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Navigating the transition to competency-based curriculum: needs analysis and implementation guidelines for under-resourced small schools

Pinyo Wongthong[1], Wanchai Noiwong[2], Somsamer Thaksin[1]
[1]Educational Research Development and Demonstration Institute, Srinakharinwirot University, Nakhon Nayok, Thailand
[2]Department of Compulsory Science, Institute for the Promotion of Teaching Science and Technology, Bangkok, Thailand

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ABSTRACT

This study investigated priority needs and formulated strategic guidelines for implementing a competency-based curriculum (CBC) in under-resourced small schools in Thailand. Employing a convergent parallel mixed-methods design, quantitative data were gathered from 99 school directors and 316 teachers using a structured questionnaire, while qualitative insights were collected concurrently via semi-structured interviews and focus groups. The modified priority needs index (PNI) analysis identified learner competency—specifically higher-order thinking—as the top developmental priority (PNI=0.3202), followed by integrated curriculum design (PNI=0.2796), teacher competency (PNI=0.2677), 21st-century learning management (PNI=0.2371), and authentic assessment (PNI=0.2334). Qualitative findings revealed that systemic constraints, including severe staffing shortages and infrastructure deficits, significantly hinder implementation. To address these challenges, a five-dimensional framework as guidelines for implementation was established: i) prioritizing higher-order thinking; ii) operationalizing curriculum integration; iii) enhancing teacher digital competency; iv) embedding active learning methodologies; and v) institutionalizing authentic assessment systems. The study concludes that successful CBC execution in resource-constrained environments requires structured mentoring, multi-stakeholder collaboration, and tailored policy support to bridge the policy-to-practice gap.

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Corresponding Author:

Pinyo Wongthong
Educational Research Development and Demonstration Institute, Srinakharinwirot University
63 Rangsit - Nakhon Nayok Rd, Ongkharak District, Nakhon Nayok 26120, Thailand
Email: pinyo@g.swu.ac.th

1. INTRODUCTION

Education is widely recognized as the cornerstone of national development. In an era characterized by volatility and rapid global transformation, a dynamic educational management system is indispensable for cultivating high-quality human capital. By fostering such resources, nations can catalyze social and economic progress, ensuring sustained competitiveness within a shifting global landscape [1]. Frameworks for the 21st century provide essential strategies to identify the competencies students must acquire for the future workforce; consequently, educators are tasked with evaluating whether current pedagogical methodologies are sufficiently aligned with these imperatives. The partnership for 21st century skills [2], a collaborative nexus of government and industry, defined a framework centered on the skills, aptitudes, and attitudes necessary for success in contemporary society. This framework categorizes competencies into three pivotal

domains: i) learning skills (creativity, critical thinking, and collaboration); ii) literacy skills (information, media, and information and communications technology (ICT) literacy); and iii) life skills (flexibility, initiative, and leadership). Accordingly, educational institutions must restructure their management systems to cultivate environments where learners can achieve substantive, real-world competencies. This global shift is evidenced by extensive curriculum reforms aimed at bridging the gap between traditional schooling and the rigorous demands of modern labor markets [1], [3].

For education to maintain parity with the evolving marketplace, the focus must shift from what to think to how to think. A student's capacity to navigate change is deeply rooted in their propensity for adaptive learning and problem-solving. Competency-based education (CBE) has emerged in the literature as a robust response to this need, providing a comprehensive administrative framework that encompasses competency-based curriculum (CBC), instruction (CBI), and assessment (CBA). The CBE serves as a comprehensive pedagogical framework designed to equip learners with specific competencies—comprising integrated knowledge, skills, and attitudes—essential for academic and professional success. Central to the CBE philosophy is the principle of personalized advancement, wherein progression is predicated upon the demonstrated mastery of explicit learning objectives rather than on the amount of time spent in instruction [4]. Within this framework, the CBC acts as the operational manifestation, providing a structured roadmap that aligns instructional strategies, content, and meaningful assessments with predefined learning outcomes [5]. The relationship between the two is inherently hierarchical: CBE provides the overarching educational philosophy, while CBC functions as the practical vehicle for its implementation. By integrating diverse disciplinary knowledge into a cohesive, application-oriented structure, CBC operationalizes CBE principles, ensuring that educational practices are systematically geared toward fostering higher-order thinking and real-world efficacy.

The CBE personalizes the educational experience by aligning it with individual interests and talents. The five core pillars of CBE, including advancement upon mastery, explicit learning objectives, meaningful assessment, differentiated support, and knowledge application, collectively ensure that learners are prepared for both higher education and professional life [6]. This transition reflects a global movement to synchronize academic theory with practical application, ensuring graduates possess high-demand skills [7], [8]. Ultimately, CBE empowers students to navigate an increasingly complex world through the authentic application of knowledge. Despite the conceptual merits of CBE, scholars have identified significant implementation hurdles. Rogers [9] highlighted a persistent tension between macro-level policy goals and the micro-level pedagogical beliefs of instructors, which often act as internal constraints on curriculum realization. To mitigate these gaps, Assey [10] advocates for a multi-dimensional strategy emphasizing pedagogical leadership and infrastructural modernization. However, progress is frequently impeded by inadequate training strategies that hinder effective assessment [11]. Research by Mogere and Mbataru [12] further established that CBC operationalization is heavily influenced by leadership styles and collaborative practices. Additionally, studies have revealed significant deficiencies in teachers' ICT skills [13] and general pedagogical preparedness [14]. In emerging contexts, science programs often remain tethered to traditional methods despite CBC adoption [15]. Recent reports by Ogembo [16] underscore that the policy-to-practice gap is exacerbated by financial constraints, teacher shortages, and fragmented stakeholder coordination. This systemic misalignment necessitates urgent reform to transform institutional constraints into innovative opportunities for authentic learning.

In alignment with global trends, Thailand promulgated the national education plan B.E. 2560–2579 (2017–2036) to develop human capital suited for the Thailand 4.0 innovation-driven economy [17]. However, the Thai education sector faces systemic challenges, continuing to rely on the Basic Education Core Curriculum B.E. 2551 (2008) [18], which is increasingly viewed as insufficient for a competency-based future. The critical need for reform is starkly illustrated by Programme for International Student Assessment (PISA) 2022 results, where Thai students scored significantly below Organisation for Economic Co-operation and Development (OECD) averages in reading, mathematics, and science [19]. The current framework's emphasis on content-heavy standards compels teachers to prioritize rote coverage over the depth of understanding, resulting in a failure to develop functional competencies [20]. According to the OECD [21], while Thailand has achieved commendable progress in expanding educational access—particularly at the primary level—the quality of instruction remains inconsistent across diverse institutional contexts. Within this landscape, school size emerges as a pivotal determinant in shaping the learning environment and the extent to which constructivist pedagogical principles are integrated into classroom practice [22]. Evidence suggests that both school scale and student-teacher ratios profoundly influence educational outcomes.

Currently, the Office of the Basic Education Commission (OBEC) oversees 29,583 schools, of which 14,958 (50.56%) are categorized as small schools. Within the Thai educational landscape, small schools are formally categorized as institutions with an enrollment of fewer than 120 students. This classification holds significant weight as these schools are predominantly situated in rural or marginalized

regions, frequently grappling with systemic challenges regarding resource allocation, staffing, and pedagogical quality. To contextualize this definition globally, a comparison with international frameworks, such as those established by United Nations Educational, Scientific and Cultural Organization (UNESCO) and the OECD, reveals both shared principles and contextual variances. While UNESCO eschews a rigid numerical threshold, it emphasizes equitable access to quality education, advocating for tailored policy support to address the unique requirements of remote and underserved institutions [23]. Conversely, the OECD [24] often identifies small schools as those with fewer than 100 students, acknowledging their capacity for personalized learning environments while simultaneously highlighting constraints such as limited curricular offerings and difficulties in faculty retention [25]. By aligning the Thai definition with these international benchmarks, this study underscores the localized specificities of small-school challenges within a broader global discourse, thereby enhancing the depth of the analysis and providing a comprehensive understanding of the multifaceted opportunities and constraints inherent in diverse educational settings.

In the Thai context, predominantly situated in rural or marginalized areas, these small schools are characterized by chronic understaffing and significant operational constraints across grade levels. Unlike their urban counterparts, under-resourced small schools in Thailand confront a multidimensional crisis precipitated by severe fiscal limitations and unfavorable demographic shifts. A declining national birth rate, coupled with a parental preference for urban centers, has drastically reduced student enrollment. This attrition triggers a direct budgetary deficit, as allocations are determined on a per-capita basis, consequently depriving these schools of essential educational technology and specialized instructional expertise. These systemic deficiencies are intrinsically linked to lower national assessment scores compared to larger, well-equipped institutions. Furthermore, geographic isolation and inconsistent management policies exacerbate the challenges of mobilizing community resources. Despite these structural vulnerabilities, initiatives for school consolidation frequently encounter resistance from local communities and educators due to deep-seated emotional attachments, safety considerations, and a misalignment in policy understanding, creating a formidable bottleneck for systemic reform [26]. Given that these limitations in budget, personnel, and instructional materials directly compromise educational quality, stakeholders consistently scrutinize the effectiveness of these institutions. In response, the Ministry of Education (MOE) has initiated a series of strategic projects aimed at enhancing instructional standards and closing the achievement gap within the small school sector. Thailand's transition toward the CBC serves as a strategic catalyst to synchronize national education with the rapid technological advancements of the 21st century.

Diverging from traditional standards-based frameworks, the CBC prioritizes measurable learning outcomes and demonstrable mastery through authentic, real-world applications [20]. This paradigm shift is currently operationalized within educational sandboxes, which are innovative regulatory zones designed to mitigate centralized bureaucratic rigidities. Preliminary evidence from these sandboxes indicates a favorable shift in learner affect, with Jarernrak [27] reporting enhanced student engagement and agency fostered through hands-on experiential practice. However, despite these localized successes, the nationwide transition is hampered by a significant knowledge-to-action gap. The study showed that many institutions continue to struggle with a lack of specialized expertise and concrete pedagogical guidance for CBC integration [28]. Furthermore, Pongpitaya [29] identified a critical limitation in competency-based learning management, noting that instructional assessment often remains confined to the output stage—evaluating knowledge, skills, attitudes, and attributes in isolation. This fragmented approach neglects the outcome stage, where actual competency is manifested as an integrated construct. Consequently, the assessment process remains incomplete, as competency cannot be effectively evaluated through compartmentalized metrics.

More recently, Sereerat and Chitrarangsan [30] argued that notwithstanding the benefits of instructional leadership and professional learning communities (PLCs), the CBC implementation is stifled by systemic gaps, including assessment ambiguity and a conceptual void in evaluation methodologies. These challenges, exacerbated by fragmented professional development and restricted administrative autonomy, hinder the curriculum's intended catalytic effect. Addressing these constraints through evidence-based management is imperative for translating CBC's inherent flexibility into quantifiable improvements in student competencies. Despite existing research on pilot programs, persistent challenges in curriculum design, administrative governance, and assessment frameworks remain. Identifying the multifaceted determinants of success is therefore essential; continuous empirical investigation is required to optimize the efficacy of competency-based learning management within the Thai educational ecosystem.

Although previous studies have examined teacher preparedness, curriculum implementation, and educational leadership in isolation, a critical research gap remains regarding how priority needs align with context-specific strategies in under-resourced small schools. Therefore, this study aims to investigate essential needs and formulated strategic guidelines for implementing a CBC in resource-constrained small schools using a mixed-methods approach. A mixed-methods needs assessment represents an appropriate

approach to bridge this gap; while quantitative analysis via the modified priority needs index (PNI) identifies and prioritizes systemic deficiencies, qualitative insights from interviews, and focus groups elucidate the contextual nuances affecting implementation. A convergent parallel mixed-methods design [31] was employed to triangulate these data streams. Specifically, this investigation is guided by three research questions:

- What are the current and desirable states of CBC implementation in under-resourced small schools?
- What is the hierarchy of priority needs for CBC implementation in under-resourced small schools?
- What evidence-based guidelines can facilitate the effective and sustainable implementation of CBC in under-resourced small school settings?

2. METHOD

This study employed a convergent parallel mixed-methods design [31] to examine the implementation of a CBC in under-resourced small schools. Quantitative data from the needs assessment (PNI) and qualitative data from interviews and focus groups were collected concurrently and analyzed to triangulate findings and inform the development of implementation guidelines.

The population comprised 132 directors and 1,504 teachers from 132 small schools in Thailand. The required sample size was determined using the Yamane formula [32]. The final sample consisted of 99 school directors and 316 teachers by simple random sampling. The questionnaire items were developed from the literature, competency frameworks, and theoretical constructs before expert validation [20], [33], [34]. Data collection was conducted via a structured questionnaire aligned with the research objectives. Participants received an informed consent form and a link to the survey via Google Forms. The instrument required participants to respond using checklists and Likert-type scales, with an additional section for qualitative remarks. To ensure anonymity, no personally identifiable information was collected.

The research instrument comprised seven components designed to capture comprehensive data: i) general respondent information; ii) curriculum frameworks; iii) teacher competencies; iv) learner competencies; v) instructional management; vi) assessment methodologies; and vii) qualitative open-ended questions. The situational survey utilized a 5-point Likert scale alongside open-ended questions. Participants rated items on a scale from 5 (strongly agree) to 1 (strongly disagree). To interpret the resulting mean scores, the data were categorized according to the following criteria: 4.50–5.00 (very high), 3.50–4.49 (high), 2.50–3.49 (moderate), 1.50–2.49 (low), and 1.00–1.49 (very low).

In addition to the Likert-scale items, participants were invited to provide qualitative insights through open-ended questions. The research instrument was developed based on established competency frameworks and refined through expert consultation to ensure robust content validity. The index of item-objective congruence (IOC) yielded values ranging from 0.67 to 1.00, confirming that all items were conceptually aligned with the research objectives. Furthermore, the internal consistency of the questionnaire was rigorously tested, resulting in a Cronbach's alpha coefficient of 0.962. This high score indicates exceptional reliability and demonstrates that the instrument is highly suitable for data collection within the target context. Data analysis was performed using descriptive statistics, including frequency, mean (M), and standard deviation (SD). Additionally, the PNI was calculated according to (1) to determine the gap between current and desirable states.

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

Where, D is the mean of the desirable states and C is the mean of the current states [35]. For the qualitative phase, 10 small school directors, 20 teachers, three educational supervisors, and five parents were selected to participate in semi-structured interviews. This voluntary cohort provided data through semi-structured interviews designed to explore the current situations, difficulties, and specific needs for effective CBC implementation. Subsequently, a focus group discussion was conducted to facilitate the exchange of experiences and the generation of strategic recommendations. Qualitative data from both the interviews and the focus group were analyzed using thematic analysis to develop comprehensive guidelines for CBC implementation in small schools. Ethical approval for this study was granted by the Srinakharinwirot University Ethics Committee (Protocol No. SWUEC-672320). All participants were informed of the study's details and provided their consent before participating. The researchers ensured the protection of participants' rights, anonymity, and data confidentiality throughout the study duration.

3. RESULTS AND DISCUSSION

3.1. Needs analysis for implementing CBC in small schools

The study sample comprised 415 participants, including 99 school directors (23.86%) and 316 teachers (76.14%). The demographic characteristics of the participants (gender, age, educational attainment, and teaching experience) are presented in Table 1. Descriptive analysis indicates a predominantly female respondent base (80.96%), with the largest age group falling between 41 and 50 years (31.33%). Regarding educational qualifications, a majority held a bachelor's degree (60.24%), while a negligible proportion (0.96%) possessed an associate degree. Furthermore, more than half of the respondents (54.70%) had over six years of teaching experience, whereas only 4.82% reported less than one year of experience in a small-school context.

Table 1. General information of respondents (N=415)

Item		Frequency	%
Status	School director	99	23.86
	Teacher	316	76.14
Gender	Male	79	19.04
	Female	336	80.96
Age	Below 30 years old	87	20.96
	30–40 years old	115	27.71
	41–50 years old	130	31.33
	Above 50 years old	83	20.00
Educational qualification	Associate's degree	4	0.96
	Bachelor's degree	250	60.24
	Master's degree	145	34.94
	Doctorate degree	16	3.86
Teaching experience	Below 1 year	20	4.82
	1-3 years	71	17.11
	4-6 years	97	23.37
	Above 6 years	227	54.70

The assessment of current and desirable states regarding CBC implementation in small schools is summarized in Table 2. The results showed that the means of the current implementation across all dimensions was at a high level. When ranked by mean scores in descending order, the dimensions are: i) learning management; ii) assessment; iii) teacher competency; iv) curriculum; and v) learner competency. While most sub-aspects were rated highly, several areas exhibited only moderate levels, indicating specific gaps: integrated learning management (curriculum), action research for learner development (teacher competency), and both higher-order thinking and sustainable coexistence with nature and science (learner competency). Also, the means of each component were compared between the current and desired states. It was found that the means of the desired major components were higher than those of the current ones. It can be seen that the means of the desirable states for CBC implementation were perceived at the highest level across all dimensions. The prioritized order of desirable states is: i) learner competency; ii) learning management; iii) teacher competency; iv) curriculum; and v) assessment. Notably, all sub-aspects within the desirable states were consistently rated at the highest level, reflecting a strong consensus on the necessity of comprehensive CBC integration.

The PNI was employed to prioritize the developmental needs for CBC implementation in small schools, as shown in Table 2. The analysis yielded an overall PNI value of 0.235. Notably, two dimensions exceeded this overall average: learner competency (PNI=0.3202) and curriculum (PNI=0.2796). Ranking the indices in descending order, the results identify learner competency (PNI=0.3202) as the most critical area for intervention, followed by curriculum (PNI=0.2796), teacher competency (PNI= 0.2677), learning management (PNI=0.2371), and assessment (PNI=0.2334), respectively. These findings underscore that the primary urgency for Thai small schools lies in enhancing student competencies and aligning the curriculum with competency-based standards.

Regarding the specific dimensions of learner competency, six sub-components were analyzed: i) higher-order thinking, encompassing critical thinking, problem-solving, and creativity; ii) sustainable coexistence with nature and science, including the integration of mathematics, science, and digital literacy; iii) self-management, focusing on self-esteem and the regulation of emotions, stress, and challenges; iv) communication, involving appropriate channel selection and respect for diverse cultural perspectives; v) active citizenship and global mindedness, emphasizing social responsibility and the capacity to drive positive social change; and vi) teamwork and collaboration, characterized by systematic processes and effective leadership-followership dynamics. The analysis identified higher-order thinking as the most critical priority for development (PNI=0.4567).

Table 2. Current and desirable states and PNI for implementing CBC in small schools

No.	Items	Current states (C)			Desirable states (D)			PNI	Rank
		M	SD	Interpretation	M	SD	Interpretation		
Learner competency		3.60	0.67	High	4.73	0.7	Very high	0.3202	1
1	Higher-order thinking, encompassing critical thinking, problem-solving, and creativity	3.35	0.63	Moderate	4.88	0.78	Very high	0.4567	
2	Sustainable coexistence with nature and science, including the integration of mathematics, science, and digital literacy	3.41	0.74	Moderate	4.73	0.65	Very high	0.3871	
3	Self-management, focusing on self-esteem and the regulation of emotions, stress, and challenges	3.67	0.63	High	4.85	0.61	Very high	0.3215	
4	Communication, involving appropriate channel selection and respect for diverse cultural perspectives	3.54	0.61	High	4.64	0.65	Very high	0.3107	
5	Active citizenship and global mindedness, emphasizing social responsibility and the capacity to drive positive social change	3.67	0.64	High	4.69	0.78	Very high	0.2779	
6	Teamwork and collaboration	3.95	0.76	High	4.61	0.74	Very high	0.1671	
Curriculum		3.66	0.67	High	4.66	0.69	Very high	0.2796	2
1	Emphasis on integrated learning management	3.44	0.65	Moderate	4.75	0.65	Very high	0.3808	
2	Provision of essential life competencies and skills	3.51	0.65	High	4.81	0.74	Very high	0.3703	
3	Relevance and alignment with learner needs	3.84	0.61	High	4.58	0.65	Very high	0.1927	
4	Responsiveness to societal evolution	3.84	0.78	High	4.51	0.72	Very high	0.1745	
Teacher competency		3.69	0.69	High	4.67	0.72	Very high	0.2677	3
1	Learner development	3.61	0.65	High	4.95	0.68	Very high	0.3712	
2	Action research for learner improvement	3.41	0.62	Moderate	4.61	0.81	Very high	0.3519	
3	Curriculum administration and learning management	3.68	0.76	High	4.73	0.73	Very high	0.2853	
4	Class management	3.77	0.62	High	4.64	0.61	Very high	0.2308	
5	Educational leadership	3.82	0.75	High	4.58	0.86	Very high	0.1989	
6	Community engagement and partnership building.	3.87	0.74	High	4.52	0.62	Very high	0.1679	
Learning management		3.79	0.72	High	4.69	0.73	Very high	0.2371	4
1	Designing activities to enhance student competencies and 21st-century skills	3.84	0.74	High	4.89	0.75	Very high	0.2734	
2	Adopting instructional designs where teachers function as coaches or facilitators	3.76	0.65	High	4.66	0.68	Very high	0.2393	
3	Creating learning experiences that emphasize systematic thinking and the practical application of knowledge.	3.78	0.76	High	4.53	0.76	Very high	0.1984	
Assessment		3.73	0.69	High	4.59	0.69	Very high	0.2334	5
1	Authentic assessment	3.65	0.83	High	4.59	0.78	Very high	0.2575	
2	Formative assessment	3.81	0.67	High	4.74	0.65	Very high	0.2440	
3	Utilization of assessment data to enhance learning management	3.74	0.61	High	4.55	0.73	Very high	0.2165	
4	Summative assessment	3.71	0.64	High	4.51	0.61	Very high	0.2156	
Overall		3.68	0.68	High	4.68	0.71	Very high	0.2735	-

Note. C=current states, D=desirable states, M=mean score, SD=standard deviation

The curriculum component was evaluated based on four sub-dimensions: i) emphasis on integrated learning management; ii) provision of essential life competencies and skills; iii) relevance and alignment with learner needs; and iv) responsiveness to societal evolution. Among these, integrated learning management emerged as the most critical priority for development (PNI=0.3808). This finding highlights a significant gap between the intended curriculum design and the actual implementation of multidisciplinary approaches in small school settings.

The teacher competency component was categorized into six sub-dimensions: i) learner development; ii) action research for learner improvement; iii) curriculum administration and learning

management; iv) classroom management; v) educational leadership; and vi) community engagement and partnership building. The PNI analysis identified learner development as the most critical priority for enhancement (PNI=0.3712), signaling an urgent need for professional development programs focused on student-centered pedagogical strategies.

The learning management component comprised three sub-dimensions: i) designing activities to enhance student competencies and 21st-century skills; ii) adopting instructional designs where teachers function as coaches or facilitators; and iii) creating learning experiences that emphasize systematic thinking and the practical application of knowledge. It was found that designing activities to enhance learners' competency and 21st-century skills was identified as the most critical priority for development (PNI=0.2734).

Finally, the assessment component was categorized into four sub-dimensions: i) authentic assessment; ii) formative assessment; iii) the utilization of assessment data to enhance learning management; and iv) summative assessment. The analysis revealed that authentic assessment represents the most critical priority for development (PNI=0.2575). This finding suggests that while traditional evaluation methods may be established, there is a significant need to transition toward performance-based evaluations that reflect real-world competencies.

The comprehensive PNI analysis across all investigated dimensions reveals a distinct hierarchical pattern of developmental gaps necessitating urgent intervention within Thai small schools. The priorities for development, ranked by their respective indices, identify learner competency as the most critical area, with a specific exigency for enhancing higher-order thinking. This is followed by curriculum development, particularly the implementation of integrated learning management. In terms of professional capacity, teacher competency requires significant attention regarding learner development strategies. Furthermore, learning management needs a focused redesign of activities to foster 21st-century skills, while assessment frameworks should prioritize the integration of authentic assessment practices.

3.2. Guidelines for implementing CBC in small schools

The transition toward the CBC represents a fundamental paradigm shift in Thai basic education, particularly for under-resourced small schools grappling with unique socio-economic and structural constraints. The findings of this study provide a critical roadmap for this transition, revealing a significant readiness gap that persists despite a high level of stakeholder intent. To bridge this divide, comprehensive implementation guidelines were synthesized through a rigorous qualitative process, including focus group discussions and in-depth interviews with key educational experts. These guidelines, visually summarized in Figure 1, offer a contextualized framework designed to navigate the complexities of small-scale educational settings. This is organized into five strategic dimensions, each serving as a vital pillar for systemic reform:

a. Learner competency

The most compelling finding of this research is that learner competency exhibited the highest PNI (PNI=0.3202), with higher-order thinking—encompassing critical thinking, problem-solving, and creativity—identified as the most urgent sub-dimension for development. This quantitative evidence is strongly corroborated by qualitative insights from a small school administrator, who highlighted the practical challenges of this competency gap as:

> "*…In the context of small schools, the disparity in learner quality is deeply concerning. While our students can memorize content for standardized tests, they fall into a 'competency vacuum' when faced with complex, real-world challenges. Cultivating 21st-century skills—particularly critical thinking and creativity—is no longer an option but the most urgent necessity. Without an immediate pivot toward a competency-based curriculum, the achievement gap between rural and urban students will widen beyond repair, leaving our children ill-equipped for the future.*"
> School Principal, Small Primary School (Informant 1)

This underscores a significant disparity between the aspirations of the CBC and the prevailing classroom realities within small-scale schools, where traditional rote learning remains a persistent barrier. Given that 21st century skills necessitate high levels of cognitive engagement, traditional direct instruction often proves inadequate—a challenge exacerbated by the fact that many small-school environments are currently unequipped to facilitate such complex learning processes [36]. To bridge this gap, it is imperative for under-resourced schools to prioritize constructivist-based learning activities that promote student agency and active engagement [37]. By shifting toward these pedagogical strategies, educators can foster the systematic development of critical thinking, thereby ensuring that learners are prepared to navigate complex challenges within a robust, competency-driven framework [38].

The findings of this study reveal a critical and urgent need to address learner quality within resource-constrained small schools, where the disparity in competency development remains a formidable challenge. The guidelines for this dimension stipulate that these schools must immediately prioritize the cultivation of a holistic suite of 21st-century competencies, namely critical thinking, complex problem-solving, creativity, and collaborative communication, to ensure that students in marginalized contexts are not left behind. In light of the severe resource limitations and unique socio-economic constraints of small schools, it is imperative to establish clear, age-appropriate competency standards that serve as essential benchmarks for both foundational life skills and future-ready proficiencies. By implementing these structured and sequential frameworks for longitudinal growth, small schools can bridge the achievement gap, transforming systemic vulnerabilities into opportunities for equitable and high-quality educational outcomes.

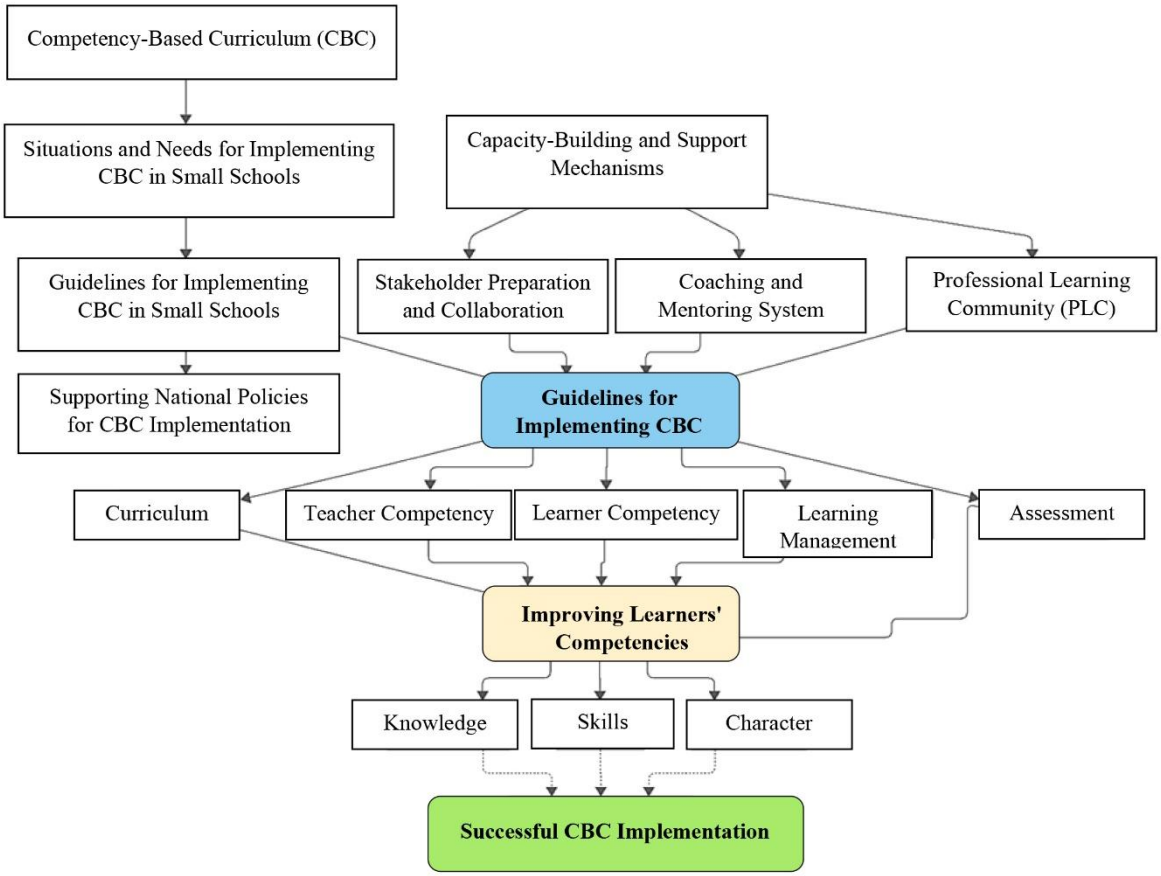


Figure 1. Visual summary of guidelines for implementing CBC of small schools in Thailand

b. Curriculum integration

The current primary education landscape in Thailand is predominantly governed by a standards-based framework, characterized by a rigid architecture of content-driven benchmarks that compel educators to prioritize instructional pace over depth [18]. These pedagogical constraints—compounded by disproportionate administrative workloads in resource-constrained settings—often lead to suboptimal learning management and a persistent application gap, where learners struggle to translate theoretical knowledge into real-world solutions. Specifically, the analysis identified curriculum development as a high-priority area (PNI=0.2796), suggesting that while multidisciplinary integration is a structural necessity for multi-grade classrooms, it is often superficially executed. This systemic friction is vividly echoed in the qualitative reflections of school leaders. One principal articulated that the current curriculum has become a race against indicators, arguing for a fundamental shift toward integration as a survival strategy:

> "*...The current curriculum is a race to fulfill content-heavy indicators, leaving teachers exhausted and students unable to apply what they learn. In a small school with limited staff, teaching subjects in isolation is no longer viable; multidisciplinary integration is our only*

> *lifeline. We must shift from 'covering the book' to 'uncovering competency' through a flexible framework that blends core subjects with local wisdom. Without this transition, our students will remain trapped with theoretical knowledge they cannot use in the real world.*" School Principal, Small Primary School (Informant 2)

To address these systemic deficiencies, the proposed guidelines mandate a strategic realignment of the CBC framework with specific institutional and community contexts. Successful implementation requires a shift from compartmentalized subjects toward a streamlined, multidisciplinary approach that reduces content density to facilitate deeper, competency-based exploration. By conducting a comprehensive community context analysis, schools can bridge the gap between national standards and students' lived experiences—utilizing local human capital, geography, and indigenous wisdom as primary learning platforms. Central to this transition is a paradigm shift toward learner agency, emphasizing the functional application of 21st-century skills over rote acquisition [6]. Furthermore, to ensure sustainability, the implementation must be grounded in the plan-do-check-act (PDCA) cycle, fostering continuous professional development and collective goal-setting among administrators, teachers, and stakeholders. As emphasized by Thummaphan *et al.* [28] such iterative improvement is indispensable for providing the strategic direction required to cultivate a robust school-based curriculum. Ultimately, by reconciling national standards with socio-technological advancements through a clear institutional vision, small schools can transform their inherent constraints into a responsive and efficient educational ecosystem.

c. Teacher competency

A significant barrier identified in this study is the gap in teacher competency (PNI=0.2677), particularly regarding the integration of digital tools for active learning. Beyond technical skills, the findings highlight a capacity paradox: while teachers demonstrate a high commitment to reform, their professional growth is severely obstructed by the inherent structural demands of small-scale institutions. In resource-constrained settings, educators are often forced to prioritize operational survival over pedagogical innovation. This professional tension is vividly captured in the testimony of a teacher who describes the struggle to balance multi-grade instruction with systemic pressures:

> "*...I fully recognize the importance of competency-based learning, but the reality of a small school is overwhelming. Balancing multi-grade teaching with heavy administrative duties leaves almost no time for professional development. It is a constant struggle between the desire to innovate and the exhaustion of keeping up with the daily demands of a resource-constrained environment.*" Teacher, Small Primary School (Informant 3)

This professional tension reflects a global paradigm shift: educators are expected to transition from lecturers to facilitators, yet often without the necessary structural scaffolding. In resource-constrained small schools, this challenge is intensified by chronic understaffing and the exigencies of multi-grade instruction, where a limited number of teachers must master and deliver all subjects across various grade levels. Such environments frequently foster professional isolation, depriving educators of the peer collaboration essential for pedagogical growth. The alignment between the high PNI and these qualitative insights underscores that professional development in this context cannot be rectified through traditional, isolated training sessions. Instead, it necessitates a systemic overhaul, namely a significant reduction in administrative burdens and the institutionalization of flexible, school-based professional development. Such a model must explicitly acknowledge the unique temporal constraints of multi-grade educators, moving beyond one-size-fits-all training toward a supportive ecosystem that fosters sustainable innovation within the local school community.

The findings strongly advocate for the institutionalization of PLCs as a strategic remedy. PLCs empower teachers to collaboratively bridge the gap between curriculum standards and classroom practice through collective inquiry. As Paletta [39] demonstrated, school principals who view PLCs as a multidimensional construct—integrating personal, interpersonal, and organizational capacities—can significantly improve student learning outcomes. Furthermore, the data reveals a critical deficiency in research experience and digital literacy among educators. The lack of classroom-based research skills hinders the development of evidence-based learning management, while insufficient ICT expertise prevents the effective adoption of 21st-century instructional models. This is compounded by systemic pressure to prioritize instructional pace over depth, leaving little room for learning by doing. Consequently, students often fail to develop the systematic thinking and multidisciplinary skills necessary to synthesize knowledge across science, mathematics, and technology. Transitioning to a CBC requires a fundamental shift in pedagogical orientation [40]. However, in small schools, teachers often possess only basic computer literacy and face inadequate ICT infrastructure [41]. To overcome these hurdles, it is imperative to move beyond one-size-fits-all training. Relevant agencies should implement hands-on workshops focusing on the

integration of artificial intelligence (AI) and educational technology to streamline administrative tasks and enhance learning management. To ensure sustainability, this study proposes a mentoring ecosystem where faculty members from local universities serve as instructional coaches. These mentors can provide ongoing consultancy and monitoring, helping teachers conduct action research and adopt AI-driven solutions to manage multi-grade complexities. Such partnerships are essential for transforming under-resourced schools into centers of pedagogical innovation.

d. Active learning management

The research findings reveal that while overall readiness for learning management is high, a critical priority gap exists in designing activities that authentically enhance student competencies (PNI=0.2371). This suggests a translation gap: educators understand the theoretical importance of active learning but struggle to operationalize it within complex classroom structures. In small schools, this challenge is acutely felt as teachers must navigate the pedagogical demands of diverse age groups and subjects simultaneously. This quantitative insight is vividly corroborated by the lived experience of a practitioner, who describes the overwhelming nature of multidisciplinary instruction:

> "*…Managing multi-grade classrooms across diverse subjects is a massive challenge. While I value 21st-century skills, I feel inexperienced in multidisciplinary integration. It is difficult to bridge these fragmented subjects into a cohesive, competency-based experience that actually works in practice.*" Teacher, Small Primary School (Informant 4)

This underscores a pivot in Thai educational reform from theoretical mandates toward classroom-level execution. As traditional, passive pedagogical models prove insufficient for CBC implementation, instructional strategies must shift toward active, learner-centric methodologies—such as inquiry-based, project-based, and research-based learning—that require higher-order cognitive tasks [42]. In the context of resource-constrained small schools, the proposed guidelines advocate for science, technology, engineering, art, and mathematics (STEAM) education as a strategic multidisciplinary framework. STEAM offers a pragmatic solution to curriculum density by integrating fragmented subjects into a cohesive, problem-solving narrative, thereby maximizing limited instructional time and personnel [43]. To operationalize this, schools should institutionalize annual development plans that set specific benchmarks for competency enhancement. Educators are encouraged to diversify their pedagogical repertoire by integrating evidence-based strategies: project-based learning [44], problem-based learning [45], and research-based learning [46]. Furthermore, the application of cooperative learning, such as the jigsaw method [8], and game-based learning platforms like Kahoot [47], can significantly enhance collaboration, motivation, and engagement. Central to this transformation is the fostering of self-directed learning (SDL) and learner agency. In small-scale settings where teachers manage multi-grade classrooms, autonomy is not only a pedagogical goal but a vital management strategy. Aligning with self-determination theory (SDT) [48], the guidelines propose that learning management be redesigned to allow students to define problems collaboratively and pursue study themes based on their unique interests and aptitudes. By positioning students as lead learners and teachers as instructional coaches, schools can cultivate age-appropriate innovation. This shift enables students to develop creative solutions to daily life scenarios using digital tools for inquiry, ultimately transforming them from passive consumers of knowledge into active creators of social value and global citizens.

e. Authentic assessment

While assessment yielded a lower overall PNI (PNI=0.2334), authentic assessment emerged as the most critical sub-aspect, revealing a persistent pedagogical disconnect. Even when active learning is successfully implemented, educators often revert to traditional paper-and-pencil tests, which fail to capture the multidimensional nature of competency. This suggests that the reform is stalled at the final stage: the inability to certify what students can actually do rather than what they merely know. This quantitative gap is substantiated by the qualitative reflections of a practitioner, who identifies the lack of specialized evaluation instruments as a primary hurdle:

> "*…Currently, my assessment relies heavily on traditional tests. While I occasionally evaluate skills, I lack a deep understanding of holistic competency assessment. The primary obstacle is the dearth of quality tools and specific rubrics needed to accurately measure complex student competencies.*" Teacher, Small Primary School (Informant 5)

To ensure that CBC implementation in Thailand transcends superficiality, there must be a systemic shift toward performance-based evaluations that replicate real-world challenges [29]. This transition requires moving beyond the output stage—which evaluates isolated knowledge and skills—toward the outcome stage, where competency is manifested as an integrated construct. To bridge this conceptual gap, educators in resource-constrained small schools must institutionalize multi-method authentic assessments. The evaluation

framework should prioritize formative practices that monitor student learning in real-time, utilizing diverse tools such as behavioral observation scales, interviews, and rubric-based evaluations. A cornerstone of this approach is the triangulation of data through instructor evaluations, digital portfolios, and the integration of student involvement via self-assessment and peer-assessment [49]. As highlighted by Liu *et al.* [50], engaging students in these reflective processes fosters metacognition and empowers learners to take responsibility for their own developmental trajectories. Furthermore, the utilization of digital tools such as Quizizz, Kahoot, and Google Forms can enhance assessment engagement and data efficiency, providing the necessary formative feedback to drive learning management. This alignment with Ponomariovienė *et al.* [51] suggests that effective assessment allows students to demonstrate knowledge across diverse situations while gaining clarity on their personal learning goals. Although implementing such complex strategies remains challenging due to the required pedagogical content knowledge [52], these practices are essential for transforming assessment from a mere grading tool into a powerful engine for personalized growth. By maintaining flexible criteria that adapt to the specific needs of learners, small schools can effectively bridge the existing evaluation void and ensure a comprehensive overview of student proficiency [30].

The suitability of the proposed guidelines suggests that despite resource limitations, small schools possess a unique strategic advantage: community agility. Their compact scale facilitates deeper collaboration among principals, teachers, and parents—a form of social capital essential for CBC, which demands a shared vision of learner competency within a specific local context. These comprehensive guidelines are structured five core pillars: i) curriculum; ii) teacher competency; iii) learner competency; iv) learning management; and v) assessment. This framework is strategically aligned with national quality assurance standards, which emphasize learner quality, administrative excellence, and learner-centered management [53]. Transitioning to CBE represents a fundamental paradigm shift from time-based instruction to performance-based systems. This evolution necessitates a systemic commitment characterized by cross-level collaboration and strategic coordination [54]. Unlike traditional models prioritizing content coverage, CBE focuses on achieving specific behavioral masteries and real-world outcomes. According to Thummaphan *et al.* [28], the core principle of CBC development is to ensure learner success by aligning competencies with professional and personal requirements through flexible study structures and skill-focused environments. To sustain this momentum, the implementation must be supported by expanded in-service training led by high-proficiency facilitators [7]. Ultimately, the success of a school-based CBC relies on a holistic ecosystem: the readiness of administrators and teachers, modernized classroom infrastructure, and heightened community awareness—all underpinned by adequate funding and specialized learning resources [55]. By leveraging their inherent agility, under-resourced small schools can effectively transform these guidelines into a robust foundation for cultivating future-ready proficiencies.

The conceptual foundation of this study is grounded in a dual-theoretical framework integrating SDT and constructivist learning theory, both of which are pivotal for understanding learner agency and active learning within CBE. The SDT provides a robust macro-theoretical framework for conceptualizing the psychological mechanisms that facilitate intrinsic motivation and autonomous extrinsic motivation through the satisfaction of three innate needs: autonomy (volition), competence (mastery), and relatedness (social connection). Extensive empirical evidence suggests that when these needs are met, learners exhibit enhanced academic achievement and self-efficacy [48], [56], [57]. This psychological foundation is further bolstered by constructivist learning theory, which posits that knowledge is actively constructed through hands-on experimentation and social negotiation rather than passive reception [58]. Within this integrated framework, learning is characterized as an active, reflective, and inquiry-based process where meaning is derived from cognitive and social participation. The proposed guidelines for utilizing CBC in small-school settings directly operationalize this integrated framework to bridge the persistent knowledge-policy gap [48]. By shifting from standardized compliance to student-led inquiry, the guidelines satisfy the need for autonomy and foster learner agency. Simultaneously, the transition toward real-world, problem-based assessments—mirroring the PISA framework—systematically builds competence through the constructivist lens of immersing learners in ill-structured, real-world contexts [58], [59]. Furthermore, these guidelines leverage the inherent social capital of small schools to strengthen relatedness and social constructivism through collaborative community-based projects. Consequently, the success of CBC in resource-constrained environments is not merely dependent on curriculum redesign, but on the capacity of educators to cultivate an autonomy-supportive and constructivist climate that internalizes learning goals. This synergistic approach transforms the educator's role from a purveyor of information to a facilitator of learning environments, thereby ensuring the sustainable development of high-level competencies and holistic student well-being.

The theoretical underpinning of CBC exhibits a profound alignment with the OECD's PISA framework, as both paradigms prioritize the cultivation of critical thinking, problem-solving, and real-world applications over rote memorization [60]. Empirical evidence from diverse contexts demonstrates that CBC implementation fosters significant improvements in student learning outcomes, self-efficacy, and higher-

order thinking skills through learner-centered and collaborative pedagogies [5], [61], [62]. However, a scholarly disjuncture exists regarding the direct, immediate impact of CBC on national PISA scores. While high-performing systems like Singapore and Taiwan have successfully integrated competency-based frameworks to maintain global educational leadership [63], other studies suggest that the transition from traditional to PISA-aligned curricula is often fraught with systemic challenges, including resource disparities, faculty resistance, and the need for rigorous teacher re-training [60]. Furthermore, critics argue that the polysemous nature of competencies leads to hybrid and sometimes inconsistent policy implementations [64]. Ultimately, while CBC aims to bolster PISA-related proficiencies, its success is contingent upon long-term structural commitment, effective mentorship, and the bridging of the implementation gap in under-resourced settings.

In resource-constrained settings of small schools, the most effective strategies for scaling CBC hinge on a multi-dimensional support architecture that prioritizes systemic capacity-building over isolated curricular changes. According to the proposed framework, scaling is achieved through three core mechanisms: i) stakeholder preparation and collaboration, which ensures buy-in and shared responsibility across local networks; ii) a robust coaching and mentoring system that provides continuous pedagogical scaffolding for teachers; and iii) the institutionalization of active PLCs to foster collaborative problem-solving and resource sharing. These strategies effectively bridge the gap between national policy and localized implementation by focusing on teacher competency and learning management as the primary drivers for improving learner outcomes. By leveraging these community-based support structures, the model ensures that CBC can be sustainably scaled in small schools, transforming systemic constraints into opportunities for targeted, high-quality competency development in knowledge, skills, and character. To evaluate the long-term impact of the proposed guidelines, this research outlines an integrated empirical framework comprising longitudinal assessments of learner outcomes and action research on CBC scalability. The longitudinal component involves tracking a cohort of students in small-school contexts through a multi-phase data collection design—incorporating baseline, formative, and summative assessments—to measure academic trajectories via PISA benchmarks and career readiness indicators. Simultaneously, the action research initiative employs a mixed-methods approach to identify sustainable scaling strategies, such as collaborative professional development and community-based resource-sharing models, within established school networks. By utilizing iterative feedback loops, these complementary research directions seek to address the implementation gap in resource-constrained environments. Ultimately, the synthesis of longitudinal evidence and practical action-oriented insights is poised to underpin systemic policy reforms and provide a scalable framework for elevating educational quality in diverse, under-resourced settings.

4. CONCLUSION

This research underscores that while small schools in Thailand demonstrate a high level of readiness for implementing a CBC, a significant gap remains between current practices and the high perceived necessity for systemic reform. The PNI analysis serves as a strategic roadmap that prioritizes learner competency, particularly higher-order thinking, as the most urgent area for development. This is followed by the need for curriculum integration and the enhancement of teacher competency in learner-centered development. The study reveals that the transition from a traditional standards-based model to a performance-based system requires more than just a change in framework; it necessitates a fundamental shift in pedagogical management. The developed guidelines provide a five-dimensional strategy comprising curriculum refinement, teacher professionalization, learner competency standards, active learning management, and authentic assessment. The success of these guidelines hinges on the institutionalization of active PLCs and robust coaching systems to bridge the gap in teachers' digital and research literacy. Ultimately, the successful implementation of CBC in small schools is contingent upon sustained support from national authorities, particularly regarding specialized professional training, strategic funding, and the provision of modern learning resources. By aligning school-based initiatives with national quality assurance standards, these institutions can effectively cultivate the 21st-century proficiencies essential for students to thrive in an increasingly complex and interconnected global society. This alignment not only bridges the developmental gap identified in this study but also ensures that the transition to CBE is both sustainable and impactful at the grassroots level.

Future studies should extend the current research by adopting longitudinal or quasi-experimental approaches to evaluate the empirical effectiveness and long-term impacts of the proposed CBC implementation guidelines post-execution. Furthermore, it should focus on the intervention studies assessing the effectiveness of the proposed implementation guidelines and comparative studies across different school sizes, and cross-national validation of the proposed framework. Such empirical designs would provide stronger causal evidence regarding educational improvement and policy effectiveness.

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AUTHOR CONTRIBUTIONS STATEMENT

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Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Pinyo Wongthong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wanchai Noiwong	✓	✓		✓	✓	✓	✓	✓	✓					
Somsamer Thaksin	✓	✓		✓	✓	✓	✓	✓	✓					

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

We have obtained informed consent from all individuals included in this study.

ETHICAL APPROVAL

This research was certified by the Human Research Ethics Committee of Srinakharinwirot University (Protocol No. SWUEC-672320).

DATA AVAILABILITY

The data that supports the findings of this study are available from the corresponding author, [PW], upon reasonable request.

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BIOGRAPHIES OF AUTHORS



Pinyo Wongthong is an assistant professor of science education. He has been working for Educational Research Development and Demonstration Institute, Srinakharinwirot University, Thailand. His research focuses on science education, STEM education, chemistry education, 21st century teaching and learning, and classroom research. He can be contacted at email: pinyo@g.swu.ac.th; pinyowongthong@hotmail.com.



Wanchai Noiwong is a senior academic professional in the Compulsory Science Department at the Institute for the Promotion of Teaching Science and Technology (IPST), Thailand. His research focuses on science education, STEM education, 21st century teaching and learning. He can be contacted at email: wnoiw@ipst.ac.th.



Somsamer Thaksin is a lecturer of physics subject. She has been working for Educational Research Development and Demonstration Institute, Srinakharinwirot University, Thailand. Her research focuses on physics education, science education, curriculum and instruction development, STEM education, and classroom research. She can be contacted at email: talayha@hotmail.co.th.