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Integrating Design Thinking into Blended Learning to Develop Critical Thinking in Thai General Practitioners

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ABSTRACT

This study developed and piloted a blended learning model integrating design thinking to enhance critical thinking skills among Thai general practitioners (GPs), for whom such skills are essential yet challenging to cultivate. Using a two-phase research and development approach, the model was first drafted and validated by an expert panel (n = 5), receiving high ratings for quality and appropriateness (M = 4.57, SD = 0.21). Subsequently, a single-arm pilot study with 30 Thai GPs demonstrated significant post-intervention improvements in both knowledge (from M=55.56 to M=71.36, p<.001) and critical thinking skills (from M=3.36 to M=4.86, p<.001). The findings confirm the model's feasibility and initial effectiveness, providing a strong rationale for a future randomized controlled trial

Keywords: Blended learning; Critical thinking; Design thinking; Medical education; Professional development; Thailand

INTRODUCTION

Worldwide, more than one million new health professionals are trained annually in various selective medical, nursing, midwifery, and public health programs. The production of health professionals is distributed unevenly around the world, with some countries hosting hundreds of medical schools while others have none (Frenk et al., 2010). Investment in health professional education is modest, accounting for less than 2% of global health expenditure, with wide variations in the cost and quality of health worker training across regions. Despite innovative initiatives, weak stewardship and inadequate research capacity continue to hinder evidence-based reform in the education of the health workforce (Correia et al., 2025).

Moreover, critical thinking (CT) is the foundation for clinical reasoning (Araújo et al., 2024), enabling physicians to navigate the increasingly complex and uncertain issues inherent in modern medical practice (Macauley et al., 2017). This imperative for higher-order reasoning is central to the emerging global consensus on reforming health professions education in a manner that better meets the needs of modern health systems (Frenk et al., 2010). It encompasses the intentional, self-regulatory decision to interpret, analyze, and evaluate evidence to reach reasonable decisions concerning patient care (Havenstein, 2024). However, despite broad agreement on its value, fostering essential critical thinking skills (CTS) in practicing clinicians remains one of the field's most outstanding deficiencies (Batarfi & Agha, 2025), often hamstrung by didactic norms that emphasize knowledge acquisition and retention over cognitive skill acquisition (Ho et al., 2023).

These needs are particularly challenging for general practitioners (GPs) learning integrative medicine, where it is necessary to integrate conventional and complementary approaches to medical care, contextualize care to individual patients, and exercise reasoned judgement from a vast and sometimes conflicting evidence base (Frenk

et al., 2010; Rakel & Minichiello, 2022). Furthermore, conventional training programs struggle to address these needs, as large cohort sizes limit personalized feedback, and time constraints restrict opportunities for the deep, reflective practice required to hone CTS.

However, two pedagogical approaches provide opportunities to address these challenges. One is blended learning (BL), which combines online digital media with traditional face-to-face teaching practices. Blended learning has emerged in recent times as a potent approach to health professions education (Lockey et al., 2022). BL also allows for the combination of flexible, scalable, self-paced online learning with valuable on-site time reserved for interactive, applied learning, an essential component in developing HOTS (Mulenga & Shilongo, 2025). Chien et al. (2024) also confirmed that frequent retraining can maintain high-quality CPR (Cardiopulmonary Resuscitation) skills and that blended refresher training is not inferior to traditional refresher training.

Systematic reviews and meta-analyses have consistently shown BL to be more effective than or at least as effective as traditional, non-blended instruction for knowledge acquisition in health professions (Liu et al., 2016; Lockey et al., 2022). By offering flexibility and scalable, self-paced instruction online, BL frees up valuable on-site time for interactive, applied learning that is crucial for developing HOTS (Pimdee et al., 2024).

Second, design thinking (DT), a human-centered and iterative approach to creative problem-solving, provides a roadmap to promote a critical and innovative mindset in a structured manner (Saeidnia & Ausloos, 2024; Swarup, 2024). Stages of DT (Empathize, Define, Ideate, Prototype, Test), which align with the process of clinical reasoning (Badwan et al., 2018; Deitte & Omary, 2019; Lee & Park, 2021), force learners to gain deep insight into the problem, reframe assumptions, develop evidence-based solutions, and test ideas (Jones, 2024). Similarly, Oliveira et al. (2025) have reported that Design Thinking (DT) has become a promising solution at developing innovative healthcare solutions. However, a gap exists has to how to implement a DT approach at the organizational level and its connection to other innovation management strategies. Although DT originated in other disciplines, it is increasingly attracting the attention of health professions educators as a powerful tool for curriculum development and a teachable skill for students to approach complex healthcare problems (Beaird et al., 2018; McLaughlin et al., 2019; Roberts et al., 2016).

The intersection of BL and DT has high potential but has not been fully leveraged (Amaral & Gamez, 2023; Saliba et al., 2022). BL can efficiently provide basic knowledge (Haftador et al., 2023), while DT-based on-site activities can actualize that knowledge into concrete CT competence (Ericson, 2022; Navarro et al., 2021). Efforts to integrate these concepts and models have been made in previous independent studies, which have found that BL improves knowledge outcomes (Pimdee et al., 2024, 2025) and DT enhances creativity and problem-solving competence in nursing and business education. To our knowledge, however, their intentional integration as pedagogical strengths into a coherent model for physicians within the CT framework is unprecedented.

Therefore, a strong, evidence-based model that draws on the affordances of BL to teach integrative medicine, organized around the DT framework to target CT abilities explicitly, is lacking. This would address specific needs among GPs, namely the need for evidence-based training that accommodates tight timetables and various practice contexts.

Therefore, to address this gap, the present study pursued two objectives: (1) to develop and validate a blended learning model in integrative medicine based on design thinking through expert review, and (2) to conduct a pilot study evaluating its preliminary efficacy and feasibility in enhancing knowledge and CTS among Thai GPs.

RESEARCH METHODS

Research Design

This study employed a research and development (R&D) design in two phases to develop, validate, and evaluate a BL model in integrative medicine based on DT, aiming to promote critical thinking among Thai GPs. Phase 1 involved model development and validation, while Phase 2 piloted the model to assess its feasibility and preliminary effectiveness.

Phase One: Model Development and Validation

Step 1: Drafting the Model

A draft training model was developed through a workshop with five experts in integrative medicine and medical education who were purposively selected (Wang et al., 2025). The data used were recorded by using a model draft form with an Index of Item–Objective Congruence (IOC) of 1.00. The data were analyzed by content analysis. An overview of the drafted EDIPT model is shown in Figure 1.

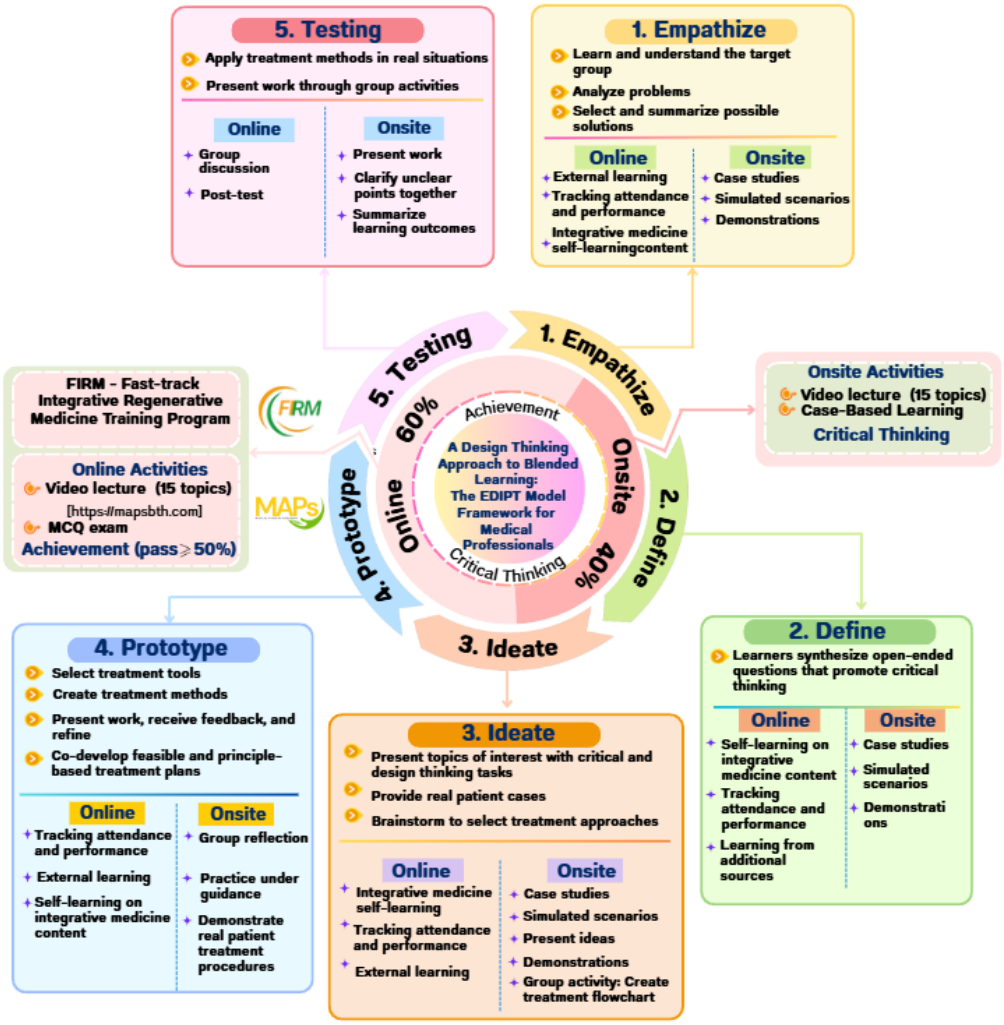

Figure 1. The Proposed EDIPT Model for Medical Professionals.
Source: *The Authors*

Step 2: Expert Validation

The expert group examined and verified the quality of the draft model. The same structured evaluation form was completed to evaluate the quality of the draft model, which received an IOC of 1.00. Quantitative data from the experts' ratings were analyzed using mean (M) scores and standard deviations (SD). While this small expert reference group can be viewed as a constraint in terms of representation, the iterative process followed here is appropriate to the R&D research cycle in early-stage model development (Sukkamart et al., 2024; Wang et al., 2025).

Phase 2: Pilot Study to Evaluate the Model's Efficacy

A pilot study was conducted to test the feasibility and preliminary impact of the model with 30 purposively sampled Thai GPs. Such a design suits innovative and early-stage education, albeit one that does not guarantee generalizability as described in the Discussion (Yoon et al., 2022). The EDIPT-based blended learning program consisted of 60% online modules and 40% on-site workshops (Vallée et al., 2020). The online modules covered most of the core content. The on-site workshops focused on applied activities, namely case studies, prototyping exercises, and small-group discussion sessions.

Instruments

Learning Achievement Test

Knowledge acquisition was assessed using a 75-item multiple-choice test explicitly developed for this study (Table 1). The instrument was structured into 15 thematic domains central to integrative medicine: (1) anatomy and embryology, (2) inflammation and hormonal imbalance, (3) digestion, absorption, and metabolism, (4) cell biology and genetics, (5) immunology, (6) pathophysiology, (7) pharmacology, (8) philosophy of integrative medicine, (9) integrative diagnostic processes, (10) detoxification (chelation therapy and colon cleansing), (11)

intravenous antioxidants and injectable nutrients, (12) nutrition and supplements, (13) ozone therapy and hyperthermia, (14) introduction to cell therapy, and (15) contemporary Thai traditional medicine. Each domain contributed five items, giving comprehensive coverage of foundational science, diagnostic principles, and therapeutic approaches. Structured multiple-choice instruments are widely recognized as a reliable method for assessing knowledge in medical education (Schuwirth & van der Vleuten, 2011; Case & Swanson, 1998), and their adaptation to integrative medicine domains reflects international trends toward incorporating complementary, nutritional, and traditional medicine into competency-based training (Frenkel & Borkan, 2003; Gray et al., 2019; Charoensup et al., 2022).

Items were mapped to cognitive levels according to Bloom's taxonomy, spanning from factual recall to application, analysis, and evaluation (Assaly & Smadi, 2015). For example, questions in anatomy and cell biology primarily targeted recall and comprehension, while case-based questions in pathophysiology and diagnostic processes required analysis and evaluative reasoning. This design ensured the instrument moved beyond rote memorization to probe the application of knowledge in authentic clinical contexts.

The test demonstrated strong psychometric properties. Content validity was established through expert review, yielding IOC values between 0.80–1.00. Item difficulty indices ranged from 0.36–0.64, indicating a balanced distribution across easier and more challenging items. Discrimination indices ranged from 0.36 to 0.78, confirming that the items effectively differentiated between higher- and lower-performing learners. Internal consistency reliability was excellent (Cronbach's $\alpha = 0.98$). Table 1 summarizes the distribution of items across content domains and example cognitive levels.

Table 1. Distribution of the 75-Item Learning Achievement Test by Content Domain**.**

Domain	Items	Cognitive focus
Anatomy & embryology	5	Recall, comprehension
Inflammation & hormonal imbalance	5	Application, analysis
Digestion, absorption & metabolism	5	Recall, application
Cell biology & genetics	5	Recall, comprehension
Immunology	5	Application, evaluation
Pathophysiology	5	Application, analysis
Pharmacology	5	Recall, application
Philosophy of integrative medicine	5	Comprehension, evaluation
Integrative diagnostic processes	5	Analysis, evaluation
Detoxification (chelation & colon cleansing)	5	Application, analysis
Intravenous antioxidants & nutrients	5	Application, evaluation
Nutrition & supplements	5	Recall, application
Ozone therapy & hyperthermia	5	Application, analysis
Introduction to cell therapy	5	Comprehension, evaluation
Thai traditional medicine	5	Application, evaluation
Total	75	—

Two sample items are provided below to illustrate the style and level of questioning:

- ***Sample Item 1 (Recall – Anatomy & Embryology)*** - Which embryonic germ layer gives rise to the epithelial lining of the gastrointestinal tract? a) Endoderm b) Mesoderm c) Ectoderm d) Neural crest
- ***Sample Item 2 (Application/Analysis – Pathophysiology)*** - A patient presents with fatigue, pallor, and shortness of breath. Laboratory tests reveal a hemoglobin level of 8 g/dL and a mean corpuscular volume (MCV) of 72 fL. Which of the following is the most likely underlying condition? a) Iron-deficiency anemia b) Vitamin B12 deficiency c) Aplastic anemia d) Hemolytic anemia

The complete 75-item instrument, including all items, answer options, and cognitive mapping, is provided as an online supplementary file to ensure transparency and replicability.

Critical Thinking Skills (CTS) Assessment

Critical thinking was assessed using a performance-based task in which participants analyzed a complex clinical case. Two independent raters scored responses using a validated rubric targeting analysis, inference, and evaluation. Simulation-based assessments of this type are increasingly recommended in health professions education as authentic measures of higher-order reasoning (Foronda et al., 2020). Inter-rater reliability was excellent (ICC = 0.98).

Intervention: The EDIPT's Blended Training Model

The EDIPT model integrates the five stages of design thinking (Empathize, Define, Ideate, Prototype, Test) (Kustiarini & Alquriyah, 2025), within a BL structure (online 60% and on-site 40%). Each stage of DT constitutes the CT task objectives and is linked to different learning activities.

- ***Empathize:*** Case studies and simulated scenarios built contextual understandings and fostered skills of analysis and inquiry.
- ***Define:*** Facilitated workshops supported synthesis and problem framing, with a focus on interpretation and causal planning.
- ***Ideation:*** Brainstorming and decision-flowchart construction promoted evaluation and inference.
- ***Prototype:*** Participants experimented with treatment planning and benefited from each other's understanding through peer learning, exploratory learning, and formative assessment, applying skills by actively synthesizing and explaining their reasoning.
- ***Test:*** The plans were enacted in simulated or practice-based settings, following group and individual reflection that focused on evaluation and improvement.

Asynchronous online modules delivered core content and afforded flexible, self-paced learning, while the synchronous on-site workshops fostered collaboration and authentic problem-solving. Such a blended structure was to promote higher-order cognitive activities and sustained iterative performance.

Data Analysis

Descriptive statistics (*M, SD*) were computed for all outcome variables. Paired-samples t-tests were used to compare pre- (T1) and post-intervention (T2) scores (Roesler et al., 2025). Assumptions of normality were tested and met. The results of this pilot study are best interpreted as early evidence supporting feasibility and potential efficacy, rather than definitive outcomes that can be generalized.

Ethical Considerations

This study analyzed non-vulnerable populations; data that can identify a person was not collected, and no intervention was performed. This study was thus exempted from formal ethics review according to Thailand's *Guidelines for Conducting Human Subjects Research in Behavioral Science, Social Sciences, and Humanities* (Phuangsuwan et al., 2024). The study was conducted in accordance with the Declaration of Helsinki and the study and obtained exemption approval from the authors' university ethics committee (EC-KMITL_68_132). Participation was voluntary, informed consent was obtained, and all data were anonymized. The researchers were neither supervisors nor involved in the evaluation of any of the participants, thereby minimizing the power imbalance. The authors also acknowledge their roles as medical educators and the attendant implications of this positionality. Bias in the data was mitigated through the use of standardized instruments and independent external validation by multiple experts (Wang et al., 2025).

RESULTS

Participant Characteristics

The study included 30 Thai general practitioners. Slightly more than half of the participants were male (53.3%), while 46.7% were female. A majority held a bachelor's degree (60.0%), with the remaining 40.0% having earned a master's degree. In terms of clinical experience, 40.0% had worked for 6–10 years, 33.3% for more than 16 years, 10.0% for 11–15 years, and 16.7% for 1–5 years.

Phase 1: Model Validation

Expert review confirmed the appropriateness and feasibility of the proposed design-thinking-based blended learning model. The overall *M* rating was 4.57 (*SD* = 0.21) on a 5-point scale, with all components—Instructor, Learner, Activities, Resources, and Evaluation—rated at the highest quality level (Table 2).

Table 2. The EDIPT's Model Quality Assessment Results, as Evaluated by Expert Reviewers (*n* = 5).

Components assessed	*M*	*SD*	Interpretation
1. Instructor	4.67	0.50	Highest Level
2. Learner	4.44	0.52	Highest Level
3. Activity: Instructional activities based on the design thinking concept	4.78	0.44	Highest Level
4. Resources	4.56	0.52	Highest Level
5. Evaluation	4.44	0.52	Highest Level
Overall	**4.57**	**0.21**	Highest Level

Phase 2: Preliminary Efficacy

All 30 participants completed the pilot program. Both knowledge and CT scores improved significantly from the pre-test to the post-test (Table 3) (Roesler et al., 2025). Knowledge scores increased from $M = 55.56$ ($SD = 2.29$) to $M = 71.36$ ($SD = 2.20$), $t(29) = 26.69$, $p < .001$.

Critical thinking scores also rose substantially, from $M = 3.36$ (SD = 0.49) to $M = 4.86$ ($SD = 0.31$), $t(29) = 11.83$, $p < .001$. These results indicate a marked improvement in participants' ability to apply higher-order reasoning and analysis following the intervention.

Table 3. Pre- and Post-Test Scores for Knowledge and Critical Thinking ($n = 30$).

Measure	Testing	*n*	Max Score	*M*	*SD*	*t*	*p*-value
Knowledge Test	Pre-test	30	75	55.56	2.29	26.69**	< .001
	Post-test	30	75	71.36	2.20		
Critical Thinking Test	Pre-test	30	5	3.36	0.49	18.53**	< .001
	Post-test	30	5	4.86	0.31		

Note. *p < .01.*

DISCUSSION

Summary of Key Findings and Model Validation

This study achieved both of its stated objectives. First, the BL model integrating DT in integrative medicine was successfully developed and validated through expert review, with all components rated at the highest quality level. Second, the pilot study with Thai GPs demonstrated promising preliminary efficacy, with statistically significant improvements in both knowledge acquisition and CTS.

Model Validation and Expert Consensus

Marked consistency in high ratings from the expert panel suggested that the model was not only conceptually coherent, but was interpreted as being relevant and applicable to the intended educational context. Such credible content and face validity lend confidence that the framework can be transferred into applied training settings. The findings align with a growing trend to recognize DT as a pedagogical approach well-suited to health professions education (Beaird et al., 2018; Deitte & Omary, 2019; Lee & Park, 2021; McLaughlin et al., 2019; Roberts et al., 2016).

Efficacy Outcomes and Their Interpretation

The observed gains are noteworthy. Knowledge scores increased by over 15 points, demonstrating that the blended design-thinking-based approach effectively supported content mastery (do Amaral & Gamez, 2023). Similarly, CT scores showed a substantial improvement, rising from a mean of 3.36 to 4.86 out of 5.

These results are consistent with the literature, which demonstrates that BL outperforms traditional methods in medical education (Vallée et al., 2020) and that DT can foster HOTS by engaging learners in iterative, problem-solving activities (McLaughlin et al., 2013).

Possible Mechanisms for Success

Our results may be explained by the synergistic strengths of BL and DT (Wang et al., 2025). While asynchronous online modules enabled practitioners' flexible access to core content (Sinclair et al., 2017; Villatoro et al., 2019), in-person collaboration developed participants' capacity to engage in authentic, sophisticated problem-solving with their colleagues. This hybrid approach aligns with established best practices for implementing adult learning principles.

It offers a framework for integrating DT in medical education, which has been widely advocated to help develop medical learners' analytical, evaluative, and creative cognitive reasoning skills. This aligns with broader understanding in medical education, where the success of near-peer teaching also requires careful design decisions that address both feasibility and pedagogical value. The iterative and non-linear process of the DT approach allowed learners to go through local and repetitive cycles of empathizing, defining, ideating, designing, and testing (Rusmann & Ejsing-Duun, 2022; Silva & Zancul, 2023), which accentuated learners' engagement with the complexity of clinical problems (rather than surface memorization efforts) (Auernhammer & Roth, 2021).

These observed mechanisms are in line with general educational research, which has found that DT contributes to creativity (Kalam, 2020), CT (Hashim et al., 2019; Rusmann & Ejsing-Duun, 2022), collaboration (Pulyavina et al., 2022), iterative learning, and metacognition (Rusmann & Ejsing-Duun, 2022; Silva & Zancul, 2023). However, there are challenges in implementing DT, including its resource-intensive and time-consuming nature, as well as the difficulty in defining concrete outcomes in all contexts (Pulyavina et al., 2022). Trade-offs are to be expected and considered, especially when resources are constrained, or steps of DT are omitted or shortened (e.g., to suit continuing education programs). Further work is needed to clarify which features of DT are most important for a given context and how DT models can be adapted to different constraints.

LIMITATION AND FUTURE RESEARCH

As a pilot study with a single-group pre–post design and small sample size (n = 30), generalizability is limited. Future work should include randomized controlled trials with larger samples. While the current assessment tool demonstrated good discrimination and reliability, additional instruments capturing more nuanced dimensions of critical thinking (e.g., diagnostic reasoning, clinical decision-making under uncertainty) would provide deeper insight into participants' development.

CONCLUSION

This pilot study suggests the feasibility and effectiveness of the BL and DT-based training model for Thai GPs in preparation for learning in the digital age, despite its limitations. The training model was validated among experts, yielding high scores (Wang et al., 2025), and the intervention group demonstrated improvements in both knowledge and critical thinking. Although the findings may not be reliably generalized due to their limitations, the findings justify the conduct of future large-scale trials of the training model. Promoting the implementation of learner-centered and problem-driven learning models could help prepare clinicians to meet the complexity and uncertainty of healthcare in the 21st century.

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Informed Consent Statement: Informed consent was obtained from all participants involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

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