and metacognitive awareness, which research has linked to more sustained engagement (Nickel & Osborn, 2009; Yan, 2020).

In Stage 2: Designing Activities Connected to Authentic Experiences, instructors translate learning goals into real-world scenarios that position digital tools within meaningful disciplinary contexts (Burgess, 2025; Morris, 2020). At this point, the TPACK domains work in unison: content knowledge ensures disciplinary accuracy, pedagogical knowledge shapes engagement strategies, and technological knowledge identifies the most suitable digital resources (Bose et al., 2022; Gan et al., 2020). The resulting activities are intended not simply as exercises but as immersive experiences that mirror the kinds of challenges learners might encounter beyond the classroom.

Stage 3: Implementation and reflection on learning shift the focus to active participation. Learners engage with the planned activities while also being encouraged to pause, observe, and critically reflect on their experiences (Kolb & Kolb, 2005; Ningrum et al., 2024). Reflection prompts are structured to draw explicit connections between theory and practice, ensuring that students move beyond merely completing tasks toward a deeper conceptual understanding (Leary & Sherlock, 2020; Maharsi, 2017).

During Stage 4: Concept Formation and Assessment, students consolidate their experiences into conceptual models, projects, or other artifacts that serve as evidence of learning (Burgess, 2025; Vargas-Merino et al., 2025). Assessment at this stage moves beyond checking procedural accuracy to evaluate how well learners integrate knowledge, skills, and attitudes, a triad recognized as central to digital competency (Moore, 2008; Shute, 2008).

The emphasis on Stage 5: Feedback and Repeated Practice reflects the model's commitment to iterative learning. Feedback, whether from instructors or peers, is designed to be specific, actionable, and constructive (Hattie, 2008; Nickel & Osborn, 2009). Opportunities for re-engagement with tasks not only allow skill refinement but also help students develop the evaluative judgment needed for responsible participation in digital environments (Black & Wiliam, 2009; Yan, 2020).

Finally, Stage 6: Extension and Application of Learning focuses on the transferability of learning. Learners are encouraged to apply their newly developed competencies in unfamiliar contexts, demonstrating adaptability and problem-solving beyond the original learning setting (Moore, 2008; Woelk & Lefrere, 2002). This may involve independent projects, collaborations with external communities, or the creation of digital portfolios that document growth across all domains of digital competency (Maharsi, 2017; Nickel & Osborn, 2009).

By structuring the learning process in this way, the TPACK-EPL Model ensures that technological,

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pedagogical, and content considerations are not treated as isolatesd design variables but as mutually reinforcing components that operate throughout the cycle. The bidirectional knowledge flow between TPACK and EPL not only supports continuous improvement but also positions learners as active agents in their own competency development.

4.2.3. The Results of an Expert Evaluation of TPACK-EPL Model

Experts who reviewed the TPACK-EPL Model expressed strong confidence in its value for both theory and practice. They awarded an average score of 4.82 (SD = 0.20), showing broad agreement that the framework is practical to implement, well-grounded in educational theory, and directly relevant to building digital competencies (Muyambi & Ncube, 2023; Sahito, Sukri, & Hadi, 2024). Two areas in particular, principles and concepts, and the promotion of holistic digital competence earned perfect ratings (M = 5.00, SD = 0.00). This outcome reflects the depth of the model's conceptual design and its capacity to address knowledge, skills, and attitudes in an integrated way (Chiecher, 2020; Naumeca & Āboliņa, 2023). One area that stood out as needing attention is active learner engagement, which scored 4.40 (SD = 0.49) (Li et al., 2022; Pérez Jiménez & Gómez Aldana, 2024). To raise this figure, instructors might introduce game-based tasks, offer choices within set activities, encourage online collaboration, and connect assignments to topics learners care about or see in the real world (Antonio, 2025; Liu & He, 2022). A defining strength of the model is its consistent use of the TPACK framework at every stage of the experiential performance learning process. By maintaining the connection between technology, pedagogy, and content considerations, the approach supports decisions grounded in sound teaching practices and subject relevance (Cao, Li, & Guo, 2021; Zhou et al., 2022). This balance also reduces the risk of adopting digital tools simply for novelty, ensuring that their use is tied to clear instructional benefits (Ercan & Özdemir, 2020; Qasem & Viswanathappa, 2016).

Table 7. The results of an expert evaluation.

Evaluation list	**Evaluation results**		**Suitability**
	Mean	**S.D.**	
1.To what extent are the principles and concepts in developing the TPACK-EPL Model appropriate?	5.00	0.00	Most
2. Suitability components of the TPACK-EPL Model			
2.1 **Content Knowledge**			
2.1.1 Content is accurately defined according to academic principles	5.00	0.00	Most
2.1.2 Content is appropriate for learners' ability levels	4.80	0.40	Most
2.2 Pedagogical Knowledge			
2.2.1 Various teaching methods are utilized and appropriately aligned with content	4.80	0.40	Most
2.2.2 Learning activities are designed with a learner-centered approach	5.00	0.00	Most
2.3 Technological Knowledge			
2.3.1 Technology is selected appropriately to support learning objectives	4.80	0.40	Most
2.3.2 Various and contemporary technologies are utilized appropriately	4.60	0.49	Most
3 Learning Roles and Contexts			
3.1 Instructor's Role			
3.1.1 The instructor prepares content and learning resources adequately	5.00	0.00	Most
3.1.2 The instructor functions as a learning facilitator	4.80	0.40	Most
3.2 Learner's Role			
3.2.1 Learners participate in establishing learning goals	4.60	0.49	Most
3.2.2 Learners actively engage in learning activities	4.40	0.49	Much
3.3 Learning Objectives			
3.3.1 Learning objectives are clearly defined and measurable	4.80	0.40	Most
3.3.2 Learning objectives align with digital competence development	5.00	0.00	Most
3.4 Blended Learning			
3.4.1 There is an appropriate integration of onsite and online learning environments	5.00	0.00	Most
3.4.2 Digital tools are utilized to support both synchronous and asynchronous learning	4.80	0.40	Most
4. Experiential Performance Learning Process			
4.1 Define Learning Goals and Experiences	4.80	0.40	Most
4.2 Design Activities that Connect Real Experiences	4.80	0.40	Most
4.3 Practical Reflection Learning Outcome	4.80	0.40	Most
4.4 Create Summaries and Evaluate	4.80	0.40	Most
4.5 Provide Feedback and Practice	5.00	0.00	Most
4.6 Develop and Extend Learning	4.80	0.40	Most
5 Digital Competency Development			
5.1 Knowledge Domain			
5.1.1 Learners demonstrate knowledge and understanding of digital technologies	4.80	0.40	Most
5.1.2 Learners comprehend the operational principles and applications of digital tools	4.80	0.40	Most
5.2 Skills Domain			
5.2.1 Learners exhibit proficiency in searching, evaluating, and creating digital content	4.80	0.40	Most
5.2.2 Learners can solve problems and collaborate effectively through digital tools	4.60	0.49	Most
5.3 Attitudes Domain			
5.3.1 Learners demonstrate creativity and openness to innovation	4.80	0.40	Most
5.3.2 Learners exhibit ethical awareness and responsibility in technology usage	4.60	0.49	Most
5.4 Holistic Digital Competency Development			
5.4.1 Digital competency is developed in a holistic manner	5.00	0.00	Most
5.4.2 Learners can apply digital competencies in authentic contexts	5.00	0.00	Most
Overall	**4.82**	**0.20**	Most

Table 7 presents the results of the expert evaluation of the TPACK-EPL Model. The findings indicate a high overall suitability score (M = 4.82, SD = 0.20), reflecting the model's theoretical soundness and practical applicability. Perfect scores (M = 5.00) are observed in key areas such as principles and concepts, holistic digital competency development, and several aspects of content and pedagogical knowledge, underscoring the model's strong conceptual foundation. Most other dimensions, including technological knowledge, instructor roles, and

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blended learning integration, receive very high ratings (M = 4.60–4.80). Only one dimension, learners' active engagement, records a relatively lower mean score (M = 4.40, SD = 0.49), though it is still rated as "Much suitable." These results demonstrate that the model is consistently regarded as highly relevant, well-structured, and effective in promoting digital competence across knowledge, skills, and attitudes.

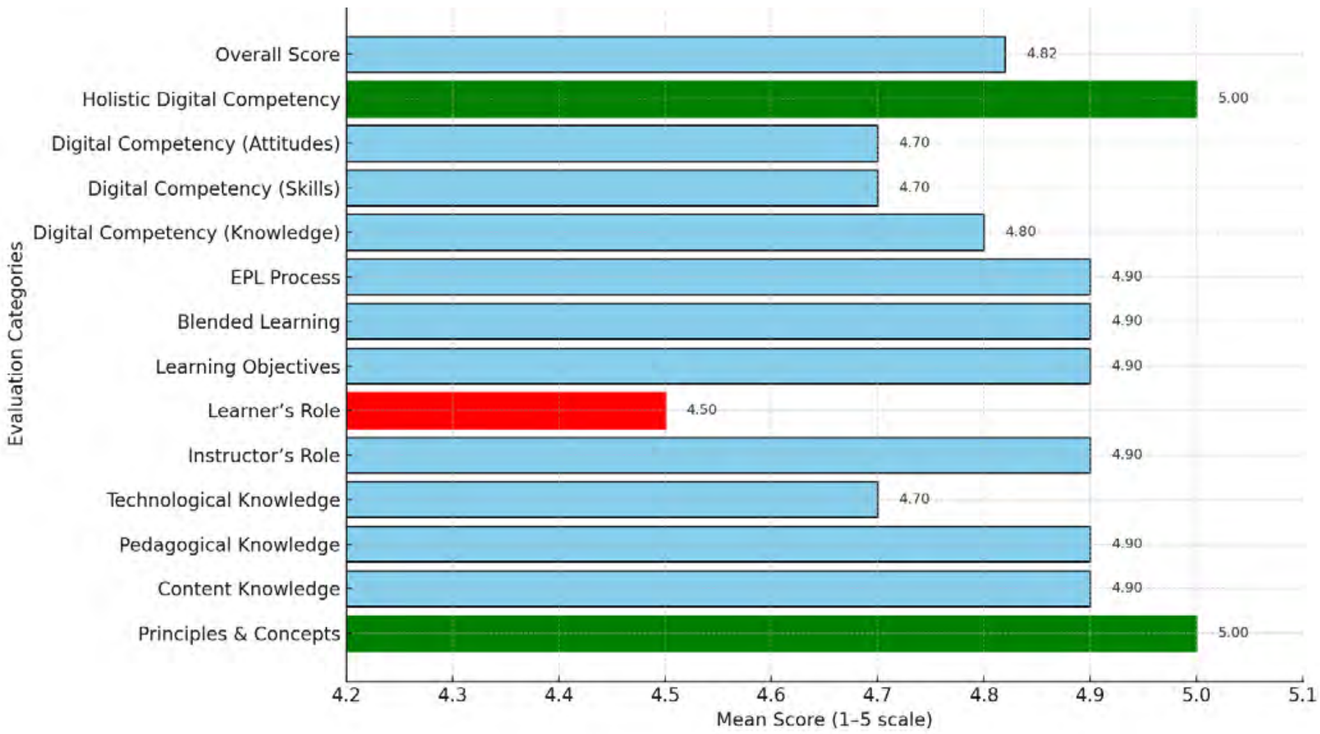

Figure 2. Expert evaluation results of the TPACK-EPL model across key dimensions.

Figure 2 presents the mean scores of the expert evaluation for the TPACK-Integrated Experiential Performance Learning (TPACK-EPL) Model. The results consistently show high ratings across all dimensions, with the highest scores observed for principles and concepts, as well as holistic digital competency development (M = 5.00). Most categories, including content knowledge, pedagogical knowledge, blended learning, and instructor roles, received very strong evaluations (M = 4.80–4.90). The lowest score was assigned to learners' active engagement (M = 4.40), though it still reflects a rating of "much suitable." These findings highlight the model's theoretical soundness, instructional applicability, and capacity to support the holistic development of digital knowledge, skills, and attitudes, while also suggesting the need to strengthen further strategies that enhance learner participation.

5. Discussion

The TPACK-EPL Model offers a distinctive integration of the TPACK framework with principles drawn from experiential and performance-based learning, aiming to advance the development of learners' digital competence. Rather than treating these elements as separate, the design maps each dimension of TPACK to a six-phase experiential performance learning cycle and defines the specific roles of both instructors and learners at every stage. This arrangement enables the creation of technology-enhanced activities that remain pedagogically aligned while directly linked to competency outcomes.

A foundation built on established learning theories and instructional design practices, combined with a targeted emphasis on digital competence, positions the model as a meaningful contribution to current discourse on technology-supported, competency-based education (Albeta et al., 2023; Gan et al., 2020; Kim et al., 2017). By extending prior research on TPACK and experiential learning (Jiang & Liang, 2017; Maharsi, 2017) into the interconnected domains of knowledge, skills, and attitudes (Chiecher, 2020; González Fernández, 2021; Oberländer et al., 2020) the model offers a coherent pathway for comprehensive digital literacy growth.

Evaluation by a panel of experts yielded consistently high ratings across all criteria. Perfect scores for principles and concepts and holistic digital competency development indicate that the framework effectively synthesizes theoretical foundations with the multidimensional aspects of digital competence. The indicator for active learner engagement, while still rated as suitable, received the lowest mean score, suggesting an opportunity for refinement during practical application.

Several limitations warrant attention. The development of the framework relied primarily on a systematic literature review and expert judgment, leaving room for empirical trials in varied educational contexts to further confirm its effectiveness and adaptability. Although the expert panel represented a range of specialisations, the relatively small number of participants limits the breadth of evaluation. A primary focus on digital competence may also restrict immediate applicability to other fields; however, the integration of TPACK with experiential performance learning principles holds potential for adaptation to other competency-based domains.

Future investigations should examine the framework through longitudinal studies, comparative analyses with alternative instructional models, and qualitative inquiries into the experiences of instructors and learners. Such research could provide a deeper understanding of its long-term impact and practical implications.

For educators, curriculum designers, and researchers, the TPACK-EPL Model delivers a structured approach to aligning technology, pedagogy, and content with authentic, reflective learning tasks. Teachers can employ the framework to guide the creation of TPACK-informed performance activities. Instructional designers may adapt its principles to develop comprehensive digital competence programs, and researchers can extend the theoretical base

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to explore the interplay among TPACK, experiential learning, and performance assessment in fostering digital literacy for the 21st century.

6. Conclusion

This research introduced and empirically validated the TPACK-Integrated Experiential Performance Learning (TPACK-EPL) framework. This innovative pedagogical model consolidates Technological Pedagogical Content Knowledge (TPACK) theory, experiential learning principles, and performance-oriented instructional approaches to foster digital literacy competencies among learners. The framework encompasses a comprehensive six-stage experiential learning progression that systematically aligns TPACK theoretical constructs with authentic learning experiences, reflective practices, and competency-driven educational activities, while delineating the responsibilities of educators and students. Expert validation results demonstrated consistently elevated assessment scores across all evaluative criteria (M = 4.82, SD = 0.20), substantiating the model's theoretical rigor, instructional viability, and congruence with comprehensive digital competency cultivation objectives.

The principal contributions of this investigation highlight the TPACK-EPL framework's ability to provide systematic guidance for educational practitioners and curriculum developers in establishing organized, student-centered learning environments that foster digital knowledge acquisition, applied skill development, and ethical awareness. This framework advances contemporary instructional design scholarship by reconceptualizing TPACK beyond its traditional educator-focused application to a comprehensive organizational schema for advancing learner competency.

Nevertheless, several methodological constraints warrant acknowledgment. Initially, the validation methodology relied exclusively on expert consultation without empirical implementation within authentic educational settings. Furthermore, despite the disciplinary diversity represented among the expert panel, the restricted sample of five participants potentially constrains the external validity of the assessment outcomes. Additionally, the framework's current application domain remains confined to digital competency development and may necessitate modifications to accommodate broader pedagogical objectives.

Subsequent investigations should prioritize empirical validation of the TPACK-EPL framework across diverse educational environments, encompassing elementary, secondary, and post-secondary institutional contexts. Longitudinal research designs could examine the framework's influence on the sustained progression of digital competency among learners. Moreover, comparative analyses with alternative instructional paradigms and qualitative explorations of educator and learner implementation experiences could contribute to refining the model and enhancing its practical applicability.

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Appendix A.

Table 1A. 34-Item expert evaluation rubric for the TPACK-EPL model.

No.	Evaluation Criteria	Dimension
1	The model is based on sound theoretical principles.	Principles and Concepts
2	The overall structure of the model is coherent and logical.	Principles and Concepts
3	The content knowledge is accurate and clearly defined.	Content Knowledge (CK)
4	The content is suitable for learners' ability levels.	CK
5	Pedagogical methods are appropriately selected and aligned with learning goals.	Pedagogical Knowledge (PK)
6	Learning activities reflect a learner-centered approach.	PK
7	Technologies are appropriately selected to support learning goals.	Technological Knowledge (TK)
8	Technologies used are current and relevant.	TK
9	The instructor's role is clearly defined across learning phases.	Instructor Role
10	The instructor facilitates learning effectively.	Instructor Role
11	Learners participate in establishing learning goals.	Learner Role
12	Learners are actively engaged throughout the process.	Learner Role
13	Learning goals are specific, measurable, and aligned with digital competency.	Learning Goals
14	The model appropriately integrates online and face-to-face learning modes.	Blended Learning
15	Digital tools are used effectively for synchronous/asynchronous learning.	Blended Learning
16	Phase 1: Establishing Learning Goals is clearly structured.	EPL Process
17	Phase 2: Activities are authentically linked to real-world contexts.	EPL Process
18	Phase 3: Learners engage in practice and reflection.	EPL Process
19	Phase 4: Conceptualization and assessment are well-integrated.	EPL Process
20	Phase 5: Feedback mechanisms are clearly described and actionable.	EPL Process
21	Phase 6: Learners are guided to extend and apply their learning.	EPL Process
22	The model facilitates knowledge acquisition in digital technologies.	Digital Competency - Knowledge
23	Learners comprehend how digital tools operate and can apply them.	Digital Competency - Knowledge
24	Learners can search, evaluate, and create digital content.	Digital Competency - Skills
25	Learners collaborate and solve problems using digital tools.	Digital Competency - Skills
26	Learners show creativity and openness to innovation.	Digital Competency - Attitudes
27	Learners demonstrate ethical use and responsibility in digital contexts.	Digital Competency - Attitudes
28	The model supports holistic development across knowledge, skills, and attitudes.	Holistic Digital Competency
29	Learners can apply digital competencies in authentic tasks.	Holistic Digital Competency
30	The graphical representation (model diagram) effectively conveys the structure.	Visual Clarity
31	The model allows adaptation to various educational levels and contexts.	Applicability
32	The evaluation rubric covers all important dimensions of the model.	Evaluation Validity
33	The rubric is easy for experts to understand and use.	Evaluation Validity
34	The evaluation process contributes meaningfully to model validation.	Overall Evaluation

Scoring Scale:
1 = Poor | 2 = Fair | 3 = Good | 4 = Very Good | 5 = Excellent

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Table 1A presents the 34-item expert evaluation rubric developed to assess the TPACK-EPL Model. The rubric covers multiple dimensions, including theoretical principles, content knowledge, pedagogical knowledge, technological knowledge, instructor and learner roles, learning objectives, blended learning integration, experiential performance learning processes, digital competency development, holistic competency growth, and visual clarity. Each item is structured around specific criteria to ensure comprehensive coverage of the model's conceptual soundness, instructional applicability, and evaluative validity. By organizing the rubric into these domains, the table provides a transparent framework for expert reviewers to evaluate the model consistently and systematically.

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