Integrating Thai Traditional Medicine and Local Wisdom: A Herbal Garden-Based Learning Management Model

Montree WONGSAPHAN[1*]
Jiraporn CHANO[1]
Ananya KONGSAENKHAM[1]
Senny LUCKYARDI[2]

Abstract
This study investigated the effects of an integrated learning management model utilizing school herbal gardens—functioning as repositories of Thai traditional medicine and local wisdom—on students' 21st-century skills, learning outcomes, and characteristics of sufficiency living. By connecting multidisciplinary subject areas with indigenous practices through authentic learning experiences, the model implemented a six-stage pedagogical framework known as the GARDEN Model: Grounding and Engagement, Asking and Exploring, Researching and Connecting, Doing and Experimenting, Enriching and Creating, and Narrating and Reflecting. The study evaluated student performance before and after model implementation using descriptive statistics and comparative analysis based on 21st-century skills assessments, learning achievement tests, and sufficiency living evaluations. The empirical findings demonstrated significant improvements across all measured dimensions. Specifically, students' overall 21st-century skills increased from a pre-test mean of 3.22 to 4.25, with marked progress in critical thinking, problem-solving, communication, collaboration, creativity, and technology literacy. Academic learning outcomes rose substantially from 22.64 points (56.60%) to 33.72 points (84.30%), while characteristics of sufficiency living improved from an overall mean of 3.23 to 4.31. Consequently, the study concludes that utilising school herbal gardens as authentic learning contexts effectively harmonises academic knowledge with local wisdom, active inquiry, and hands-on production. Ultimately, the GARDEN Model offers a practical and meaningful educational framework for holistic student development, successfully linking traditional culture, essential 21st-century competencies, and real-life application.

Keywords: *Integrated Learning Management, School Herbal Garden, Learning Resource-Based Learning, 21st-Century Skills, Learning Outcomes.*

Introduction

Changes in global society in the 21st century have required the education system to shift from focusing on knowledge transfer to developing students' competencies to apply knowledge in their lives, such as analytical thinking, problem solving, innovation, communication, and working effectively with others. Educational institutions therefore need to design learning management that

[1] Faculty of Education, Mahasarakham University, Thailand
*Montree.v@msu.ac.th
[2] Universitas Komputer Indonesia, Indonesia

connects to students' real contexts, providing opportunities for them to learn from direct experience through practice, research, experimentation, and knowledge creation of their own, using learning resources both inside and outside the school as a base for learning. This aligns with constructivist learning (Vygotsky, 1978) and meaningful learning (Ausubel, 1968), which emphasise learners connecting new knowledge with previous experiences to gain deeper understanding (Beane, 1997; Drake & Burns, 2004).

Aligned with Thailand's educational policy promoting holistic student development, educational institutions are encouraged to use local resources and indigenous knowledge to create experiential learning spaces that foster systems thinking and connect academic concepts to daily life (Office of the Secretariat of the Council of Education, 2018; Harefa, 2025). Within this framework, the "Herb Garden in School" emerges as a highly effective, multidisciplinary learning environment rich in Thai traditional medicine and community culture. It allows students to naturally integrate various subjects—such as science, mathematics, languages, and art—through hands-on activities ranging from botanical classification to product processing and marketing, ultimately enabling them to see the relationships between different disciplines and apply their competencies to real-world situations (Botanical Garden Organization, 2012; Sucipto & Fatihin, 2024).

Many studies and academic articles reflect this: using the herb garden as a learning base increases academic achievement and develops scientific process skills, analytical thinking skills, creativity, teamwork, and awareness of natural resource conservation. It also helps promote professional skills, entrepreneurship, and lifelong learning. In addition, developing participatory learning resources helps foster cooperation among schools, parents, communities, and local agencies (Boyer, 1996; Cheang et al., 2017; Wongsaphan, 2026).

Although many educational institutions have herb gardens, these spaces remain systematically underutilised, often confined to science classes or extracurricular activities, while their rich connections to Thai traditional medicine and local wisdom are overlooked (Cheang et al., 2017; Wongsaphan, 2026). This gap highlights the necessity for a clear, competency-based learning management model that promotes active learning and integrates 21st-century skills with real-world contexts. By utilising the herbal garden as an integrated educational foundation, teachers can facilitate hands-on exploration, experimentation, and practical application, empowering students to develop essential competencies, social responsibility, and a commitment to sustainable development (Beane, 1997; Office of the Secretariat of the Council of Education, 2018; Cheang et al., 2017; Wongsaphan, 2026).

For that reason, the researcher set out to develop a herbal garden-based learning management model that integrates Thai traditional medicine and local wisdom. This aims to create a learning management model with clear components and operating processes that can be used to organize learning activities in a school context, promote the integration of knowledge from many disciplines, and

develop students' key competencies (advanced thinking skills, life skills, vocational skills, and awareness of local resource conservation), while also serving as a model for making the most of educational resources. This will raise the quality of education and create a sustainable network of cooperation between schools and communities.

Research Objectives:

1. To develop an integrated learning management model using the school's herbal garden as a learning resource.
2. To study the learning outcomes of students who learn using the integrated learning management model based on the school's herbal garden.

Research Methodology

This research employed Participatory Action Research (PAR) to develop an integrated learning management model using school herbal gardens as a learning resource. This was achieved through the participatory process of school administrators and teachers at every stage, from problem analysis and model design to pilot testing, reflection, and model refinement to suit the school's context.

1. Data Providers. The data providers were selected using purposive sampling, consisting of administrators and teachers from four schools under the Mahasarakham Primary Educational Service Area Office 1: Ban Don Wan Hua Nong School, Mueang Mahasarakham District, Mahasarakham Province, Ban Wang Bua Samakkhi Witthaya School, Kantharawichai District, Mahasarakham Province, Ban Khok Klang School, Borabue District, Mahasarakham Province, Ban Sok Daeng School, Kae Dam District, Mahasarakham Province. Data providers included 4 school principals, 4 deputy school principals, and 37 teachers, for a total of 45 participants. All participants acted as co-researchers, engaging in collaborative thinking, planning, implementation, evaluation, and development of management models.

2. Research Procedure. The research was conducted in two phases:

Phase 1: Model Development through Participatory Action Research (PAR). The model was developed through three iterative PAR cycles consisting of planning sessions, workshops, and collaborative meetings with school administrators and teachers. Key activities involved exploring herbs, classifying plant species, creating a herbal database, tracking plant growth, experimenting with herbal processing, and establishing interdisciplinary links. Data were gathered through observation rubrics, field notes, photographs, and student work artefacts. Following each cycle, continuous reflection meetings were conducted to analyse strengths, identify operational challenges, and integrate stakeholder feedback to refine the instructional model.

Phase 2: Model Refinement, Implementation, and Evaluation. Building upon the initial findings, learning units, instructional processes, assessment methods, and resource utilisation strategies were systematically improved. Knowledge exchange was facilitated across all four participating schools through

Professional Learning Communities (PLCs). The refined model was then fully implemented and monitored to evaluate its contextual suitability and pedagogical effectiveness, culminating in the final learning management model.

Research Results

1. The integrated learning management model utilises the school's herbal garden as an authentic resource to connect multidisciplinary knowledge through active exploration, experimentation, and reflection. It emphasizes student-led knowledge construction drawn from direct experience, linking academic concepts to real-life contexts, community practices, and the rich heritage of Thai traditional medicine. Guided by the core philosophy of integrating academic knowledge with local wisdom, teachers act as facilitators while students explore and apply their learning independently. Structurally, the model comprises four key components: 1) Instructional Process (Syntax), 2) Principle of Reaction, 3) Social System, and 4) Support System.

1.1 Teaching Procedure (Syntax) The teaching process of this model consists of six steps are collectively referred to as the "GARDEN Model" to reflect the use of herb gardens as a learning base, as follows:

Step 1: Grounding and Engagement (G)

Teachers initiate the learning process by introducing real-world situations grounded in the school herbal garden through physical exploration, study of live specimens, or garden-based problem scenarios. To stimulate curiosity, teachers pose inquiry-driven questions regarding plant classification, medicinal properties, traditional Thai healing roles, growth factors, and garden utility. Students connect their prior experiences with real-world observations to collaboratively identify key learning focus areas, supported by the teacher acting as a catalyst for engagement.

Expected Outcome: Students develop interest in and appreciation for the herbal garden while identifying specific issues or problems to investigate.

Step 2: Asking and Exploring (A)

Working in small groups, students systematically explore the garden using field notebooks, maps, cameras, and digital recording technology to observe plant morphology, medicinal uses, and environmental habitats. Based on their observations, students formulate research questions and hypotheses. Rather than offering direct answers, teachers facilitate higher-order thinking through probing questions regarding supporting evidence, data verification, and remaining knowledge gaps.

Expected Outcome: Learners collect empirical data, formulate analytical questions, and define structured learning topics from authentic contexts.

Step 3: Researching and Connecting (R)

Students investigate their chosen topics by gathering information from diverse academic and local sources, including textbooks, digital databases, community experts, and Thai traditional medicine practitioners. They critically compare, synthesize, and verify the credibility of the data. This stage emphasizes interdisciplinary integration, enabling students to link traditional wisdom seamlessly with academic concepts across multiple subjects.

Expected Outcome: Students construct a holistic understanding of the research topic by connecting interdisciplinary knowledge with validated real-world information.

Table 1. Interdisciplinary Integration of Thai Traditional Medicine and Local Wisdom Across Subject Areas.

Science/Subject Group	Examples of integration
Science	Plant characteristics, growth, ecosystem, important substances, and their traditional medicinal properties.
Mathematics	Measuring area, number of trees, growth rate, and data presentation.
Thai language	Reading comprehension, report writing, presentation.
English	Common names, English names, and herbal terminology.
Social studies	Local wisdom, way of life, culture, and the history of Thai folk healers.
Careers	Cultivation, processing, and value addition.
Art	Label, packaging, and promotional material design.
Technology	The use of technology to research, store, and present information.

Teachers help students see the relationships between areas of knowledge, not by bundling content from multiple subjects together, but by using a single "issue or situation" as a central focus. Then, knowledge from various disciplines is applied to understand and solve the problem. Expected Outcome: Students are able to connect knowledge from multiple disciplines with the issues under study and create a holistic understanding.

Step 4: Doing and Experimenting (D)

Students actively engage in experiential learning activities to test hypotheses, solve problems, and address research questions. Tasks involve evaluating variables affecting plant growth, designing garden layouts through mathematical calculation, processing herbal remedies using traditional techniques (e.g., crafting balms or compresses), consulting local healers, managing production costs, and creating promotional materials. Working in organised groups, students assign roles, collect data, and utilise empirical evidence to guide their decisions. Teachers serve as facilitators—providing guidance on safety, tools, and methodologies without intervening directly in student decision-making.

Expected Outcome: Students apply theoretical knowledge to real-world scenarios while building practical skills, collaborative problem-solving capabilities, and evidence-based decision-making.

Step 5: Enriching and Creating (E)

Students synthesise their research and experimental findings into tangible, creative projects or innovations. This step emphasizes interdisciplinary application to deliver value to the school and community. Deliverables may include local herbal handbooks, digital databases linked with plant QR codes, garden maps,

value-added herbal products with custom packaging, media content (e-books, video clips), public exhibitions, or garden sustainability proposals.

Expected Outcome: Students synthesise multidisciplinary knowledge to design valuable artefacts, products, or functional innovations for their educational community.

Step 6: Narrating and Reflecting (N)

Students showcase their findings and creations to authentic audiences—including peers, administrators, parents, and community members—via oral presentations, digital media, interactive exhibitions, or herbal market fairs. Following presentations, students engage in structured reflection centred on three reflective questions: *What did we learn? How did we learn? How will we apply this knowledge?* Constructive feedback from teachers and peers helps students evaluate their performance, recognise strengths, and identify areas for growth. Finally, students articulate the lasting value of the herbal garden as a learning resource and propose continuous improvement strategies.

Expected Outcome: Learners articulate self-constructed knowledge, reflect critically on their learning process, evaluate project outcomes, and connect academic concepts to real-life application.

1.2 Principle of Reaction

The Principle of Reaction outlines the pedagogical guidelines teachers must adopt to respond effectively to students' behaviours, cognitive processes, and diverse learning needs. As responsive facilitators, teachers validate student interests by offering curricular flexibility and using open-ended, thought-provoking questions to stimulate independent problem-solving rather than providing direct answers. To cultivate learner autonomy, teachers employ dynamic scaffolding—initially providing robust assistance and progressively fading support as students' competencies grow. This approach respects individual differences by accommodating varying baseline abilities through flexible instructional activities. Furthermore, the model prioritises cognitive processes over definitive right-or-wrong binaries, encouraging students to ground their conclusions in empirical data, observation, and logical reasoning. Throughout the learning journey, teachers deliver timely, specific, and actionable feedback while promoting collaborative learning, turning differing opinions into opportunities for active listening and evidence-based peer discourse.

1.3. Social System. The model operates within a participatory social system characterised by distinct yet highly interdependent roles and dynamic interactions among all stakeholders.

1.3.1. Teacher and Learner Roles. The teacher functions across six critical dimensions: as a learning designer who maps the herbal garden context to the curriculum, a facilitator of self-directed learning, a questioner stimulating higher-order thinking, a supportive coach during challenges, a community resource coordinator, and an evaluator utilizing assessment for learning rather than mere judgment. Conversely, the learner transitions from a passive recipient to an active, self-directed constructor of knowledge. Taking ownership of their educational journey, students initiate learning by exploring the garden, asking analytical

questions, bridging interdisciplinary theory with practice, and transforming their insights into tangible innovations.

1.3.2. Interpersonal and Group Dynamics. The teacher-student relationship shifts away from traditional knowledge transmission toward guided facilitation. Students are granted the autonomy to think and act independently, operating within safe, objective-driven boundaries established by the teacher. Concurrently, peer-to-peer relationships are rooted in cooperative learning. Students collaborate in groups, systematically rotating through diverse responsibilities—such as explorer, data recorder, researcher, analyst, media creator, and presenter—to ensure comprehensive and equitable skill development.

1.3.3. Community Integration. Finally, the social system extends beyond the classroom, utilizing the herbal garden as a vital nexus that connects the school, families, and the broader community. This ecosystem actively integrates local wisdom by inviting community experts to share traditional herbal knowledge, investigating historical uses of local flora, and empowering students to add value to local agricultural produce, thereby grounding their academic learning in authentic cultural heritage.

1.4. Support System.

The successful implementation of the learning model relies on a comprehensive support system that seamlessly integrates physical infrastructure, specialised equipment, digital technology, human networks, and robust evaluation mechanisms into a cohesive framework. At its core, the school herbal garden functions as an interactive outdoor classroom equipped with systematically categorized plant species, informational signage, and dedicated zones for continuous scientific observation, all supported by safe, age-appropriate tools for gardening, measurement, and experimental processing. This physical foundation is supported by a modern technological ecosystem where students use academic databases, QR codes, and digital platforms to research and present findings, alongside a collaborative network of administrators, educators, parents, local herbalists, and healthcare professionals who serve as learning facilitators. Furthermore, student progress across diverse learning styles is systematically captured through a multifaceted evaluation toolkit—comprising behavioural observation rubrics, practical skill assessments, portfolios, and reflective logs—all situated within an accessible, learning-friendly outdoor environment that ensures meaningful inquiry extends naturally beyond standard classroom hours.

2. Learning outcomes using an integrated learning approach based on the school's herbal garden as a learning resource. This study investigated the effects of the developed model on students' 21st-century skills, learning outcomes, and self-sufficiency characteristics. The research findings are presented as follows:

1. The assessment revealed a significant improvement in students' 21st-century skills following the implementation of the learning model, with the overall mean score increasing from 3.22 to 4.25. While all specific skill areas demonstrated growth, the most substantial improvements were observed in creative thinking and innovation, followed by communication and collaboration,

and critical thinking and problem-solving. These findings indicate that utilizing the school herbal garden as a hands-on learning resource effectively fosters essential 21st-century skills by engaging students in active exploration, inquiry, experimentation, and creative production (see Table 2).

Table 2. Comparison of 21st-century skills of students before and after using the model.

21st-Century Skills	Before class (Mean)	SD	After class (Mean)	SD	Difference
1. Critical thinking and problem solving	3.18	0.48	4.21	0.39	1.03
2. Communication	3.24	0.51	4.28	0.36	1.04
3. Collaboration	3.31	0.47	4.35	0.34	1.04
4. Creative thinking and innovation	3.12	0.52	4.17	0.41	1.05
5. The use of information and technology	3.27	0.49	4.23	0.38	0.96
Total	3.22	0.39	4.25	0.31	1.03

2. A comparison of student learning outcomes before and after model implementation revealed significant improvements across knowledge, understanding, application, and synthesis. Pre-test scores averaged 22.64 points (56.60%), whereas post-test scores rose to 33.72 points (84.30%), marking an overall increase of 11.08 points (27.70%). Beyond numerical growth, students demonstrated a greater capacity to explain phenomena, analyse data, and solve real-world problems using their herbal knowledge, particularly when completing assignments directly connected to their experiential learning in the garden (see Table 3).

Table 3. Comparison of learning outcomes before and after using the model.

Evaluation	Full score	Mean	SD	Percentage
Before class	40	22.64	4.18	56.60
After class	40	33.72	3.21	84.30
Difference		11.08		27.70

3. The assessment of students' self-sufficiency characteristics revealed significant post-implementation improvements across both overall and individual components, with the total mean score increasing from 3.23 to 4.31. Among the evaluated dimensions, ethical conditions achieved the highest post-test average, followed sequentially by moderation, knowledge, rationality, and resilience. These results demonstrate that utilising the herbal garden as a learning base extends beyond academic skill development to cultivate essential life skills, including efficient resource utilisation, strategic planning, evidence-based decision-making,

and responsible work habits. Ultimately, this approach fosters a deep appreciation for natural resources and Thai local wisdom as fundamental pillars for sustainable living (see Table 4).

Table 4. Comparison of self-sufficiency characteristics before and after implementing the model.

Characteristics of living a self-sufficient life	Before the lesson (Mean)	SD	After the lesson (Mean)	SD
1. Moderation	3.21	0.51	4.34	0.38
2. Rationality	3.18	0.47	4.27	0.40
3. Having a strong immune system	3.15	0.49	4.22	0.42
4. Knowledge requirement	3.27	0.46	4.31	0.36
5. Ethical conditions	3.34	0.43	4.39	0.34
Total	3.23	0.38	4.31	0.30

4. Behavioural observations during model implementation revealed significant developmental milestones in student autonomy and engagement. While learners initially relied on teacher guidance to structure their research, they progressively became self-directed in formulating questions, planning surveys, delegating roles, and selecting appropriate methodologies. During field exploration, students enthusiastically applied interdisciplinary knowledge—integrating mathematics for calculations, science to explain plant growth, language arts for reporting, and technology for media creation. Notably, students demonstrated a heightened respect for local wisdom by proactively consulting community elders to uncover traditional herbal remedies. Furthermore, they embodied the principles of moderation, rationality, and resilience through sustainable daily habits, such as conserving water, utilising recycled materials for projects, caring for medicinal plants, and sharing group equipment.

Discussion

This study of an integrated learning management model using the school's herbal garden as a learning resource found that, after implementing the learning model, students demonstrated improved 21st-century skills, higher learning outcomes, and enhanced self-sufficiency in living. These results can be discussed as follows:

1. Implementation of the GARDEN Model significantly improved students' 21st-century skills, increasing overall mean scores from 3.22 to 4.25, notably in creative thinking, innovation, communication, collaboration, and critical thinking. Grounded in the school herbal garden, this model replaces traditional instruction with real-world inquiry, shifting learners from passive recipients to active knowledge creators. Through the *Asking and Exploring*, *Researching and Connecting*, and *Doing and Experimenting* stages, students test hypotheses and collect data to build systematic problem-solving and teamwork. Furthermore, the *Enriching and Creating* stage drives innovation by guiding students to construct herbal

guidebooks, digital databases, QR codes, processed products, and promotional materials, demonstrating that competencies develop best through authentic context.

2. This improvement is driven by using the school herbal garden to bridge abstract academic concepts, including biology, mathematics, literacy, and vocational skills—with hands-on experience, fostering meaningful learning over rote memorisation. Furthermore, the model establishes a continuous cycle of inquiring, researching, practising, creating, and reflecting. Specifically, project creation and presentation during the *Enriching and Creating* and *Narrating and Reflecting* stages compel students to organise, analyse, and articulate knowledge in their own words, thereby consolidating mastery and yielding higher post-learning achievement.

3. Implementation of the GARDEN Model significantly improved students' self-sufficiency characteristics, with mean scores increasing from 3.23 to 4.31, particularly in moderation, knowledge, and ethical conditions. Using the herbal garden as an experiential learning space, students practised moderation via resource conservation and recycling, built rationality through collaborative planning, and strengthened ethical traits through shared teamwork. Crucially, by integrating the Sufficiency Economy Philosophy into authentic, hands-on tasks rather than teaching it in isolation, the model enabled students to internalise self-sufficiency principles through active practice rather than rote memorisation.

In summary, the research shows that an integrated learning management model that uses school herbal gardens effectively promotes holistic student development across academic learning outcomes, 21st-century skills, and self-sufficiency traits. By providing an experiential framework grounded in real-world contexts, the model enables students to engage in hands-on activities, apply multidisciplinary knowledge, construct meaningful projects, and reflect on their learning. Beyond numerical score improvements, the core value of these findings lies in transforming school herbal gardens into active learning spaces that shift instruction from passive reception to experiential engagement—ultimately translating academic knowledge into practical skills and desirable life attributes.

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