

UTILIZING SCHOOL BOTANICAL GARDEN FOR COMMUNITY HEALTH PROMOTION: A CASE STUDY OF RAJAPRAJANUGROH 42 SCHOOL, SATUN PROVINCE, THAILAND

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ABSTRACT

This research article aimed to drive the utilization of the school botanical garden for community health promotion. The study was conducted at Rajaprajanugroh 42 School, Satun Province, during November 2023 to December 2024. The research adopted an action research approach consisting of four key steps: Planning, Action, Observation, and Reflection. The findings revealed that the school botanical garden was arguably effective in promoting community health and wellness. The herbal plant Plai (*Zingiber montanum*) was selected for the project due to its ability to alleviate musculoskeletal pain, a common issue among older adults in the community. A group of 12 students and 2 teachers from the school's Thai traditional massage for health club were trained in the formula and production method of the herbal heat patch for muscle pain relief. This formula and production process was subsequently transferred, by the school, to 14 village health volunteers in Ketri Subdistrict where the school is located. This enabled the village health volunteers to use the knowledge and innovation to communicate health promotion to the elderly. A survey of 103 elderly adults revealed a very high level of satisfaction with the Plai extract patches, with an average satisfaction score of 4.32 out of 5.00.

Keywords: School Botanical Garden, Community Health Promotion, Herbal Heat Patch

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INTRODUCTION

Rajaprajanugroh 42 School, located in Ketri Subdistrict, Mueang District, Satun Province, Thailand, is the largest free boarding school in the southern border provinces of Thailand that offers education at grade 1st to 12th, available for all genders, religions and cultural backgrounds. This kind of school was established by the cooperation from Ministry of Education, Royal Thai Army, and Rajaprajanugroh Foundation under the Royal Patronage for the purpose of fostering the children affected by the pro-longed 20-year insurgency, vulnerable students, orphan, or defenseless children. As of June 10, 2024, for the academic year 2024, the school had a total enrollment of 777 students- the vast majority were boarding students (99.74%) and came from economically disadvantaged backgrounds (93.95%).

Rajaprajanugroh 42 School is a member of the school botanical garden project since August 20, 2021. This project is part of the plant genetic conservation project (RSPG) under the royal initiative of Her Royal Highness Princess Maha Chakri Sirindhorn. The school botanical garden was established to create an educational ecosystem promoting an awareness for plant genetic conservation and utilization. The school botanical garden of Rajaprajanugroh 42 School occupied several plant groups such as tropical fruit plants, ornamental plants, and medicinal plants. The school botanic garden has been used as a learning center for various educational activities like fabric natural dyeing and eco-printing.

This research highlighted that the school botanical garden could serve not only as an educational tool and a means to cultivate students' awareness of plant conservation but also as a resource for promoting community health. Rajaprajanugroh 42 School was encouraged to participate in developing the surrounded communities through its botanic garden activities. The research activities were firstly be performed at the school level and then extended to the larger scale of Ketri Subdistrict, Mueang District, Satun Province, where the school is located. Knowledge management and implementation for community health promotion was performed with the cooperation of Satun Provincial Public Health Office, Ketri Subdistrict Administrative Organization and Ban Wang Phaniad Subdistrict Health Promoting Hospital, Ketri Subdistrict.

Research Objectives

This research aimed to promote the use of school botanical gardens as a tool for enhancing community health.

LITERATURE REVIEWS

The plant genetic conservation project (RSPG) under the royal initiative of Her Royal Highness Princess Maha Chakri Sirindhorn continues the royal vision of His Majesty the King Bhumibol Adulyadej to conserve and restore the nation's plant genetic resources, to sustainably support national development. The RSPG project operates as a unit under the Bureau of the Royal Household in collaboration with various institutions, following a series of 5-year master plans initiated in 1992. Currently, the project is implementing its 7th master plan (October 1, 2021-October 1, 2026). Accordingly, the school botanical garden project has been established by the RSPG-in order to provide the youth opportunity to learn about the plants and their benefit. This would offer the student's ideas for further conservation of plants. The school botanical garden is operated based on the format of a normal botanical garden, consisting of 5 elements: 1) plant name tag preparation, 2) plant collection and cultivation, 3) plant identification and description, 4) result report, and 5) educational implementation. By integrating with classroom, school botanic garden could serve as the learning center for the student practices such as plant information record, plant collection and exhibition in herbarium, and natural history museum activities (RSPG, 2017). The Ministry of Education has determined the school to be the member of school botanical garden project, based on volunteerism and school readiness.

Nowadays, the school botanical garden project is comprised of 5,858 members throughout Thailand (RSPG, 2021). Several schools integrated the school botanic garden with learning

and teaching strategies. For example, to promote the analytical thinking ability for seventh grade students, Nonthai Kuru Uppatham School has developed 5-step learning activities integrated with local resources and the school botanical garden in the topic of local plant (Thitithananan, 2019). In Piboonbumpen Demonstration School, three-dimensional art design and Lai Kam Ma Law Creation in the Pan Mai Lai Thong Collection were created from plant patterns in a school botanical garden (Vadhanabhu, 2022). STEM education was integrated with School Botanical Garden for the learning and innovation skill of students studied at Renunakhonwittayanukul School (Pattraummarit, 2023). For developing a set of activities in combination with school botanical gardens of Chiang Mai Rajabhat University Demonstration School and STEM education, basic data of science and economics of the essential oil by using constructed system was elucidated (Boonchom & Kongkham, 2019). Interestingly, the curriculum on school botanical garden for the topic of local plants was developed for fifth grade students of Srieam Anusorn School (PornKoa, 2022).

RESEARCH METHODOLOGY

This research was carried out by employing the action research methodology based on the concept of Kemmis and McTaggart (2007), which divided the process into four steps: 1) planning, 2) action, 3) observation, and 4) reflection. The duration of the study spanned 13 months (November 2023-December 2024). The details of the implementation for each step were as follows.

Step 1: Planning

This step consisted of three sub-activities as describe below.

1) *Studying the school's background and building relationships with school personnel:*

Understanding the background and context of the school helps minimize the risk of premature conclusions or overgeneralized interpretations. The researcher therefore studied the background and context of Rajaprajanugroh 42 School through documents, with the school's annual report being a key resource. Building relationships with the school personnel is a critical step. If the researcher fails to integrate themselves with the school staff or to convey the research project's concept effectively, progressing to the next steps, which require active participation, will be challenging. Techniques for building relationships with school personnel include both formal (such as meetings and school tours) and informal approaches (such as conversations via social media platforms).

2) *Studying the background, problems, and public health needs of Ketri Subdistrict, Mueang District, Satun Province, where Rajaprajanugroh 42 School is located:*

The researcher studied the background and context of the Ketri Subdistrict through the Ketri Subdistrict Administrative Organization Plans. It was found that Ketri Subdistrict consists of seven villages with a total of 1,973 households and a population of 6,630 people (3,274 males and 3,356 females). The majority of the population was Islamic and engaged in agricultural occupations. The Ketri Subdistrict Local Development Plan (2023-2027) has identified public health problems and needs through community analysis, revealing that residents particularly the elderly population lack knowledge and understanding of health issues and place little importance on maintaining their personal health. As a result, promoting community health aligns with the area's problems and needs.

3) *Organizing a meeting with Rajaprajanugroh 42 School:* Two meetings were held with Rajaprajanugroh 42 School-one on November 22, 2023 and another on May 8, 2024, to explore appropriate approaches for extending the use of the school's botanical garden to promote community health. The meetings were attended, including the school's executives and teachers, by 14 participants and 30 participants for the first and the second meetings, respectively. The meetings established guidelines for leveraging the school's botanical garden to promote community health. The focus was on increasing the area for cultivating medicinal plants and

encouraging students to learn about herbal garden work through hands-on experience. This process includes upstream (planting medicinal plants), midstream (processing and developing herbal products), and downstream (using herbal products to promote community health). The expected benefits of extending the use of the school's botanical garden to promote community health include not only fostering an awareness of plant genetic conservation among students but also instilling a sense of social responsibility and community development.

Step 2: Action

This step consisted of three sub-activities as described below.

1) Planting the medicinal plants

1.1) Designating the herbal garden area: The school assigned the agricultural science teacher to be responsible for planning the herbal garden to maximize its use. This included creating a planting plan and labeling plant species.

1.2) Selecting medicinal plant species: The herbal garden involved collaboration between teachers and students from grades 9-12 across 13 classrooms, totaling 239 students. Species of medicinal plants were chosen based on students' interests. Each class was responsible for planting and maintaining its designated herbal plot. This hands-on involvement allowed students to develop an appreciation for the value, benefits, and beauty of medicinal plants, fostering a conservation mindset. The herbal garden was officially opened on July 9, 2024, with the district chief of Mueang Satun as the guest of honor. Currently, the garden contains a variety of medicinal plants, such as Plai (*Z. montanum*), turmeric (*Curcuma longa*), citronella (*Cymbopogon nardu*), pandan (*Pandanus amaryllifolius*), chili (*Capsicum annuum*), medicinal aloe (*Aloe vera*), and pennywort (*Centella asiatica*).

2) Processing and developing herbal products

2.1) Knowledge management on medicinal plants: Although various Thai medicinal plants are commonly used to promote community health, the medicinal plant named Plai (*Z. montanum*) was chosen from botanical garden to focus on promoting community health. Plai was selected for its ability to alleviate musculoskeletal pain, a common issue among older adults in the community. Currently, the garden has at least 50 Plai individual plants.

2.2) Designing applications for medicinal plants: The research project developed the herbal heat patch formula using Plai extract as the main ingredient to relieve muscle pain. The microwave-assisted extraction (MAE) with eco-friendly and biocompatible solvents was utilized during the extraction process. This method is energy-efficient, time-saving, and minimizes the use of toxic solvents, promoting sustainability. Gelatin is used as a film-forming agent to create a stable gel with a soft and elastic texture. The gel has a golden-yellow color and a pleasant herbal aroma, offering a non-sticky and non-irritating experience when applied. The patch provides a gentle and consistent warmth that helps relieve muscle pain without causing discomfort. Plai (*Z. montanum*) is known for its medicinal properties, especially in relieving muscle pain. The patch delivers the therapeutic benefits of Plai in a safe, natural, and user-friendly form, making it an excellent alternative to chemical-based pain relief products, ideally for individuals seeking a natural solution for pain relief. The product targets consumers looking for non-pharmaceutical options. The product adds value to locally available herbs and plants, supporting community agriculture and school botanical garden. This combination of innovation, effectiveness, and sustainability makes the herbal patch a standout solution for muscle pain relief.

2.3) Knowledge and innovation transfer activity: The knowledge on formula and production method of the herbal heat patch for muscle pain relief was transferred to 2 teachers and 12 students who are the participant of the school's Thai traditional massage for health club. This group was chosen as our target because of 2 reasons. Firstly, the herbal patch complemented Thai massage therapy which associated with the activity of the massage club. Secondly, the teachers and students had intention to use the herbal patch to promote community health.

Workshop on herbal heat patches was held on June 22-23, 2024. After the training, to test market acceptance, the teachers and students conducted a consumer satisfaction survey on the prototype product among 50 external participants which was selected by the purposive sampling. They were working people in public organizations in the area. The consumer satisfaction questionnaire, validated by three experts and achieved an index of item-objective congruence (IOC) of 1.00 was used for this study. The questionnaire, with a Likert Scale ranging from 1 (lowest) to 5 (highest), was comprised of the following evaluation criteria: 1.00-1.80 (Very low), 1.81-2.60 (Low), 2.61-3.40 (Moderate), 3.41-4.20 (High), and 4.21-5.00 (Very high).

3) Organizing a meeting with relevant local partner organizations

In collaboration with Rajaprajanugroh 42 School, we held two meetings with relevant local partner organizations in order to explore appropriate approaches for extending the use of the school botanical garden to promote community health. The first meeting was held on July 9, 2024, with 50 participants including the District Chief of Mueang Satun, village heads and leaders from Ketri Subdistrict, Thai traditional medicine practitioners from government hospitals in Satun, village health volunteers from Ketri, teachers and students from the Thai traditional massage for health club of Rajaprajanugroh 42 School, and representatives from related organizations such as the Ketri Subdistrict Administrative Organization, the Satun Provincial Public Health Office, and the Ban Wang Phaniat Subdistrict Health Promotion Hospital in Ketri. The second meeting was held on November 14, 2024, with 20 participants who were local stakeholders including the director of public health and environmental division, health promotion officers from the Ketri Subdistrict Administrative Organization, the director of Ban Wang Phaniat Subdistrict Health Promotion Hospital, village health volunteers, and local care volunteers from Ketri. During the meeting, the participants planned to organize activities to disseminate the royal initiatives of Her Royal Highness Princess Maha Chakri Sirindhorn regarding the conservation of Thai medicinal plants. The transfer of knowledge and innovation on the herbal heat patch for community health promotion was also schemed for village health volunteers in Ketri.

Step 3 Observation

This step consisted of two sub-activities as describe below.

1) Knowledge and innovation transfer to village health volunteers: The formula and production method of the herbal heat patch for muscle pain relief, by Rajaprajanugroh 42 School, were transferred to 14 village health volunteers stayed in Ketri Subdistrict, comprising of 7 villages (2 volunteers per village), and other 2 local care volunteers from Ketri Subdistrict. Totally, 16 participants attended the training session. The activity to disseminate the royal initiative on the conservation of Thai medicinal plants, along with knowledge and innovation on the herbal heat patch for muscle pain relief, was held on December 10, 2024, at the school.

2) Utilization of the herbal heat patch for the elderly in the community: From group discussion, it was found that the musculoskeletal pain is a common issue among older adults in the community. Following the activity on disseminating the royal initiative regarding Thai medicinal plant conservation, knowledge, and innovation on herbal patches for relieving muscle pain, Rajaprajanugroh 42 School in collaboration with 14 village health volunteers from Ketri Subdistrict therefore utilized the herbal heat patch prototypes. These were used to communicate health education to elderly community members, emphasizing self-care with locally available medicinal herbs.

Step 4 Reflection

After the utilization of the herbal heat patch for the elderly in the community, a user satisfaction survey on the prototype product to test market acceptance was conducted by the village health volunteers from Ketri Subdistrict- with purposive sampling covering 7 villages in Ketri Subdistrict. The user satisfaction questionnaire, validated by three experts and achieved an

index of item-objective congruence (IOC) of 1.00, was employed for our research. The survey using a questionnaire comprised of a Likert Scale ranging from 1 (lowest) to 5 (highest), with the following evaluation criteria: 1.00- 1.80 (Very low), 1.81-2.60 (Low), 2.61- 3.40 (Moderate), 3.41-4.20 (High), and 4.21-5.00 (Very high) was operated.

RESEARCH RESULTS

The research findings illustrated that the school botanical garden was arguably effective to promote community health and wellness. In addition to fostering awareness associated with plant genetic conservation among students, this project also cultivated a sense of social responsibility and community development in the students. To drive the utilization of school botanical garden for community health promotion, Rajaprajanugroh 42 School emphasizes hands-on learning for students through its school botanical garden program which integrates the entire process from cultivating medicinal plants (upstream), processing and developing herbal products (midstream) to applying these products to promote community health (downstream). The herbal plant Plai (*Z. montanum*) was selected for the project because of its ability to alleviate musculoskeletal pain which is a common issue among older adults in the community. The formula and production method for herbal heat patches to relieve muscle pain using Plai extract as the main ingredient was developed by this research project. A group of 12 students and 2 teachers from the Thai traditional massage for health club at Rajaprajanugroh 42 School was trained for the knowledge and innovation associated with the herbal patch. By conducting the survey on the prototype satisfaction among 50 external participants, it displayed that consumer satisfaction with the prototype herbal patch was at the very high level, with an average score of 4.27 out of 5.00 (Table 1).

Table 1 Consumer satisfaction towards the prototype herbal patch product

Evaluation Items	Satisfaction Level	Interpretation
1) The patch with herbal fragrance	4.41	Very high
2) Does not cause allergic reactions	4.24	Very high
3) Easy to use and apply	4.45	Very high
4) Provides a relaxing sensation when applied	4.22	Very high
5) Provides long-lasting effects	4.22	Very high
6) Relieves muscle pain and tension	4.18	High
7) Attractive, clean packaging with complete information	4.37	Very high
8) Suitable for use after exercise or Thai massage	4.33	Very high
9) The price of 59 Thai Baht per patch is reasonable	4.00	High
10) The product is modern and suitable for the younger generation	4.23	Very high
Overall Satisfaction	4.27	Very high

The research project then supported the school in passing on the royal commitment to conserving Thai herbs, along with the knowledge and innovation of the herbal heat patch, to village health volunteers in Ketri Subdistrict. This enabled the village health volunteers to apply the research knowledge and innovation to communicate health promotion to the elderly in the community. Rajaprajanugroh 42 School, in collaboration with village health volunteers, utilized the herbal heat patches for muscle pain relief to communicate health promotion to the elderly in the community. This activity operated with elderly individuals across seven villages in Ketri Subdistrict, promoting awareness of the importance of self-care using locally available herbal plants. Moreover, the satisfaction of the elderly with the herbal patches was surveyed.

Out of 103 respondents, the elderly rated their satisfaction with the prototype herbal patch at the very high level, with an average score of 4.32 out of 5.00 (Table 2).

Table 2 Older user satisfaction towards the prototype herbal patch product

Evaluation Items	Satisfaction Level	Interpretation
1) The patch with herbal fragrance	4.54	Very high
2) Does not cause allergic reactions	4.29	Very high
3) Easy to use and apply	4.50	Very high
4) Provides a relaxing sensation when applied	4.40	Very high
5) Provides long-lasting effects	4.37	Very high
6) Relieves muscle pain and tension	4.28	Very high
7) Attractive, clean packaging with complete information	4.45	Very high
8) Suitable for use after exercise or Thai massage	4.13	high
9) The price of 59 Thai Baht per patch is reasonable	3.79	high
10) The product is modern and suitable for the younger generation	4.43	Very high
Overall Satisfaction	4.32	Very high

DISCUSSION & CONCLUSION

This research demonstrated that school botanical gardens could be utilized to promote community health and well-being. Although the school botanical garden housed a variety of plant species, Rajaprajanugroh 42 School selected Plai (*Z. montanum*) as the primary herb for promoting community health due to its properties that effectively relieve muscle pain in the elderly within the community. The school emphasized hands-on learning for students through the school botanical garden, starting from cultivating medicinal plants (upstream), then processing and developing herbal products (midstream), and finally to utilize herbal products for promoting community health and well-being (downstream). The benefits of expanding the use of the school botanical garden to promote community health and well-being included not only fostering students' awareness of plant genetic conservation but also instilling a sense of social responsibility and community development. In this research, the formula and production process for herbal heat patch for relieving muscle pain using Plai extract as the main ingredient were developed. Rajaprajanugroh 42 School has been trained for knowledge and innovation related to the herbal heat patch. The research project then supported the school in disseminating the royal initiative on the conservation of Thai medicinal herbs, as well as the knowledge and innovation of the herbal heat patch, to village health volunteers in Kerti Subdistrict. This activity aimed to apply the knowledge and innovation for health communication with the elderly in the community-encouraging them to recognize the importance of maintaining their health using locally available herbs. The satisfaction of the elderly with the herbal patch was also surveyed. With the herbal patch being well-accepted by local consumers, village health volunteers proposed that the Thai traditional massage for health club at Rajaprajanugroh 42 School should produce the herbal patches as a community-accessible health product. This would provide an income for vulnerable students in the Thai traditional massage for health club.

In a situation where ensuring healthy lives and promoting well-being for all at all ages is a critical national and international issue, developing students through an education system that emphasizes social consciousness and community development can serve as a policy proposal contributed to the achievement of the sustainable development goals (SDGs). School botanical gardens can be used as a tool for education aimed at promoting community health and well-being. Students were engaged in hands-on learning through several activities in the school

botanical garden, such as growing medicinal plants (upstream), processing and developing herbal products (midstream), and utilizing herbal products for community health and well-being promotion (downstream). The benefits students gained from this project included 1) developing awareness of plant genetic conservation, 2) fostering social consciousness and a sense of community development, 3) enhancing entrepreneurial skills, particularly in creating new products or adding value to local resources, and 4) generating income during their studies through the sale of health-related products.

The education approach for promoting community health and well-being mentioned above focused on active learning which is contrarily to traditional lecture-based passive learning. It emphasized learning based on the constructivist theory where learners create new knowledge by themselves through the learning strategies such as experiential learning, problem-based learning, and project-based learning (Fuchs et al., 2008; Honig, 2004). This approach encouraged students to engage deeply with the content and apply their knowledge in practical, or in the real-world contexts. Jones and Iredale (2010) proposed that active learning required the integration of experiential learning, creative problem-solving, and hands-on learning. These approaches were essential to fostering student engagement with the learning process. The experiential learning cycle, as outlined by Kolb (1984), consisted of four stages. The first stage was concrete experience, involving the learner actively engaging in and perceiving experiences. It emphasized focusing on the real events encountered in the moment. The second stage was reflective observation, in which the learners think critically about what they have observed, process their understanding, and reflect their experiences. The third stage was abstract conceptualization. For this stage, the learners summarized the insights gained from reflection and observation, transforming their experiences into conceptual knowledge. The final stage was active experimentation, in which the learners apply what they have learned by experimenting in real-world situations, planning, and testing new ideas. The integration of all four stages within the cycle fostered life-long learning by encouraging continuous self-reflection and practical application.

Currently, education extends beyond merely producing a skilled workforce for the global or local environment. It serves as a vital and integral component of community development. Schools are no longer solely focusing on teaching; instead, community service has gained significant importance as an additional responsibility of schools in recent years due to natural societal shifts. Schools arguably have the potential to create a significant impact on communities, contributing to the improvement of people's lives. This role is central to what schools stand for-forming an essential part of their mission and purpose. Community-based learning (CBL) provides a framework that brings constructivist principles to life by integrating meaningful community engagement with instructional strategies. It enhances student learning, fosters civic responsibility, and strengthens connections between schools and their surrounded communities. This approach bridges classroom theory with practical, real-world applications, prioritizing collaboration between educational institutions and local communities. Prasarn et al. (2022) noted that community-based learning activities can enhance higher-order thinking, communication skills, teamwork, and collaborative competency among secondary school students. Similarly, Kambanfai et al. (2021) highlighted that CBL helps cultivate 21st-century competencies in the learners. Research consistently shows that community-based learning delivered positive outcomes across all stakeholders, including students, educators, institutions, and communities. Furthermore, Andrade et al. (2022) emphasized that this approach fostered the development of a lifelong learning mindset, a critical component of modern business school curricula, and supported sustainable community development.

In conclusion, this research represented the transformative potential of school botanical gardens in promoting community health and well-being. By integrating hands-on and community-based learning approaches, Rajaprajanugroh 42 School has demonstrated how

students can actively be engaged in cultivating, processing, and utilizing medicinal plants to address local health needs or problems. This model not only enhanced students' awareness of plant conservation and entrepreneurial skills but also instilled a sense of social responsibility and community contribution. The development of the herbal heat patch exemplified the practical application of this approach, creating a sustainable impact on community health and generating income for vulnerable students. As education evolved to emphasize active learning and real-world engagement, the result gained here could contribute to a valuable policy model for achieving sustainable development goals through lifelong learning and community-centered education.

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