Development of a learning center and career advancement in natural dyeing in Maha sarakham Province

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Abstract - This article aims to: 1) Establish a learning center to serve as a repository of knowledge and training; 2) Collect, disseminate, and develop knowledge related to natural dyeing from local experts and specialists; and 3) Enhance the natural dyeing profession in the province to compete in the global market. The target groups include community enterprises and local weaving profession groups, comprising 30 individuals, as well as 20 interested members of the public in textile production, selected through purposive sampling. The project evaluation tools include: 1) A questionnaire assessing the suitability of establishing the learning center as a knowledge repository and training hub; 2) A satisfaction questionnaire for training activities aimed at enhancing natural dyeing capabilities; and 3) A cost calculation table for natural dyeing with raw materials. Data will be analyzed using mean, standard deviation, and t-test.

The evaluation results found:

1. Based on a survey of 50 participants, the overall opinion regarding the establishment of the Learning Center and Career Development in Natural Dyeing is positive, with a mean score of 4.85, indicating a high level of agreement. The detailed evaluation results, ranked from highest to lowest, are as follows:

- The highest agreement was for Question 2: "Do you think the establishment of the center is necessary for career development in the community?" with a mean score of 4.96, indicating a high level of agreement.
- The second-highest agreement was for Question 9: "Do you think the center should be located at Mahasarakham University?" with a mean score of 4.94, also indicating a high level of agreement.

• The lowest agreement was for Question 5: "Do you think the establishment of the center will promote tourism in the community?" with a mean score of 4.76, still indicating a high level of agreement.

2. From the survey of 50 participants regarding their satisfaction with the training activities aimed at enhancing capabilities in natural dyeing, the overall satisfaction was found to be positive, with a mean score of 3.99, indicating a good level of satisfaction. When considering the three categorized aspects, it was found that:

• For the aspect of the training/location of study visits, the overall satisfaction had a mean score of 3.72, indicating a good level of satisfaction. However, one point regarding accommodation, food, beverages, and other services had a mean score of 3.05, indicating a moderate level of satisfaction.

• For the content and activities, the satisfaction had a mean score of 4.13, indicating a good level of satisfaction.

• For the benefits received from participating in the conference, the satisfaction also had a mean score of 4.13, indicating a good level of satisfaction.

The results of the evaluation on the utilization or the increase in community income or reduction in expenses after the training aimed at enhancing capabilities in natural dyeing showed that, when calculating the cost of the dyeing process for 1 kg of fiber, expenses could be reduced by 40.79%. This demonstrates that developing the dyeing process using natural raw materials can lower production costs for entrepreneurs, resulting in increased profits compared to chemical-based production processes.

Keywords: Learning center and career development in natural dyeing, Mahasarakham Province, natural dyeing

1. Introduction

Woven fabric is an art of local wisdom that is deeply intertwined with the way of life, beliefs, and rituals of the Thai people. The science and art of weaving have been passed down from generation to generation to the present day. In many regions, weaving continues to preserve its unique characteristics. Therefore, woven fabric is a social heritage that reflects the historical background connected to the lifestyles of various communities. Archaeological evidence indicates that the land that is now Thailand has been home to weaving for over 2,500 years. The first woven fabrics were plain, naturally colored fabrics without patterns. Later, patterns were created using printing techniques, which have continued to evolve through the era when humans formed tribes and kingdoms, using fabric patterns as symbols representing their beliefs.

The art of weaving has developed continuously until the era when the Thai people united into various kingdoms, approximately in the 20th to 21st Buddhist centuries. Fabrics were woven for family use and became a medium for trade. Fabric has played a significant role, not only as clothing but also in relation to customs, beliefs, culture, religion, and society. Fabrics are also important in trade and the economy (Wiboon Leesuwan, 1987). Therefore, it is crucial to find ways to sustain this tradition alongside Thai society.

Currently, weavers tend to use synthetic dyes for dyeing to reduce costs, as they are more time-efficient and convenient for production. However, the excessive use of synthetic dyes has detrimental effects on health, society, and the environment. The primary dangers stem from chemical synthetic dyes, which some producers often use for dyeing fabrics or paper, containing heavy metals such as lead, mercury, arsenic, zinc, and chromium. These contaminants can adversely affect health, leading to symptoms such as fatigue, loss of appetite, headaches, anemia, and, with higher accumulation, paralysis in the arms and legs, delirium, convulsions, loss of consciousness, and potential carcinogenic effects.

Natural dyes, on the other hand, have advantages, such as softer and cooler colors compared to synthetic dyes, offering beauty and uniqueness that cannot be easily replicated (Purohit et al., 2007). If the current situation continues, it is likely to result in broader impacts in the future.

Natural dyeing represents a viable method for reducing the reliance on synthetic chemicals by utilizing locally available natural dyes. With increasing public awareness regarding the safety and potential hazards associated with chemical residues, there has been a notable shift towards products derived from natural materials. While such natural products may incur higher costs, they provide substantial value and reflect a commitment to environmental conservation and ecological integrity.

This approach not only minimizes adverse impacts on both producers and consumers but also fosters distinctiveness within local communities, thereby generating employment opportunities and increasing income. It aligns with the **BCG Model**, which advocates for holistic economic development across three dimensions:

1. **Biological Economy**: This dimension emphasizes the use of biological resources to create added value, particularly by developing high-value products.
2. **Circular Economy**: This aspect focuses on maximizing resource utilization through effective recycling and reuse practices.

Both components are integrated within the framework of a **Green Economy**, which aims to foster economic growth in tandem with social development and environmental stewardship, ensuring a balance that promotes stability and sustainability. By capitalizing on Thailand's rich biodiversity and cultural heritage, it is possible to enhance competitive advantage through innovation. This strategy aims to cultivate a thriving BCG economy that is competitive on a global scale, facilitates equitable income distribution within communities, reduces social disparities, and promotes environmentally sustainable practices alongside long-term development.

In response to the issues mentioned above, the Faculty of Fine and Applied Arts and Cultural Sciences has recognized the importance of natural dyeing and dyeing processes. Consequently, there is a proposal to establish a **Learning Center and Career**

Development for Natural Dyeing in Maha sarakham Province. This center aims to serve as an institution that gathers, disseminates, and develops knowledge related to natural dyeing processes, incorporating relevant technologies and innovations to facilitate rapid development.

The center will equip learners with skills and knowledge to enhance the aesthetic qualities and overall quality of dyed fibers while ensuring that the processes are environmentally friendly. This initiative will create pathways for increasing the value of handwoven fabrics, making them more desirable in the market. It seeks to elevate the production of naturally dyed local textiles, fostering income generation and strengthening community resilience. Furthermore, it aims to preserve traditional wisdom and ensure the ongoing development of natural dyeing practices.

2. Objectives

1. To establish a Learning Center and Career Development for Natural Dyeing.
2. To gather, disseminate, and develop knowledge regarding natural dyeing processes using natural materials.
3. To advance the profession of natural dyeing in Maha sarakham Province for the international market.

Table. 1 The development of activities to guide the establishment of the Learning Center and Career Development for Natural Dyeing is based on the following conceptual framework:

Input	Process: PDCA Workshop	Output
Natural Dyeing Laboratory: Department of Design and Product Development, Faculty of Fine and Applied Arts and Cultural Sciences. **Research Project:** "Development of Local Fabrics with UV Protection, Antibacterial Properties, and Water Repellency using Nanomaterials". **Instructional Management:** Integrated with the courses "Fashion and Textile Design and Development 1" and "Marketing and Consumers". **Body of Knowledge:** Natural dyeing processes using natural materials derived from local wisdom scholars (sages) and community specialists. **Raw Materials:** Natural dyeing materials available within the community. **Target Group:** Community enterprises and professional groups involved in natural dyeing within the community.	Plan: 1.1 Survey of natural raw materials available in the community. 1.2 Gather local experts and practitioners with knowledge of traditional weaving. Do: 2.1 Training on Marketing and Marketing Strategies. 2.2 Training on Dyeing Cotton Fibers Using Natural Dye Materials. 2.3 Training on Dyeing Silk Fibers Using Natural Dye Materials. 2.4 Training on Fashion Product Design Guidelines. 2.5 Training on Sales Promotion. Check: 3.1 Monitor and evaluate outputs and outcomes according to the project indicators (Survey, Activity Satisfaction, and Cost Calculation). Act (Improvement): 4.1 Implement improvements based on suggestions from experts (knowledge transferrers), participants, and observers.	**Establishment Guidelines:** Guidelines for establishing a Learning Center and Career Development for Natural Dyeing in Maha Sarakham Province. **Research Utilization:** The research has been increasingly utilized for practical benefits. **Educational Achievement:** Significant improvements in teaching and learning management in both designated courses. **Knowledge Application:** Knowledge about natural dyeing materials from local scholars and experts has been widely applied. **Cost Reduction:** The use of natural dye materials sourced from the community results in reduced production costs. **Capacity Building:** Community enterprises involved in natural dyeing have gained increased potential.

3. Matericls and Methosd

3.1 Population and Sample Groups Participating in the Project

The population consists of members of community enterprises or professional groups involved in local textile production, as well as the general public interested in textile weaving in Maha sarakham Province.

The sample groups include 30 members from community enterprises or professional groups related to local textile production and 20 individuals from the general public interested in textile weaving.

3.2 Project Implementation Area

The activities will take place at the Faculty of Fine and Applied Arts and Cultural Sciences (urban area) at Maha sarakham University, located in Talad Subdistrict, Mueang District, Maha sarakham Province.

Data Collection and Analysis

The implementation of this project is an academic service that utilizes the PDCA (Plan-Do-Check-Act) approach to establish a clear working framework. This methodology allows for continuous monitoring and improvement of the strategies to ensure the quality of the project development process aligns with the specified indicators, following these steps:

3.3 Plan

3.3.1 Conduct a survey of natural raw materials available in the community within Maha sarakham Province. By consulting with local professional networks in Maha sarakham, preliminary data collection revealed that there is a total of 111 community forests, predominantly mixed deciduous forests, scattered throughout Maha sarakham Province. The total area amounts to 12,832 rai, 1 ngan, and 2 square wah (according to the Community Forest Registry and the Information System of the Department of Forestry, surveyed by the Forest Resource Management Office No. 7 in Khon Kaen).

These mixed deciduous forests serve as critical natural resources for the community, providing essential food sources, medicinal plants, and raw materials for the production of handicrafts and various community products. Particularly significant are the plants found in these forests that can be utilized for dyeing natural fibers. These resources hold considerable value and potential for enhancing the marketability of community products through the creation of added value.

Natural dye plants not only contribute to reducing the use of chemical dyes, which may pose risks to health and the environment, but they also help create distinctiveness and uniqueness in products. This enhances both the value and competitive edge of these products in the market. Furthermore, utilizing natural dye plants supports the preservation of local wisdom and promotes the culture of natural dyeing, which is an integral part of our cultural heritage deserving of conservation and transmission to future generations.

3.3.2 Gather local experts and practitioners with knowledge of traditional weaving from 12 community groups of potential local textile producers in Mahasarakham Province. This will facilitate the management of knowledge derived from both local

wisdom and academic expertise from educational institutions, which is essential for the development of local textile production in Mahasarakham Province.

Table 2. Local Textile Producer Groups Providing Consultation in the Project

No.	Group	Potential	Name
1	Silk Weaving Group of Sacred Wood, Ban Kog Lam	Experience and Expertise in Natural Dyeing	Mrs. Sompian Janya-siri
2	Handwoven Fabric and Natural Dyeing Group, Kham Riang (Ban Mai Kham Riang)	Natural dyeing products	Mrs. Suchanya Khodwong
3	Natural Dyeing Cotton Weaving Group, Nong No Rung Rueang	A major source for collecting and selling natural dye materials in Maha sarakham Province	Apinya Laemmuang
4	Community Enterprise for Promoting and Learning about Lacquer Cultivation, Ban Khok Yai	Elevated to a learning center for design and tailoring in Maha sarakham Province	Mr. Wira Thipthamrongsub
5	Community Enterprise for Clothing Production, Ban Tha Tum	Production of silk fabrics featuring unique patterns that are bestsellers, such as the "Crab Pattern for Wedding Ceremony" and "Crab Pattern with Flower Garland," among others	Umaporn Prathumchai
6	Silk and Cotton Weaving Group, Ban Huay Sai	Expertise in tie-dyeing and weaving various patterns	Boonthieng Kamyodkaew
7	Weaving Group, Ban Nong Bua	Experience and Expertise in Natural Dyeing	Mrs. Sangwan Yopatum
8	Silk Weaving Group, Ban Nong Sim Mai	Handwoven silk fabric with traditional patterns dyed with natural colors	Mrs. Thongmee Thongsaa
9	Silk and Cotton Weaving Group, Ban Na Khun	Products include handwoven silk and cotton fabrics, as well as clothing, pants, silk garments, and cotton outfits	Wasana Chaiyamool
10	Mulberry Cultivation and Silk Raising Community Enterprise, Ban Nong Bua Pae, Yang Sisurat District	silk fiber products and weaving equipment for silk	Mr. Boonthom Pholboon
11	Fabric House, Huan Phae	Handwoven silk fabric with traditional patterns dyed with natural colors	Jakkaphirom Srimeuang
12	Jampakam	Handwoven silk fabric featuring tie-dye patterns dyed with natural colors	Pharmacist Supachai Paengkhamlai

3.4 Do

Organize knowledge transfer and hands-on practice, emphasizing that participants can apply the experiences gained from the training in real market situations. The training curriculum includes the following:

3.4.1 Practical Training on Marketing and Marketing Strategies

This training will emphasize the importance of "design-led marketing" in developing local textiles. Participants will learn about market demands through market analysis and target group identification to understand consumer needs and behaviors. The training will cover:

- Designing solutions that respond to market data by using it to create patterns, colors, and styles that align with customer preferences.
- Brand creation and storytelling, focusing on building a strong brand and compelling narratives to enhance value and differentiation for the textiles.
- Distribution channels, selecting appropriate distribution channels to effectively reach the target audience.
- Marketing promotion, utilizing tools and strategies to raise awareness and stimulate sales.

This training will help participants understand the significance of using marketing as a guide in designing and developing local textiles, ensuring that products meet market demands, create added value, and remain competitive in a highly competitive market.

3.4.2 Practical Training on Dyeing Cotton Fibers Using Natural Dye Materials

3.4.3 Practical Training on Dyeing Silk Fibers Using Natural Dye Material

This training will introduce participants to the world of natural dyeing, focusing on understanding the dyeing process from "Primary Colors Stage 1" (yellow from the marigold flower, red from lac, blue from indigo) to "Color Mixing Stage 2," allowing participants to create orange (yellow + red), green (yellow + blue), and purple (blue + red). The curriculum includes the following content:

Basic Knowledge

- Introduction to natural dye materials and their properties
- Preparation of cotton fibers before dyeing
- Techniques for extracting color from raw materials

Dyeing Colors Stage 1

- The process of dyeing yellow, red, and blue
- Factors affecting dyeing (temperature, time, concentration)

Color Mixing Stage 2

- The theory of color mixing
- Experiments mixing colors to achieve orange, green, and purple
- Quality control and color fastness

Participants will engage in hands-on practice, and due to the use of two types of natural fiber materials and multiple steps in both hot and cold dyeing processes, the training will require several days to ensure understanding and enable participants to apply their knowledge in creating unique and environmentally friendly products from natural fibers.

3.4.4 Workshop Training: Fashion Product Design

This training will present guidelines for designing fashion products that combine contemporary elements with market demands, emphasizing the effective use of natural colors according to color theory. The curriculum includes the following content:

Fashion Trends and Market Demands

Analyze fashion trends and consumer needs to determine the direction for clothing design.

Color Theory

Understand the principles of color mixing, color wheel, and color emotions to appropriately select natural colors for products and target audiences.

Contemporary Design

Techniques for applying natural colors in the design of modern clothing that meets market demands.

Creativity and Innovation

Encourage out-of-the-box thinking and experimentation to create unique and standout products.

From the mentioned curriculum, participants will learn and practice market analysis and target audience identification, the selection of natural colors based on color theory, the design of contemporary clothing that meets market needs, and the creation and development of innovative products. This training is suitable for entrepreneurs, designers, and anyone interested in developing fashion products, especially those looking to incorporate natural colors into the creation of valuable and environmentally friendly products.

3.4.5 Workshop Training: Sales Promotion

This training will focus on effective communication for sales promotion, emphasizing the creation of stories that connect with the target audience and meet their needs. The curriculum includes the following content:

Understanding the Target Audience

Conduct in-depth data analysis to understand the needs, attitudes, and behaviors of the target audience.

Story Creation

Techniques for creating interesting and meaningful stories to build a connection between the product and the target audience.

Effective Communication

Selecting appropriate channels and forms of communication to effectively reach the target audience.

Measuring and Evaluating

Tracking and evaluating sales promotion efforts to improve strategies further.

Participants will learn and practice analyzing and understanding the target audience in depth, creating engaging stories that connect with them, selecting suitable communication channels and formats, and measuring and evaluating sales promotion efforts. This training is suitable for marketers, entrepreneurs, and anyone interested in developing communication strategies for sales promotion, especially those looking to build brand loyalty and connection through storytelling.

3.5 Check

From the activities organized according to the objectives, the evaluation was conducted using various tools as follows:

Survey Evaluation

Assess the opinions on the establishment of the center to determine if they align with the project's objectives.

Activity Evaluation

Evaluate the effectiveness of the activities in developing natural dyeing techniques through a satisfaction survey regarding the overall training activities conducted throughout the project, focusing on how it can enhance local weaving professions.

Cost Calculation Evaluation

Assess the methodology for calculating production costs by comparing natural materials with synthetic materials to determine how value can be added to local weaving professions.

3.6 Act

From the survey conducted among 50 participants, the overall opinion regarding the establishment of the learning center and development of natural dyeing professions was positive, with an average score of 4.85, indicating strong agreement. Additionally, the participants expressed overall satisfaction with the training activities aimed at enhancing the potential of natural dyeing, with an average score of 3.99, reflecting a good level of satisfaction.

However, there were suggestions highlighting the urgent need for suitable facilities and laboratories for the learning center and development of natural dyeing professions in Maha sarakham Province. This would greatly assist the center in effectively managing the existing knowledge for the benefit of society.

The evaluation results indicate that the cost of processing the dyeing of 1 kg of fiber can reduce expenses by up to 40.79%. This demonstrates that the development of dyeing processes using natural materials can lower production costs for entrepreneurs, leading to increased profits compared to chemical-based production methods

4. Integration

4.1 Integration with Teaching and Learning: This involves integrating with the courses "Fashion and Textile Design and Development 1" and "Marketing and Consumers." Students are assigned to practice in collaboration with the community based on the learning outcomes divided into six aspects as follows:

4.1.4 **Ethics and Morality:** Students demonstrate responsibility for themselves and effectively perform tasks assigned to them.

4.1.2 **Knowledge:** Students can learn independently and gain a deeper understanding of natural dyeing principles.

4.1.3 **Intellectual Skills:** Students can appropriately apply knowledge and solve immediate problems. They can adapt to hands-on learning and plan their work collaboratively with peers effectively.

4.1.4 **Interpersonal Skills and Responsibility:**

- Students can work well with the community.
- They share a collective responsibility for the tasks assigned.
- Students are responsible for themselves, the community, and the environment.

4.1.5 Analytical Skills, Communication, and Use of Information Technology: Students can create mutual understanding.

4.1.6 Practical Skills: Students can perform tasks competently, which is reflected in the skill indicators: recognition and imitation, self-execution according to the model, accuracy, continuous execution, and natural performance.

4.2 Integration with Research

From the research on "Development of Local Fabrics with UV Protection, Antibacterial Properties, and Water Repellency using Nanomaterials" (Paweena Prawatkun, 2024), experiments were conducted using nanotechnology to enhance the fibers of local fabrics with two types of nanomaterials: zinc oxide nanoparticles, silver-doped zinc oxide nanoparticles, and titanium dioxide, combined with silver and acrylic polymer. This was done to provide properties that protect against UV rays, resist bacteria, and repel water, thereby elevating products in the batik and tie-dye fabric categories for various applications, such as bags, water-repellent masks, and antibacterial neckties. The community enterprises used cotton, muslin, cotton blends, and rayon fabrics, with dyes derived from natural sources to reduce the use of chemicals.

Samples of fabric coated with zinc oxide nanoparticles doped with silver demonstrated the best efficacy in inhibiting bacterial growth, repelling water, and protecting against UV rays compared to those coated with only zinc oxide or titanium dioxide. After 20 washes, the coated fabric retained effective antibacterial properties and the ability to block UV rays, particularly the fabric treated with zinc oxide nanoparticles doped with silver combined with acrylic polymer, which showed excellent UV protection.

4.3 Integration with Knowledge

There has been an integration of relevant knowledge as follows:

4.3.1 Knowledge on Natural Dyeing and Color Extraction

This knowledge has been integrated by gathering, organizing, and producing media based on the principles of natural dyeing, complemented by inviting local wisdom holders as speakers to train and practice various dyeing techniques. The outcome of this integration with the relevant knowledge has led to the production of high-quality and diverse products.

4.3.2 Psychology of Color

According to color theory, dyeing natural fibers is not merely about changing the material's color but also about conveying emotions, feelings, and stories through the colors derived from nature. Understanding the psychology of color, alongside color theory, allows for the effective selection of natural colors, enabling the creation of handicrafts that convey meaning and meet consumer demands.

- **Color and Emotion:** Each color has a different impact on emotions and feelings. For instance, yellow from marigold evokes feelings of brightness and cheerfulness, while blue from indigo imparts a sense of calm and relaxation. Therefore, selecting appropriate natural colors according to the objectives of the handicraft is essential.

- **Color and Culture:** Colors have symbolic meanings that vary across cultures. Understanding the meanings of colors in the context of local culture helps in creating handicrafts that communicate and connect more deeply with the community.
- **Color Mixing:** Color theory aids in comprehending the principles of color mixing to achieve a variety of new colors. Experimenting with color combinations from plants and natural materials will enhance the uniqueness and appeal of handicrafts.
- **Color and Marketing:** Choosing colors that align with target de mographics and fashion trends will enhance the value and attractiveness of products made from natural fibers.

Understanding the psychology of color in dyeing natural fibers not only allows for the creation of beautiful crafts but also empowers them to communicate and leave a lasting impression. Furthermore, it helps preserve local wisdom and promotes the sustainable use of natural resources.

4.3.3 Knowledge on Trends

The application of knowledge regarding trends in the development of local Isaan textiles is a crucial strategy for enhancing the value and competitiveness of products. This can be accomplished through various approaches:

- **Trend Analysis and Monitoring:** Studying fashion trends both domestically and internationally to understand the colors, patterns, and styles that are currently popular.
- **Adaptation and Creativity:** Integrating elements from current trends with traditional patterns and weaving techniques to create products that are modern yet maintain local identity.
- **Storytelling and Marketing:** Communicating the value and stories behind the textiles, linking them to trends and the interests of contemporary consumers.
- **Developing Distribution Channels:** Presenting products through a variety of channels, both online and offline, to reach a broader target audience.

Integrating trends with local wisdom will help elevate Isaan textiles to a wider recognition and acceptance, generating income for the community and promoting the preservation and transmission of cultural heritage.

5. Results

5.1 Findings According to Objectives

1) There are guidelines for establishing a learning center on natural dyeing in Maha sarakham Province.

2) The research has been increasingly utilized for practical benefits.

3) There have been significant improvements in teaching and learning management in both subjects.

4) Knowledge about natural dyeing materials from local scholars and experts has been widely applied.

5) The use of natural dye materials sourced from the community has resulted in reduced production costs.

6) Community enterprises involved in natural dyeing have gained increased potential.

Other Findings

From the activities conducted in the project, three findings emerged:

Understanding the use of color theory, including color psychology and the use of colors according to fashion trends, has led to greater diversity and the ability to create cohesive and appropriate color schemes for design work.

Integration with teaching has allowed students to better understand both local wisdom and knowledge, as well as the market situation of local entrepreneurs.

Research disseminated through the project has provided knowledge that entrepreneurs can use to genuinely develop their dyeing careers.