Ed Process Int J

www.edupij.com

ISSN 2147-0901 (Print), 2564-8020 (Online)

EDUCATIONAL PROCESS
INTERNATIONAL JOURNAL

Enhancing Thai General Practitioners' Critical Thinking Skills: An Educational Development Needs Assessment

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Research Article

Cite this article: Daengneam, B., Sriwisathiyakun, K., & Sovajassatakul, T. (2025). Enhancing Thai General Practitioners' Critical Thinking Skills: An Educational Development Needs Assessment. *Educational Process: International Journal, 19*, e2025541. https://doi.org/10.22521/edupij.2025.19.541

Received July 25, 2025
Accepted October 30, 2025

Keywords: Critical Thinking Skills, General Practitioners, Needs Assessment, Priority Needs Index (PNI), Thailand

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Abstract

Purpose. This study examined Thai general practitioners' (GPs) actual and expected levels of critical thinking skills (CTS) and identified developmental priorities through an educational development needs assessment (EDNA) using the modified Priority Needs Index (PNImodified).

Methodology. A descriptive survey was conducted with 346 Thai GPs selected through proportional stratified random sampling from five national training institutions. Data were collected using a dual-response questionnaire covering five CTS domains and analyzed using means, standard deviations, dependent-samples t-tests, and a PNImodified gap analysis.

Findings. GPs rated their current CTS as moderate, while expected levels were very high. The greatest developmental need was synthesis of ideas, followed by analytical processing and evaluation of outcomes. These statistically significant gaps underscore an urgent need to enhance higher-order thinking skills (HOTS) in GP training.

Conclusions. The results confirm a considerable CTS gap, with synthesis as the highest priority. Addressing these deficits is essential to strengthening decision-making and holistic care in Thai primary healthcare.

Implications for Research and Practice. The study provides evidence-based guidance for curriculum reform, continuing professional development, and workplace-based assessment. By integrating critical thinking competencies into training frameworks, Thai medical education can better prepare GPs to meet the demands of modern practice.

1. Introduction

Medical professionals who can adapt and apply critical thinking skills (CTS) are now considered to possess a core competency in the healthcare environment (Naamati-Schneider & Alt, 2024; Sornsenee et al., 2024). These skills equip clinicians to probe complex clinical data, make sound decisions under uncertainty, solve complex problems, and rapidly respond to patient challenges (Macauley et al., 2017; Scott et al., 2021). As a result, medical education is moving away from rote memorization toward pedagogies that promote cognitive flexibility, reflectivity, and independence (Facione et al., 2020; Ross et al., 2020).

This transformation is significant in primary care, where GPs are the gatekeepers to the national healthcare systems, such as in Thailand, where non-specific presentations, complex psychosocial contexts, and pressures of rapid triage. It requires effective information gathering and rapid synthesis and analysis to aid clinical reasoning, decision-making, and ultimately improve patient care and outcomes.

However, Thai GPs experience considerable challenges after graduation, including compulsory placements at rural isolated community hospitals with scarce resources, minimal supervision, and diverse patient populations (Mei et al., 2022; Sornsenee et al., 2024). As a result of this structural policy to ameliorate doctor maldistribution, new graduates face difficulty being prepared to work in the frontline with limited resources (Lertrattananon et al., 2019).

However, despite Thailand's curriculum reforms, which place strong emphasis on outcome-based learning, there remains a significant gap in CTS development practice (Thampi & Yongsorn, 2023). Recent local evidence supports that the analytical and reflective components are under-represented compared to procedural knowledge. In one study, Daengneam et al. (2023) reported that integrative medicine programs lacked analytical reflection skills. More recently, Thampi et al. (2024) reported that undergraduates perceived CTS as under-emphasized compared to prioritizing clinical procedural skills. This concern is compounded by further evidence of Thai healthcare students lagging behind international peers in essential CTS dispositions such as truth-seeking and open-mindedness (Chaisuwan et al., 2021). This leaves Thai GPs over-reliant on experience-based learning and keeps them from developing a systematic CTS process (Pimdee et al., 2024; Sireerat et al., 2025).

While interventions such as blended learning (Pimdee et al., 2025) and simulation-based training (Boonmak et al., 2022)show potential to promote CTS, they must be built on a clear, evidence-based assessment of needs. This highlights a critical research gap: while CTS is recognized as a vital competency, large-scale empirical studies investigating CTS deficits among practicing Thai GPs using validated frameworks are sparse. Previous research has primarily focused on students, specialists, or hospital settings, neglecting the frontline general practitioner who is most patients' first point of contact.

To bridge this gap, this study employs a modified Priority Needs Index (PNImodified) to conduct a systematic needs assessment. It aims to quantify and prioritize CTS deficits across five validated domains—problem identification, information collection, analytical processing, synthesis of ideas, and evaluation of outcomes—based on established models of clinical reasoning.

Drawing from identified literature gaps and the conceptual framework, the following research objectives (ROs) and research questions (RQs) have been developed:

RO1: To assess Thai GPs' actual and expected CTS levels across five skill components.

RO2: To prioritize CTS development needs using PNImodified gap analysis.

RO3: To propose the ranked order of CTS components in terms of urgency for future training programs.

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RQ1: What are the actual and expected CTS levels for each of the five components among Thai GPs?

RQ2: Which CTS component represents the highest priority need for development after PNImodified ranking?

RQ3: What statistically significant differences exist between actual and expected CTS levels?

By answering these questions, the present study contributes to the strategic planning of professional development for GPs in Thailand. It provides an empirical basis for the just-in-time revision of curricula, faculty development, and educational resource planning. It also situates Thai medicine within the broader global discourse on critical thinking in 21st-century medical practice.

2. Literature Review

2.1. Educational Development Needs Assessment (EDNA)

A common evaluation framework is the needs assessment model, or more specifically, a particular form of a gap analysis, where the needs assessment compares "what is" with "what should be" knowledge or skills, thereby providing a logical, prioritized basis for developing programs (Bisbal & Eaton, 2023). The discrepancy between the current and wanted conditions must be measured to appropriately identify the need (Sriwisathiyakun, 2024; Ussarn et al., 2022).

In medical education, needs assessments have been used to identify gaps in communication, procedural knowledge, and higher-order thinking skills (HOTS) (Lertsakulbunlue et al., 2025; Tambunan et al., 2024), and to identify and counsel students with mental health issues (Yurayat & Seechaliao, 2021).

Within the context of these educational and professional needs, this study intends to assess critical thinking skill deficits of Thai GPs using a modified Priority Needs Index (PNImodified) in order to prioritize particular skill domains (e.g., problem definition, information collection, analyzing, synthesizing and evaluating information) based on pervasive, classical models of critical thinking developed by scholars such as the Watson-Glaser Critical Thinking Appraisal (WGCTA) model (Arif, 2024) and Dewey's 1910 investigation into ‘How We Think’ and what he labeled as 'critical thinking' (Lau, 2024; Miller et al., 2024), and subsequently adapted to clinical reasoning in particular. Figure 1 reflects the synthesis of these previous concepts on CTS.

EDNAs can evaluate and improve educator training or services, clarify problems effectively, and identify appropriate interventions.

EDNAs can be a desire to improve current performance or to correct a deficiency, which often becomes part of planning processes used to improve individuals, education/training, organizations, or communities. EDNAs can evaluate and improve educator training or services, effectively clarify problems, and identify appropriate interventions.

With the clear identification of problems, finite resources can be directed towards developing and implementing a feasible solution (Sriwisathiyakun, 2024). Gathering sufficient, relevant data informs the development of an effective product that addresses the group's needs and wants. The EDNA is likely to be an iterative process that involves continual product refinement as data are collected and analyzed, and the target audience's specific needs are assessed.

EDNAs are a crucial step in the planning process, as they help determine what needs to be done to achieve the project goal. By accurately describing the 'problem,' the project can address the group's particular needs. A needs assessment often involves making difficult decisions and tradeoffs about what will be included in the assessment and what will be left out.

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Civaner et al. (2022) provided research on how an EDNA could be used in evaluating the use of AI in medical education. Although most medical students perceived AI as a significant benefit, it was interesting to note that nearly half were concerned about the loss of their jobs due to AI replacing their positions, devaluing the medical profession (58.6%), damaging patient trust (45.5%), and negatively affecting patient-physician relationships (42.7%). Thus, an EDNA's results with some very profound findings.

2.2. Higher Education Needs Assessment (HENA)

Regarding Thai education, various studies have highlighted the essential role of HENAs in enhancing cognitive and professional skills development (Al-Ismail et al., 2023). The 'needs assessment' approach is the foundation of most HENA-related research, and it stems from a 1990s United Nations Development Programme (UNDP) in Southeast Asia. For example, many recent HENA-related studies have reviewed stakeholders' needs and expectations by directly contacting them to ask about their objectives, limitations, and other concerns.

In an educational context, Chanyawudhiwan et al. (2023) used the adapted PNImodified model to assess and rank the digital competency needs of students in Thai open universities. Chimnoy et al. (2023) also used the tool to examine the management needs of teachers in private primary schools. In contrast, Choomsri and Chansirisira (2023) used the modified PNI to examine teacher needs concerning their implementation of smart schools, specifically about human resources, support with administration, digital media, and technology.

The PNImodified model has been used as a benchmark for assessing the development of individual needs over time and the extent to which they are being met (Wongwanich & Wiratchai, 2005). The modified PNI model measures the gap between the current and desirable states and indicates the extent of targeted improvement (Chainu et al., 2019; Hongcharoen, 2020; Phetthong, 2022).

2.3. Critical Thinking Conceptual Foundations

Various educational and philosophical traditions have influenced how critical thinking is understood. Watson and Glaser propose critical thinking as the systematic process of evaluating claims through inference, evidence appraisal, logical analysis, and sound judgment. Their definition was central to the development of the Watson-Glaser Critical Thinking Appraisal (WGCTA) (Arif, 2024), which is a type of standardized test that is utilized to assess individual critical thinking skills and is currently used by many educational institutions, job agencies, and organizations (Miller et al., 2024). Previously, Dewey had defined critical thinking as 'reflective thought' (Figure 1), a deliberate inquiry that begins with uncertainty and culminates in reasoned conclusions (Lau, 2024). His view emphasizes the role of self-regulated reasoning and doubt as a catalyst for deeper understanding.

As legacy frameworks within the past have demonstrated, recent ones emphasize five vital dimensions of critical thinking, namely: (1) problem identification, (2) information collection, (3) analytical processing, (4) synthesis of ideas, and (5) evaluation of outcomes (Azmi & Kurniawan, 2025; Facione & Gittens, 2020; Thampi et al., 2024). These components are especially critical in medicine, where decisions often occur in environments marked by complexity, uncertainty, and high risk. Integrative models, such as the Health Sciences Reasoning Test (HSRT) (Huhn, 2024), operationalize these dimensions to measure cognitive readiness and clinical judgment in healthcare education.

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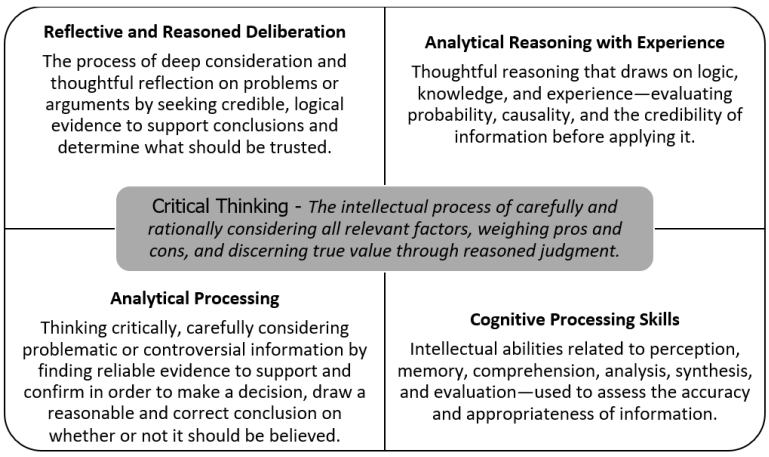

Figure 1. Synthesis of CTS concepts

2.4. General Practitioner Critical Thinking Dimensions

By integrating synthesized conceptual frameworks from international and Thai scholars, five critical thinking components were identified as essential to Thailand's GPs' needs. Derived from Pramonojati et al. (2020), Facione et al. (2020), Palavan and Özcan (2020), Gültepe and Kiliç (2021), and Irwanto et al. (2024), comparison across studies and theoretical integration yield a synthesis of five key skill areas, which are: (1) problem identification, (2) information collection, (3) analytical processing, (4) synthesis of ideas, and (5) evaluation of outcomes. Specifically:

Problem identification - This domain focuses on a person's ability to seek and retrieve relevant information from various sources, such as clinical interviews, observations, diagnostic tools, or other agencies and individuals who supplied information about a client. Knowing how to filter and organize this information in clear and relevant ways for professional tasks and client needs is also a part of this domain. Finding information quickly facilitates accurate assessment and supports practical clinical reasoning in one's judgments.

Information collection - This domain emphasizes the ability to seek and select relevant information from various sources—clinical interviews, observations, diagnostic tools, or secondary reports. Practitioners must be capable of filtering and organizing this data to align with clinical objectives and patient needs. Effective information gathering enhances the accuracy of assessments and forms the basis for further clinical reasoning.

Analytical processing - Analysis involves understanding information, comparing alternatives, and separating facts from opinions, strengths from weaknesses (scientific learning) (Kurniawan & Nawahdani, 2022). It enables GPs to understand explicit and implicit aims, identify unstated assumptions, and identify underlying logic or causal relationships. In medical decision-making, analytical skills are used to decide on the reliability of patient information, test results, and treatment possibilities.

Synthesis of ideas - Synthesis is a CTS or HOTS skill that combines different pieces of information to form a whole by drawing conclusions or making decisions based on what is relevant (Noyes et al., 2019). Synthesizing involves finding patterns in the information, problem-solving, and sifting through it to find meaning and relevance to what is being learnt. In a clinical setting, synthesis of ideas helps understand the patients' situation and enables formulating appropriate actions or interventions (Schick-Makaroff et al., 2016).

Evaluation of outcomes - The ability to judge the viability, appropriateness, and probability of the success of an inferred solution is closely linked to the ability to evaluate (Dadelo, 2025). This judgment incorporates all the previously listed skills and a healthy skepticism of the solution or the data on

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which the evaluation is based. These skills are intertwined fundamentally with moral evaluative judgement, the ability to make decisions and assess those decisions based on fair, or equitable, moral and democratic principles rooted in life-long experiential learning or contextual maturity. Intertwined too are subtler abilities to assess and judge the impact of solutions on recipients in terms of aesthetics, perception, and, perhaps most importantly, the wellness of beneficiaries. There are many reasons why evaluation might be necessary to the thinking process. One of the primary purposes of evaluation in decision-making, change implementation, and judgment is to gain insight into prior initiatives for continuity and/or improvement.

These five components serve as the analytical framework for the present study. They reflect widely accepted definitions of critical thinking in the literature and are grounded in the practical realities of medical practice in Thailand. Each component represents a distinct yet interrelated skill set contributing to a general practitioner's ability to navigate uncertainty, make informed decisions, and deliver high-quality care.

3. Methodology

3.1. Research Design

The study utilized a quantitative survey research design to assess the actual and expected levels of CTS among Thai GPs (GPs) with the objective being to identify and prioritize developmental needs using a gap analysis framework through the modified Priority Needs Index (PNImodified). The design was cross-sectional, descriptive, and comparative.

3.2. Population and Sample

The population consisted of 3,556 Thai GPs who had participated in professional development programs or academic training provided by five leading institutions in Thailand related to integrative and regenerative medicine. The sample size of 346 participants was determined using the Krejcie and Morgan sample size table, ensuring a confidence level of 95% (Wong & Abdullah, 2025). Proportional stratified random sampling was used to ensure adequate representation from each institution (Sarraju et al., 2024).

A limitation of this sampling approach is that participants were drawn from only five national GP training bodies. While proportional stratified random sampling ensured internal representativeness, the restricted institutional scope may limit the generalizability of findings to all Thai GPs, particularly those trained in other contexts.

3.3. Research Instrument

The primary data collection instrument was a paired-response structured questionnaire, which was used to assess CTS actual (D) and expected (I) conditions. The research instrument consisted of five subscales corresponding to the five important components of critical thinking identified in the literature review. These subscales used a 5-point Likert-type scale, with 1 = Strongly Disagree and 5 = Strongly Agree. The questionnaire content was validated by five medical education and psychometric experts, with the IOC of the designed items and subscales ranging from 0.80 to 1.00. Finally, the discrimination values from a pilot test involving 30 GPs (which were then excluded from the final sample) ranged from 0.44 to 0.64. Cronbach's alpha coefficients for the research instrument were 0.87 for the actual condition and 0.89 for the expected condition, indicating acceptable reliability (Table 1).

The instrument development process was conducted in three stages. First, a panel of five experts in medical education and psychometrics validated the questionnaire items for content relevance, with the index of item–objective congruence (IOC) values ranging from 0.80 to 1.00. Second, a pilot test with 30 GPs (excluded from the final sample) was conducted to evaluate item clarity and

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discrimination, yielding discrimination indices ranging from 0.44 to 0.64. Finally, internal consistency was assessed using Cronbach's alpha, which demonstrated reliability coefficients of 0.87 for the actual condition scale and 0.89 for the expected condition scale.

Table 1. Instrument validity and reliability

Subscale	IOC Range	Discrimination	Cronbach's Alpha (D)	Cronbach's Alpha (I)
All dimensions	0.80–1.00	0.44–0.64	0.87	0.89

3.4. Data Collection

Data were collected in July 2025 using the online Google Form platform. The questionnaire link was shared through professional association networks, email, and diverse messaging platforms, including LINE. Participation was voluntary, and participant confidentiality was strictly maintained. Individual response tracking and gentle follow-up reminders were employed to achieve a high response rate. Finally, all questionnaires were screened for completeness and accuracy before analysis.

3.5. Data Analysis

The collected data were analyzed using the following statistical techniques:

1. Descriptive Statistics - Mean and standard deviation (SD) were calculated to evaluate both actual and expected levels of each critical thinking skill component. Interpretation of the means was based on the criteria of Phurikultong and Kantathanawat (2022). See Table 4's note.

2. Needs Assessment Analysis - The $PNI_{modified}$ was used to quantify the gaps between the expected and actual levels for each component using the formula:

$$PNI = \frac{I - D}{D} \quad (1)$$

where I is the expected mean and *D* is the actual mean.

3. *Inferential Statistics* - A dependent-sample t-test was conducted to determine the statistical significance of differences between actual and expected levels of each skill component. A significance level of $p < .01$ was used to indicate statistically meaningful gaps.

This methodology ensured a valid, reliable, and representative analysis of the developmental needs in critical thinking among Thai GPs. It also enabled the researchers to generate prioritized, actionable findings for educational policy and curriculum reform.

Based on the research design and procedures outlined in the previous section, data were successfully collected from 346 Thai GPs across five major professional development institutions. The validated instrument enabled the researchers to capture both actual and expected levels of critical thinking skills across five core components. Statistical analyses were then conducted to examine overall trends, identify gaps between current and desired competency levels, and determine priority areas for skill development. The findings from this analysis are presented in the following section, beginning with descriptive statistics and followed by results from the priority needs assessment and inferential testing.

The analysis followed a three-step process. First, descriptive statistics (means, standard deviations, and frequency distributions) were calculated to summarize the actual and expected CTS levels across domains. Second, to determine priority needs, a gap analysis was performed using the $PNI_{modified}$ formula (I–*D*)/*D*, where I represents the expected mean and D the actual mean. Third, inferential statistics were applied, specifically dependent-sample t-tests, to evaluate whether

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differences between actual and expected means were statistically significant. A significance level of $p<.01$ was used, in line with conventional standards for educational research.

4. Results

4.1. Respondent Characteristics

The study sample included 346 GPs trained by five leading institutions in Thailand, all offering training programs in integrative and regenerative medicine (please see Figure 2). The gender ratio was about the same: 51.73% female participants and 48.27% male participants (Table 3).45.84% between the ages of 41–50 years, followed by 31.67% between the ages of 31–40 years, 15.12% between 51–60 years, and 7.37% between 25–30 years. Regarding professional experience, 39.88% of participants had practiced for 11–20 years, 34.10% for less than 10 years, 20.23% for 21–30 years, and 5.78% for more than 30 years. These personal details suggest that most respondents were mid-career professionals with a solid foundation of clinical experience.

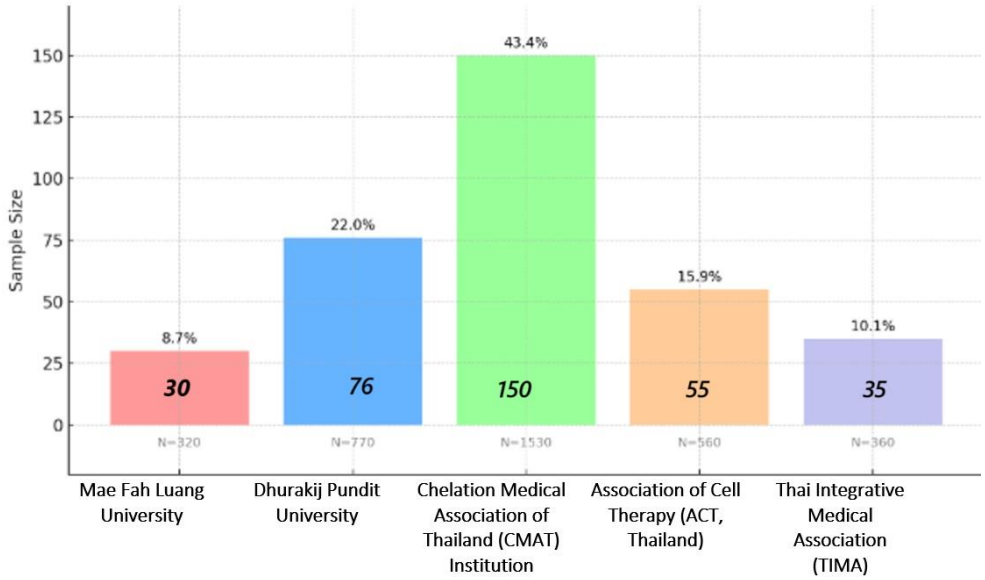

Figure 2. Sample size and percentage distribution by institution (n=346)

Note: Sample size by columns left to right: 30+76+150+55+35=346

Table 3. General characteristics of the sample group

Item	Number	%
Gender		
Male	159	45.95
Female	187	54.05
Highest level of education		
Bachelor's degree	256	75.29
Master's degree	90	24.71
Medical experience		
1-5 years	75	21.67
6-10 years	126	36.42
11-15 years	111	32.08
16 years and above	34	9.83

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4.2. Descriptive Analysis of Actual and Expected CTS Levels

A descriptive analysis was conducted to identify general practitioners' actual and expected capacity in the five dimensions of critical thinking skills (CTS). Five-point Likert scales were used, and the interpretation was proposed according to the criteria presented in Table 4.

The results suggested that students generally perceived their current critical thinking ability as moderate. Among the five elements, evaluation scored the highest mean (M = 3.43), followed by analytical processing (M = 3.40), information collection (M = 3.39), problem definition (M = 3.38), and synthesis (M = 3.30).

On the question of the level of performance that they believe is expected in their respective areas, respondents gave consistently high scores across all five areas. Synthesis remained the skill with the highest mean expected score (M = 4.64), followed by analysis (M = 4.63), evaluation (M = 4.62), problem definition (M = 4.60), and information collection (M = 4.59).

The findings suggest an important discrepancy exists between GPs' self-assessed and desired skills, with meaningful differences in synthesis. This highlights potential areas for training and development to support practitioners in integrating diverse clinical information and applying it innovatively in the decision-making process.

4.3. Physicians' Perceptions of Actual and Expected CTS Levels

Table 4 shows the results of physicians' opinions regarding the actual and expected level of critical thinking skills among Thai GPs. The analysis indicates that the participants consistently assessed current performance in all five elements (*problem identification, information collection, analytical processing, synthesis of ideas,* and *evaluation of outcomes*) at a moderate level, as the mean scores of the actual condition were from 3.07 to 3.20. It was apparent that the skills in *information collection* received the highest actual mean score (M = 3.20, SD = 0.40). *Synthesis of ideas* received the lowest actual mean score (M = 3.07, SD = 0.21).

On the other hand, overall expectations of all elements were rated at the highest level, and their means are grouped around 4.82 to 4.87. *Problem identification* and *information collection* shared the highest level of expected mean (4.87). Thus, all of the overall expectations are high. The overall means of the actual and expected conditions are 3.14 and 4.85, respectively, which confirms a significant gap between current abilities and ideal performances perceived by participants. These differences were statistically significant at the $p < .01$ level.

Table 4. GPs' opinions of general practitioner CTS classified by actual / expected conditions

Component	Actual Mean			Expected Mean		
	M	*SD*	Level	*M*	*SD*	Level
1. Problem identification	3.17	0.20	Moderate	4.87	0.19	Very High
2. Information collection	3.20	0.40	Moderate	4.87	0.25	Very High
3. Analytical processing	3.12	0.28	Moderate	4.85	0.26	Very High
4. Synthesis of ideas	3.07	0.21	Moderate	4.82	0.28	Very High
5. Evaluation of outcomes	3.15	0.34	Moderate	4.86	0.26	Very High
Overall	**3.14**	**0.21**	Moderate	**4.85**	**0.15**	Very High

Note. All differences were significant at p < .01. Mean levels used criteria in which 4.51 – 5.00 was rated 'Very High,' 3.51 – 4.50 as 'High,' and 2.51 – 3.50 was judged 'Moderate'.

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As shown in Figure 1, participants consistently rated their current CTS levels at a moderate level across all five domains, while their expected levels were rated very high. This visual representation highlights the magnitude of the discrepancy, reinforcing the statistical findings presented in Table 4.

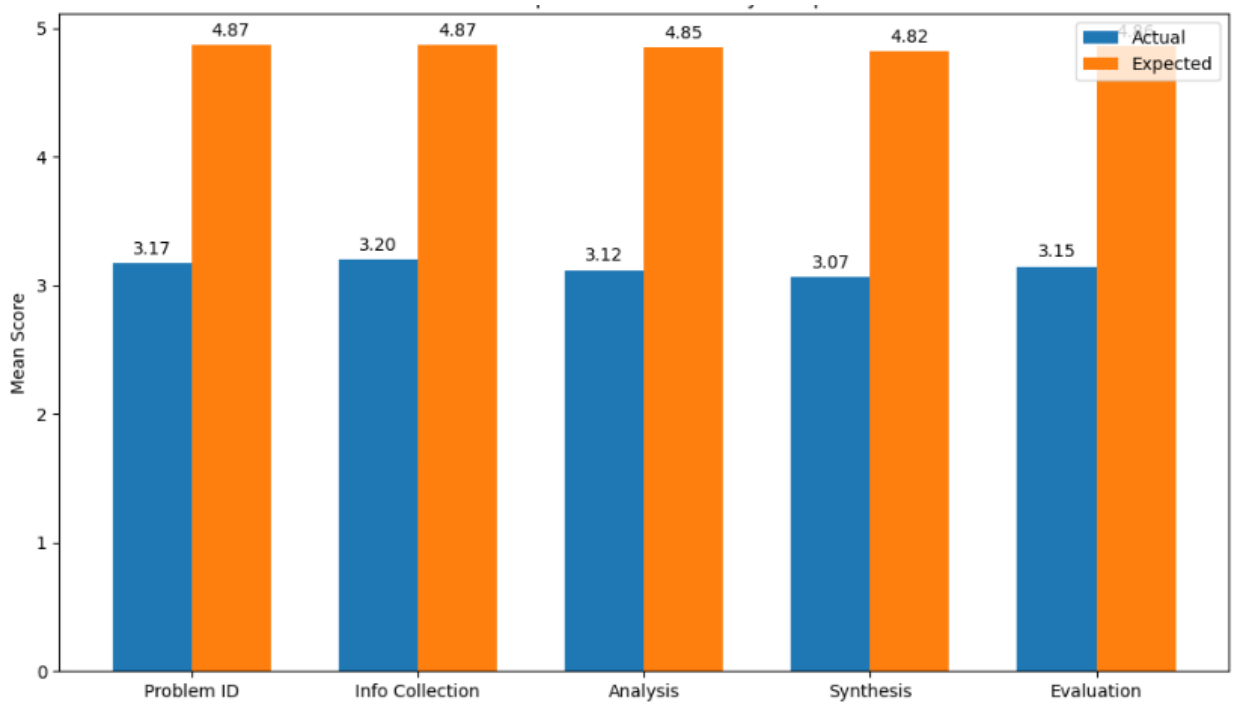

Figure 3. Actual versus expected critical thinking skills (CTS) levels among Thai general practitioners across five domains. The bar chart illustrates the gap between participants' self-rated current abilities and their perceived expectations, with consistently higher expectations observed across all skill components.

4.4. $PNI_{modified}$ and Gap Significance Analysis

To gain a better understanding of which critical thinking skills should be given priority, this study applied a modified Priority Needs Index ($PNI_{modified}$) to the discrepancy between actual and expected levels of critical thinking skills in clinical practice, and a paired-sample test to assess whether the gap between these levels was statistically significant.

As shown in Table 5, a development needs most strongly desired involved synthesis (i.e., ability to combine and interpret various clinical information, which had the most significant gap; $NI_{modified}$ = 0.57) with the highest statistical value (t = 8.66, p-values < .01), followed by analysis ($NI_{modified}$ = 0.55; t = 7.52) and evaluation ($PNI_{modified}$ = 0.54; t = 6.79). Although problem definition and information collection were lower rank categories, the gaps between current and desired performance were statistically significant.

Overall, the results highlight the importance of improving GPs' capacity in complex data integration and evaluation. This skill set is crucial in providing effective, evidence-based care in the changing healthcare landscape in Thailand.

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Table 5. Priority needs for CTS development based on $PNI_{modified}$ and t-test results

Component	I	D	$PNI_{modified}$	Rank ($PNI_{modified}$)	t	Rank(*t*)
1. Problem identification	3.17	4.87	0.53	4	5.53**	4
2. Information collection	3.20	4.87	0.52	5	4.45**	5
3. analytical processing	3.12	4.85	0.55	2	7.52**	2
4. Synthesis of ideas	3.07	4.82	0.57	1	8.66**	1
5. Evaluation of outcomes	3.15	4.86	0.54	3	6.79**	3
Overall	**3.14**	**4.85**	0.54	-	**7.43****	-

Note. All differences were significant at p < .01. Mean levels used criteria in which 4.51 – 5.00 was rated 'Very High,' 3.51 – 4.50 as 'High, ' and 2.51 – 3.50 was judged 'Moderate. '

The priority needs analysis is presented in Figure 2, which clearly demonstrates that synthesis of ideas is the most urgent area for development, followed by analytical processing and evaluation of outcomes. These rankings correspond with the $PNI_{modified}$ values reported in Table 5, emphasizing the importance of strengthening higher-order cognitive processes among Thai GPs.

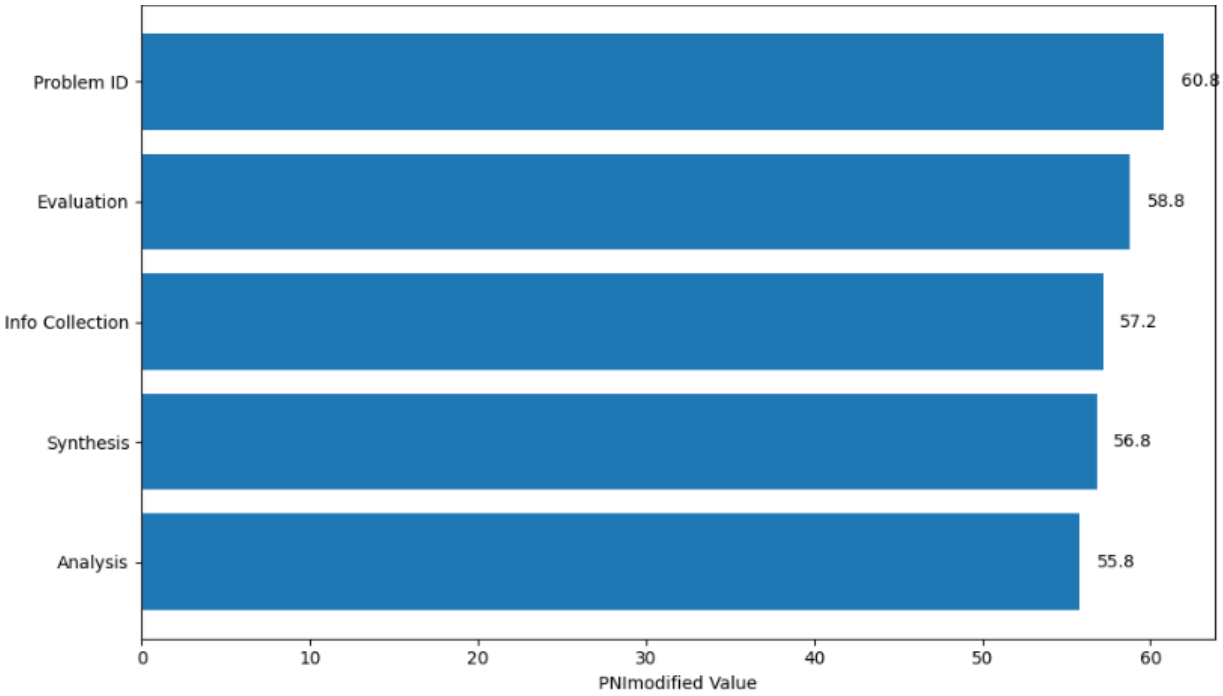

Figure 4. Priority needs ranking for CTS development among Thai general practitioners based on $PNI_{modified}$ values. The most significant development gap was observed in synthesizing ideas, followed by analytical processing and evaluation of outcomes.

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5. Discussion

5.1. RQ1: Actual and Expected CTS Levels

The Thai GPs in this study rated their current CTS as moderate across all five domains, while their expectations were consistently high. The most significant differences between expectation and current CTS were synthesizing ideas and analytical processing, key skills in solving complex problems. These results are consistent with international evidence showing clinicians commonly struggle to maintain higher-order reasoning under clinical pressures. For example, Ross et al. (2020) reported that among Canadian family physicians, CTS were only moderate, while Reale et al. (2018) showed that sustained improvements in higher-order thinking could not be assumed, even in reformed health professions curricula. Together, these results suggest that Thai GPs' perceptions of deficits in their CTS are comparable to challenges in medical education elsewhere.

5.2. RQ2: Priority Needs for Development

The $PNI_{modified}$ analysis identified synthesis of ideas as the top development priority, followed by analytical processing and evaluation of ideas. Synthesis is arguably the most essential higher-order skill for building holistic treatment plans and integrating clinical, psychosocial, and diagnostic factors; however, traditional curricula view synthesis as an unimportant skill compared to procedural knowledge.

The developmental priorities evident in this study have also appeared in international studies on problem-based learning among undergraduates and baseline postgraduate skills among new GPs (Irwanto et al., 2024; Majumder et al., 2019). The Thai GPs' developmental priorities mirror the results of various international studies. Indonesian GPs reported a strong need to improve their ability to reflect on their clinical practices, which is closely related to synthesis (Syah et al., 2015). Further findings from Bangladesh suggest that synthesis is one of the least developed higher-order skills, despite its importance in medical education (Haque et al., 2013). The developmental needs of Thai GPs reflect systemic educational gaps in higher-order skills that are evident beyond the national level. This explanatory hypothesis supports an earlier baseline study conducted among postgraduate Thai GPs. Boonmak et al. (2022) have also suggested that simulation-based learning frequently neglects cognitive skills such as planning and evaluating actions and outcomes. The findings are consistent with the skills required to be an effective GP.

5.3. RQ3: Statistical Significance of CTS Gaps

The paired-sample t-tests confirmed statistically significant differences ($p < .01$) between actual and expected CTS across all five domains, with synthesis of ideas producing the largest effect size. These results are meaningful in Thailand's primary care context, where GPs frequently manage multimorbidity, scarce resources, and complex psychosocial conditions. Lertrattananon et al. (2019) showed that Thai graduates felt underprepared for decision-making in rural hospitals, while Pengpid and Peltzer (2021) documented that rural GPs regularly face patients with multiple chronic conditions. Such findings underscore why strengthening CTS—especially synthesis and analysis—is not merely academic but central to improving patient safety and care quality.

5.4. Policy and Educational Implications

The identified CTS gaps signal the need for explicit attention to embedding higher-order thinking skills within Thai medical education and CPD infrastructures. First, the undergraduate GP programs should incorporate active pedagogy, such as problem-based learning, simulation, and interprofessional case discussions, to facilitate synthesis and analysis. Second, the CPD activities should expand beyond procedural updates to include reflective practice and decision-making workshops. Third, work-based assessment methods, such as mini-CEX, structured case reflections,

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and peer audits, should be introduced to assess reasoning in real-time. Together, these actions would integrate CTS development with Thailand's ongoing healthcare reforms, which are centered on integrative, holistic care.

5.5. Unique Contribution of the Study

This study provides a novel, data-driven perspective on decision-making regarding priority CTS needs via $PNI_{modified}$ by focusing on the experiences of practicing Thai GPs. The present study is the first empirical attempt to rank Thai GPs' needs within each CTS category based on a large sample. Most existing research has focused on either medical students or specialist physicians. By providing a clear and accessible rank order of CTS needs, the study offers policymakers, curriculum designers, CPD program developers, and professional associations with actionable evidence for reform. Ultimately, our study strengthens the local and global evidence base on better supporting frontline doctors in developing cognitive tools for modern healthcare.

6. Conclusion and Recommendations

6.1. Conclusion

This study assessed Thai general practitioners' actual and expected critical thinking skills (CTS) and identified developmental priorities using the modified Priority Needs Index ($PNI_{modified}$). The structured needs assessment showed an obvious requirement for Thai GP' critical thinking skills and consistently high gaps across all five CTS components. These gaps were identified as problem identification, information collection, analytical processing, idea synthesis, and outcomes evaluation. Among these, synthesis of ideas emerged as the most urgent need, followed by analytical processing and evaluation.

These findings underscore the importance of enhancing higher-order cognitive skills in GP education and training in Thailand. Beyond adherence to diagnostic frameworks, GPs must be equipped to synthesize diverse clinical data, reflect critically, and apply evidence-based judgment in ambiguous and resource-constrained environments. Developing these skills will enhance decision-making, facilitate holistic care, and strengthen the quality of primary healthcare delivery.

This study provides an evidence-based hierarchy of CTS needs that can inform understandable plans for curriculum reform, continuing professional development, and workplace-based assessment. The insights it generates also directly influence educational planning and policy. The findings locate critical thinking as a core competency for Thai GPs in the 21st century.

6.2. Policy Recommendations

Curriculum Enhancement for GP Training - National medical education stakeholders should revise GP training curricula to incorporate systematic critical thinking training, emphasizing *synthesis and analysis*. Simulated case-based learning, problem-based learning (PBL), and interprofessional education (IPE) modules should be used to foster these competencies.

Continuing Professional Development (CPD) - Relevant CPD programs offered by medical councils, universities, and professional associations should include structured training modules on clinical reasoning, reflective practice, and decision-making. These programs must move beyond content updates to include *thinking process transformation*.

Workplace-Based Assessment Tools - Institutions employing GPs should be encouraged to adopt evaluation tools that assess knowledge, skills, and critical thinking behaviors in real-time clinical settings, including mini-CEX, case reflections, and peer-reviewed audits.

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6.3. Future research Recommendations

Intervention-Based Development - Further research could be conducted into developing and testing specific interventions—e.g., critical thinking workshops, mentorships, or cognitive apprenticeship models—that seek to develop synthesis skills and other priorities in generalists.

Specialty and sub-population focus - Although this study was not designed to focus on different specialties, there is potential to assess the critical thinking needs of different medical specialties by administering the content- free cognitive skills assessment to specific groups based on their clinical practice such as internal medicine services, emergency departments, and rural health units to determine whether the patterns of cognitive skill gaps differ by clinical context.

Mixed-method research and longitudinal studies - Future studies could adopt qualitative or mixed-method approaches to explore how GPs conceive, develop, and use CT skills in practice, either in addition to or instead of quantitative methods. Longitudinal studies could measure the long-term impact of interventions.

7. Limitations

This study has several limitations that should be acknowledged. First, the sample was drawn from five GP training institutions, which may restrict the generalizability of the findings to all Thai general practitioners. Second, the cross-sectional design provides a snapshot in time and does not allow for causal inferences or examination of changes over time. Third, while the questionnaire was validated and demonstrated strong reliability, self-reported data may still be influenced by social desirability bias or individual interpretation of the items. These limitations should be considered when applying the findings to broader contexts, and they also point to directions for future research.

Declarations

Credit authorship contribution statement. Bancha Daengneam, Kanyarat Sriwisathiyakun and Thanongsak Sovajassatakul. Bancha Daengneam - Conceptualization, Software, Validation, Formal analysis, Investigation, Resources, Writing—original draft preparation, review and editing, supervision. Kanyarat Sriwisathiyakun - Conceptualization, Software, Validation, Formal analysis, Writing—review and editing. Thanongsak Sovajassatakul - Investigation, Resources, Writing—original draft preparation, Writing—review and editing, supervision. Both authors have read and agreed to the published version of the manuscript.

Conflict of Interests. The authors explicitly state that this paper has no conflicts of interest.

Funding. The authors received no outside funding for their research.

Ethical Approval. The study was reviewed by the Research Ethics Committee of King Mongkut's Institute of Technology, Ladkrabang, which granted an exemption from formal ethics review EC-(KMITL_68_132) in compliance with international standards. The exemption was issued in compliance with internationally recognized ethical standards, including the Declaration of Helsinki. As the study was classified as exempt, no continuing review was required. Finally, Informed consent was obtained from all participants involved in the study.

Data Availability Statement. The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Acknowledgements. The authors thank Ajarn Charlie for his invaluable contribution in editing and proofreading this paper. In preparing this manuscript, the authors utilized Google Translate and Scholar GPT 4.0 to assist in translating the work from Thai to English. Grammarly AI Premium was also used to review grammar and structure before submission. In addition to using AI tools for translation and language correction, all the content underwent a thorough review and editing by a native English

speaker working in collaboration with the authors. Therefore, the authors assert full responsibility for the final manuscript's accuracy, originality, and quality.

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https://doi.org/10.22521/edupij.2025.19.541 Published online by Universitepark Press