Development of a training curriculum for specialty green coffee bean Production according to the standards of the Specialty Coffee Association: A study of Huai Kaew community, Mae on District, Chiang Mai Province.

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Abstract

This research aims to (1) develop a training course for raw coffee bean production according to Specialty Coffee Association (SCA) standards, (2) compare academic achievement before and after implementing the course, and (3) compare practical skills before and after course use. The sample comprised raw coffee bean production entrepreneurs certified by the SCA as Q Graders, selected through purposive sampling based on criteria including SCA training and certification, association representation, and voluntary participation. Additionally, coffee farmers from Huay Kaew Subdistrict in Mae On District, Chiang Mai Province, were selected through purposive and cluster sampling, totaling 20 participants.

The research instruments were developed in two phases. Phase 1 involved creating a curriculum for raw coffee bean production in line with SCA standards. Structured interviews and questionnaires were used to collect feedback from certified SCA Q Graders, aiming to equip coffee farmers with the knowledge required for international certification. Phase 2 involved implementing and evaluating the curriculum, assessing academic achievement and practical skills through an achievement test and a practical skills evaluation form. The content consistency and reliability of the instruments ranged from 0.78 to 1.00. Data analysis used percentage, mean, standard deviation, and t-tests. Results showed that the training curriculum, comprising principles, objectives, structure, trainee qualifications, training duration, activities, media, equipment, and evaluation methods, was highly suitable, with an average quality rating of 4.73. Both academic achievement and practical skills showed statistically significant improvement at the 0.05 level after using the curriculum. This curriculum, therefore, serves as an effective tool for enhancing coffee farmers' knowledge and skills, supporting career development, and promoting value-added production that meets international quality standards.

Keywords: Training Curriculum, Green Beans, Specialty Coffee, Coffee Farmers

Introduction

The National Education Plan (2017-2036) emphasizes using education as a tool to enhane population quality and promote a fulfilling life in a modern global society. It aims to develop Thais' knowledge and skills to align with labor market demands and future national development. Amid economic and social pressures, modernization requires an educational strategy, particularly in curriculum design, as a vital framework for building a quality society through good citizenship (Office of the National Education Commission, Ministry of Education, 2002). The National Education Act of 1999 and its 2002 amendment support community strength through integrating local knowledge for sustainable development, addressing communities facing economic and employment challenges (International Coffee Organization, 2023). With global coffee consumption growing at an average of 2.1% per year,

there are opportunities for the Thai coffee industry. However, high production costs compared to neighboring Southeast Asian countries remain an obstacle, as cheaper foreign coffee impacts the Thai market. Enhancing quality coffee products and certification marks is thus critical for competitiveness. Thailand has potential for growing Arabica and Robusta coffee, which are globally demanded. By achieving world-market standards, Thai coffee can sustainably increase its industry value (Office of Agricultural Economics, 2020).

A study of coffee farming in Huai Kaew Subdistrict, Mae On District, Chiang Mai, reveals that coffee has become a significant local economic source for farmers, promoted as an alternative to previous cash crops. The community coffee supply chain still requires upgrades, including quality products like premium coffee with certification and machinery to reduce costs and boost efficiency. Knowledge integration is essential to increase coffee value through holistic production management. Using machinery and technology can motivate farmers by increasing income and reducing debt. Enhancing coffee's value also positions the community as a model for modern agriculture. Huai Kaew's community coffee needs further development to access higher-standard markets, where standardized production techniques can bolster consumer trust. Integrating value and supply chains, with vertical and horizontal business collaboration, will strengthen Thai coffee's global competitiveness. Additionally, modern production techniques, like efficient dry processing, are essential for enhancing farmers' quality of life in this high-altitude region ideal for quality coffee.

Huai Kaew's agricultural shift from tea and miang to coffee cultivation began with declining miang demand, yet farmers still face high production costs and agricultural debt. Tourism growth and community tourism routes have exposed Huai Kaew to modern economic opportunities. Farmers can develop premium coffee with quality certifications, adding value and generating income. Efficient resource management and technology will align production with international standards, supporting sustainable development goals (Office of Agricultural Economics, 2020). This has led to training coffee farmers in the Huai Kaew community in raw coffee bean production to Specialty Coffee Association standards, informed by community input. The first phase in 2023 under an integrated research plan aims to develop and elevate community coffee bean production for the international market by enhancing post-harvest processing efficiency with production lines and machinery, particularly for fresh Arabica coffee. The goal is to empower coffee processors in producing quality green coffee beans with high economic returns, balancing costs and premium quality to maximize returns. Achieving quality certification for Huai Kaew's coffee addresses low production issues and supports coffee processing, increasing farmers' future income. It also fosters community knowledge in coffee cultivation, adding regional identity, and making Huai Kaew a model of modern agriculture that encourages younger generations to return home to expand local tourism-linked coffee businesses.

Research Objectives

1. To develop a training curriculum for raw coffee bean production according to the standards of the Specialty Coffee Association for the Huai Kaew community, Mae On District, Chiang Mai.
2. To compare learning achievement before and after using the training curriculum for raw coffee bean production according to the standards of the Specialty Coffee Association for the Huai Kaew community, Mae On District, Chiang Mai.
3. To compare practical skills before and after using the training curriculum for raw coffee bean production according to the standards of the Specialty Coffee Association for the Huai Kaew community, Mae On District, Chiang Mai.

Research Hypothesis

1. Coffee farmers in Huai Kaew, Mae On District, Chiang Mai, who received training in the raw coffee bean production curriculum according to the Specialty Coffee Association standards, achieved higher learning outcomes after the training than before.

2. Coffee farmers in Huai Kaew, Mae On District, Chiang Mai, who received training in the raw coffee bean production curriculum according to the Specialty Coffee Association standards, demonstrated higher practical skills after the training than before.

Research Framework

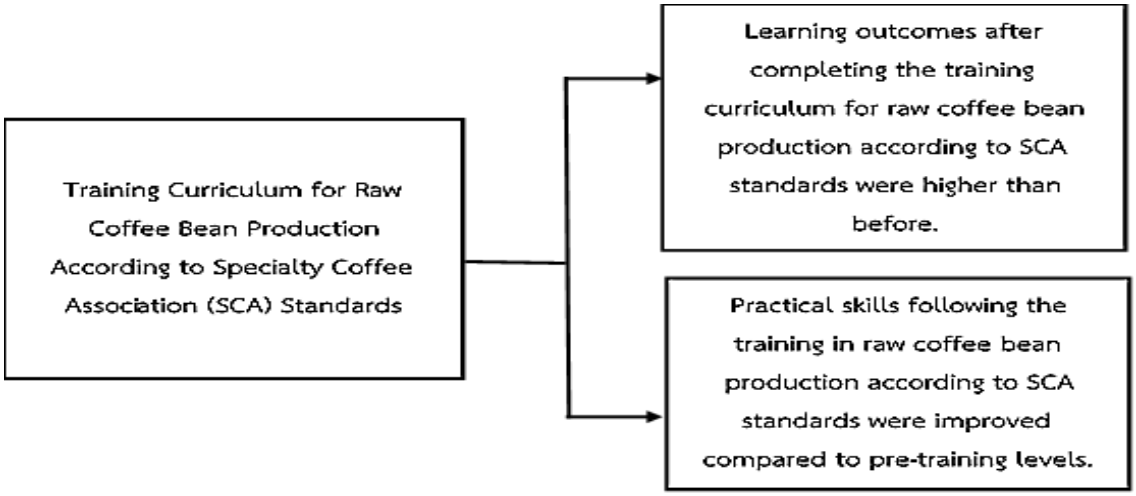

Figure 1 Research Framework

Research Methodology

The population and sample group were divided into two phases as follows: Phase 1: Development of the Training Curriculum for Raw Coffee Bean Production According to SCA Standards. This phase involved five entrepreneurs in the raw coffee bean production industry, all of whom were certified by the Specialty Coffee Association (SCA) as Q Graders. The sample group was selected using purposive sampling, not a probability-based method. The participants were required to be entrepreneurs who had been trained and practiced according to SCA standards, certified as Q Graders, and volunteered to participate in this research project. Phase 2: Implementation of the Curriculum and Evaluation of the Results. This phase focused on 20 coffee farmers from Huay Kaew, Mae On District, Chiang Mai Province. Since the population group was unknown, the Cluster Selection technique was employed, along with purposive sampling. Participants were required to be coffee farmers from the research area in Mae On District, Chiang Mai Province, specifically selected from the Huay Kaew Subdistrict community. These farmers volunteered to participate in the project, as their input was crucial to the research, and they were willing to provide data and engage in the training activities.

Research Instruments, This study employed a mixed-method research design, using both interviews and questionnaires. The questions in the questionnaire were designed to measure various variables and covered key concepts from the literature review, ensuring alignment with the research objectives. The instruments used to collect data for the research were as follows: Phase 1: Development of the Raw Coffee Bean Production Curriculum According to SCA Standards. Interview Form: A structured interview designed to gather information for developing the raw

coffee bean production curriculum in line with SCA standards. Questionnaire: A questionnaire to assess the development of the curriculum, which included details on the training format, training materials, and how they addressed the needs of entrepreneurs in the raw coffee bean production business certified by the SCA (Q Grader). The questionnaire also covered the benefits of the training and its duration. This was a closed-ended questionnaire (close form). Phase 2: Implementation and Evaluation of the Curriculum. Curriculum for Raw Coffee Bean Production According to SCA Standards, Achievement Test: A 30-question, multiple-choice test with four options, used to assess learning outcomes. Practical Skills Assessment: This consisted of four areas: agility, creativity, precision and aesthetics in specialty coffee bean production, and teamwork within the specialty coffee farmer group in Mae On District, Chiang Mai Province.

This research developed and evaluated the quality of tools for the raw coffee bean production curriculum according to the Specialty Coffee Association (SCA) standards. The study was divided into two phases as follows: Phase 1: Development of the Raw Coffee Bean Production Curriculum According to SCA Standards.

This phase was divided into three steps: 1.1 Interviews: The SCA curriculum was studied, and Q Grader experts were interviewed to determine the content of the tools. The Index of Item-Objective Congruence (IOC) was used to ensure quality, with a value of 1.00. 1.2 Questionnaires: A questionnaire was created based on a review of theories and expert interviews. It was then reviewed by advisors and experts, with an IOC index value of 1.00. Basic data was collected from documents related to training curriculum development, curriculum development research, interviews, and questionnaires. This data served as the foundation for the curriculum development process. The curriculum components included: Principles, Objectives, Project development, Trainee characteristics, Training duration, Training activities, Media and equipment, Measurement and evaluation, Course content, Activity details, Training management plan, and Course documents. 1.3 Training Curriculum Content Analysis: The suitability of the curriculum was evaluated using a 5-point Likert scale (most appropriate, very appropriate, moderately appropriate, less appropriate, and least appropriate) (Best & Kahn, 2006). The mean suitability rating was 4.72, indicating that the curriculum was considered highly appropriate. Phase 2: Curriculum Application and Evaluation of the Raw Coffee Bean Production Training According to SCA Standards. The implementation and evaluation of the curriculum involved measuring academic achievement and assessing practical skills. Tests and assessments based on SCA standards were developed to evaluate farmers' knowledge and skills. The test development process began with content analysis and the creation of 30 items. The test was then pilot-tested for accuracy and reliability (0.96) with farmers in Mae On, Chiang Mai Province. For assessing practical skills, a 4-level rubric was used (Brookhart, 2013). The rubric measured various aspects of practical skills, with scores ranging from an average of 12.50–16.00 (high quality) to 0.00–4.49 (low quality). Data were collected from 20 sample farmers and assessed by experts. The index of consistency (IOC) for the practical skills assessment was 1.00.

Data collection to evaluate the training course on raw coffee bean production according to the Specialty Coffee Association (SCA) standards for farmers in the Huay Kaew community, Mae On District, Chiang Mai Province, was conducted in two phases: Phase 1: Development of the Training Course on Raw Coffee Bean Production According to SCA Standards. This phase consisted of two main steps: interviews and questionnaires. The researcher obtained permission from the Graduate School and scheduled interview times with the sample farmers in advance. The researcher then traveled to the location, where data were collected through image and sound recordings, which were later analyzed for content. Regarding the questionnaire, the researcher introduced himself and distributed the questionnaires to five entrepreneurs, explaining the method for completing them. This process took approximately 30 minutes. Once completed, the data were analyzed to evaluate the course. Phase 2: Implementation of the Course and Evaluation of the

Training on Raw Coffee Bean Production According to SCA Standards. The implementation phase began with obtaining permission from Nakhon Ratchasima College and securing the training venue at Aqaba Co., Ltd. Coordination was made with SCA-certified trainers, and the venue and facilities were prepared. Training documents and measurement tools, such as tests and practical skills assessments, were also prepared. The training lasted for 5 days and included a workshop with a sample group of 20 participants. The process started with measuring academic achievement and practical skills before training. After the training, the same tests and assessments were administered to evaluate achievement and analyze the effectiveness of the course.

Data analysis employed various statistical methods to evaluate the research results, divided into three main categories: 1) Descriptive Statistics: Used to describe the characteristics of the variables, including mean (Arithmetic Mean), standard deviation (Standard Deviation), and percentage (p), analyzed using statistical software. 2) Tool Quality Evaluation Statistics: Included the achievement test, which was assessed for accuracy (IOC), reliability (KR-20), and difficulty (p), as well as the practical skills test, which was evaluated for accuracy (IOC) and 3) Hypothesis Testing Statistics: A t-test (Dependent t-test) was used to compare the results before and after the training.

Research Results

Phase 1: Development of a Training Curriculum for Raw Coffee Bean Production According to the Specialty Coffee Association Standards. The development of a training curriculum for raw coffee bean production, in accordance with the standards of the Specialty Coffee Association (SCA), was conducted for coffee farmers in the Huay Kaew community, Mae On District, Chiang Mai Province. The results revealed that the curriculum development process involved analyzing data from theoretical concepts, relevant documents, and research in line with SCA standards. Interviews and consultations were conducted with entrepreneurs in the raw coffee bean production business who are certified by the SCA (Q Grader). The thesis advisor utilized this data to develop the curriculum, which includes: 1) Principles 2) Objectives 3) Structure 4) Trainees 5) Training Duration 6) Training Activity Organization 7) Media and Equipment 8) Measurement and Evaluation 9) Course Content 10) Activity Details 11) Training Management Plan 12) Documents related to the raw coffee bean production curriculum. For entrepreneurs in the raw coffee bean production business who have been certified by the SCA (Q Grader), it was recommended to invite experienced lecturers to deliver both lectures and practical sessions. The training materials would include documents, computers, videos, projectors, and equipment related to the process and testing. The training duration for the raw coffee bean production course, according to SCA standards, was set to 3-4 days. The analysis of the consistency index (IOC) from experts entrepreneurs in the raw coffee bean production business certified by the SCA (Q Grader) highlighted areas for improvement. Five experts were asked to assess the suitability and quality of the course using a questionnaire (Appendix B: Raw Coffee Bean Production Training Course According to SCA Standards), rated on a 5-level scale: most appropriate, very appropriate, moderately appropriate, less appropriate, and least appropriate. The average score and standard deviation (S.D.) were calculated and compared with the set evaluation criteria. The results, shown in Table 1, indicated that the overall suitability and consistency of various components of the curriculum were deemed appropriate, with a mean score of 4.73. Before developing the curriculum, the researcher collected basic information to ensure the principles, objectives, structure, training duration, measurement and evaluation methods, activity organization details, and supporting documents aligned with the SCA standards. The average score for these components was 4.80, followed by trainees, training activity organization, media and equipment, course content, and training management plan, with an average score of 4.60.

Table 1: Results of the Suitability and Consistency Analysis of Various Components from the Questionnaire to Certify the Quality of the Raw Coffee Bean Production Training Course According to Specialty Coffee Association Standards.

Evaluation List	Mean	Standard Deviation	Interpretation
1) Principles	4.80	0.45	Most Appropriate
2) Objectives	4.80	0.25	Most Appropriate
3) Structure	4.80	0.46	Most Appropriate
4) Trainees	4.80	0.55	Most Appropriate
5) Training Duration	4.60	0.62	Most Appropriate
6) Training Activity Organization	4.80	0.54	Most Appropriate
7) Media and Equipment	4.80	0.35	Most Appropriate
8) Measurement and Evaluation	4.80	0.95	Most Appropriate
9) Course Content	4.80	0.75	Most Appropriate
10) Activity Details	4.60	0.42	Most Appropriate
11) Training Management Plan	4.60	0.45	Most Appropriate
12) Documents related to the raw coffee bean production curriculum	4.60	0.39	Most Appropriate
Average Mean	**4.73**	**0.08**	**Most Appropriate**

Phase 2: Curriculum Implementation and Evaluation Results of the Raw Coffee Bean Production Training Course According to the Standards of the Specialty Coffee Association for Coffee Farmers in the Huay Kaew Community, Mae On District, Chiang Mai Province. The results of using the raw coffee bean production training course according to the Specialty Coffee Association standards, in terms of academic achievement and practical skills, were assessed. The researcher conducted a trial of the course to evaluate both academic achievement and practical skills, following the learning management plan with a sample group of 20 coffee farmers from the Huay Kaew Community in Mae On District, Chiang Mai Province. Pre- and post-tests were administered using an achievement test and a practical skills assessment. The results revealed that the mean academic achievement scores before and after the course were significantly different. Before the curriculum trial, the mean score was 15.30 with a standard deviation (S.D.) of 2.48, while after the course, the mean score increased to 21.90 with a standard deviation (S.D.) of 2.27, resulting in an average increase of 6.55 points. The post-course achievement scores were significantly higher than the pre-course scores at a statistical significance level of 0.05, as shown in Table 2.

Table 2: Comparison of Academic Achievement in the Raw Coffee Bean Production Training Course According to the Specialty Coffee Association Standards for Coffee Farmers in the Huay Kaew Community, Mae On District, Chiang Mai Province, Before and After the Curriculum Implementation for the Sample Group.

Test	n	Mean	S.D.	t	p
Before Learning	20	15.30	2.48	34.56	0.00*
After Learning	20	21.90	2.27		

*Statistical significance at the 0.05 level

The average score of practical skills in the raw coffee bean production training course according to the Specialty Coffee Association standards for coffee farmers in the Huay Kaew community, Mae On District, Chiang Mai Province, before and after the curriculum implementation was tested. Before the curriculum implementation, the average score was 10.05 with a standard deviation (S.D.) of 1.19. After the curriculum implementation, the average score was 16.90 with a standard deviation (S.D.) of 0.76, showing an increase of 6.85 points. The average post-test score was significantly higher than the pre-test score at the 0.05 level, as shown in Table 3. The analysis of practical skill assessments for the raw coffee bean production training course according to the Specialty Coffee Association standards revealed that the coffee farmers' scores ranged from 11 to 23, indicating a good level of quality in creativity, agility, refinement, beauty, and cooperation within the group.

Table 3 : Comparison of Practical Skills in the Raw Coffee Bean Production Training Course According to the Specialty Coffee Association Standards for Coffee Farmers in the Huay Kaew Community, Mae On District, Chiang Mai Province, Before and After the Curriculum Implementation.

Test	n	Mean	S.D.	t	p
Before Learning	20	10.05	1.19	42.57	0.00*
After Learning	20	16.90	0.76		

*Statistical significance at the 0.05 level

Research Discussion

This research is aimed at developing a training curriculum for raw coffee bean production according to the Specialty Coffee Association (SCA) standards for coffee farmers in the Huay Kaew community, Mae On District, Chiang Mai Province. The researcher presents the following discussion: 1) Curriculum Development Results, The development of the raw coffee bean production training curriculum according to the Specialty Coffee Association (SCA) standards showed that the curriculum was appropriate and aligned with various components, including: 1) Principles, 2) Objectives, 3) Structure, 4) Trainees, 5) Training Duration, 6) Training Activities, 7) Media and Equipment, 8) Measurement and Evaluation, 9) Course Content, 10) Activity Details, 11) Training Management Plan, and 12) Course Documents. The consistency index was 1.00, aligning with the SCA's global standards for specialty coffee, which emphasize quality coffee and its relevant attributes. The average evaluation score for course quality certification was 4.73, indicating that the course was most appropriate. 2) Curriculum Design Approach, For the

development of the Green Beans curriculum, the researcher adopted a quality specialty coffee beans framework (Green Beans), which covers concepts and skills related to coffee grading, trade, and management. The course content includes topics such as coffee plant biology, processing, grading, storage, transportation, marketing, certification, contracts, and other related subjects to the entire coffee production and trade process (Specialty Coffee Association, 2023). The curriculum design incorporated the SCA's approach to curriculum development and course design, focusing on developing the necessary skills and knowledge for the coffee industry. The curriculum combines both theoretical and practical content, so that learners can apply the knowledge in real-life situations. The course design considers the entire coffee production process, from planting and processing to grading, storage, and marketing, ensuring a comprehensive understanding of the coffee industry and its diverse market needs (Fair Trade International, 2024). 3) Continuous Quality Development, the curriculum quality should be continuously improved using educational standards that emphasize the ability to apply knowledge and skills in practical settings, including assessments that reflect the learners' understanding and practical abilities. Additionally, the curriculum should be updated to respond to changes in the coffee industry and global markets, with collaboration from experts in various fields to ensure it stays current and meets industry demands (International Coffee Organization, 2023). This aligns with the concept of a quality curriculum, which should include at least five key components: objectives, activity content, instructional media, teaching methods, and evaluation. All these components must be aligned and integrated to ensure the curriculum effectively promotes learning. By defining clear objectives and ensuring that content, teaching methods, and assessments are tailored to the learners' needs, the curriculum can offer a complete learning experience that translates into practical applications in the coffee industry (Taba, 1962; Biggs & Tang, 2011).

Results of the Comparison of Mean Scores for Academic Achievement in the Raw Coffee Bean Production Training Course According to Specialty Coffee Association Standards for Coffee Farmers in the Huay Kaew Community, Mae On District, Chiang Mai Province. The results show that the mean score after the course experiment was significantly higher than before the course experiment, with an increase in the average score of the post-test compared to the pre-test at a statistical significance level of 0.05, confirming the hypothesis. This improvement can be attributed to the training activities, which utilized standardized materials and equipment as defined by the association, emphasized practical skills, promoted collaborative activities, and facilitated presentation and knowledge exchange. Coffee farmers actively participated, practicing the skills themselves with direct guidance from experts, which led to observable outcomes. Through hands-on practice, learners acquired practical skills, with close expert supervision, while the curriculum adhered to the standards and aligned with the planned activities. This approach resulted in enhanced knowledge and understanding of the raw coffee bean production process according to Specialty Coffee Association standards, which was significantly higher than before the training. In summary, the comparison of mean academic achievement scores in the raw coffee bean production training course according to the Specialty Coffee Association standards showed significant improvement in knowledge and skills among the coffee farmers. This aligns with various educational theories that emphasize the importance of experiential learning and active participation in activities. According to Kolb’s (1984) theory of Experiential Learning, learning derived from real-world experiences enables learners to apply acquired knowledge in practical situations by engaging in hands-on activities and reflecting on their actions. The results of this study reflect the effectiveness of this approach, as farmers developed practical skills and a clear understanding of the raw coffee bean production process. Additionally, Vygotsky’s (1978) concept of Collaborative Learning suggests that learning is most effective when there is cooperation and knowledge exchange among learners. The training program incorporated collaborative activities and knowledge sharing, allowing farmers to learn from the experiences of others, accelerating their skill development.

Furthermore, the learner-centered approach, as discussed by Brown (2004), also contributed to improved learning outcomes. By designing a curriculum that focuses on the learner's needs and interests, the training program enabled farmers to engage more fully in the process, gaining hands-on experience and receiving expert guidance. This approach is consistent with the research findings, showing that the farmers' understanding and skills in raw coffee bean production according to industry standards significantly improved after the training.

Results of the Comparison of Practical Skills in the Raw Coffee Bean Production Training Course According to Specialty Coffee Association Standards for Coffee Farmers in the Huay Kaew Community, Mae On District, Chiang Mai Province. The results showed that after the course experiment, the mean score of the practical skills was significantly higher than before the course, with the average post-test score increasing significantly at a statistical significance level of 0.05, confirming the hypothesis. The practical skills in the raw coffee bean production course, according to Specialty Coffee Association standards, were rated between 11 and 23, which indicates a good quality level. This improvement is due to the training activities, which involved demonstrations by expert instructors, learning from training materials, and hands-on practice by the coffee farmers in accordance with the Specialty Coffee Association standards. This approach led to the development of practical skills and expertise in creativity, agility, precision, aesthetics, and teamwork in applying the knowledge learned during the training. Additionally, the training was completed within the specified time frame, resulting in the production of raw coffee beans that met the Specialty Coffee Association standards. This outcome aligns with the three-step skill instruction model, which includes: Step 1: Providing knowledge for skill training. The instructor must provide knowledge about the skill, including its steps, which can be conveyed through lectures, demonstrations, or supplementary materials like DVDs or slides. Step 2: Hands-on practice. Both knowledge and hands-on practice are necessary to ensure accuracy and validate the learner's ability to perform the skill. Step 3: Testing accuracy and speed. The final step involves testing how quickly and accurately the skill is performed. If the learner can do so automatically, the skill has been successfully acquired. This process aligns with Gagne's (1985) theory, which emphasizes teaching skills by first providing knowledge through lectures or demonstrations to ensure the learner understands the steps involved. It also incorporates the use of supplementary materials like DVDs or slides to enhance communication and understanding. Furthermore, Kolb's (1984) theory of Experiential Learning highlights the importance of hands-on practice in learning, where learners gain confidence and competence by applying what they have learned in a real-world context. Additionally, Skinner's (1968) emphasis on testing skills for accuracy and speed ensures that learners are able to perform the skills automatically and confidently. The training program used this approach to assess and confirm the learning process, resulting in farmers being able to produce high-quality raw coffee beans according to Specialty Coffee Association standards with strong skills in the coffee production process.

Summary of the Research Findings on the Development of the Raw Coffee Bean Production Training Course According to Specialty Coffee Association Standards. The developed training course for raw coffee bean production aligns with the international standards set by the Specialty Coffee Association and has been successful in enhancing coffee production skills in the Huay Kaew community. The key research findings are as follows:

1. Curriculum Development Quality, The curriculum development results indicate that this training course is appropriate and consistent with the Specialty Coffee Association standards. It was evaluated based on various components such as principles, objectives, structure, training activities, instructional media, and assessment methods. The average evaluation score for appropriateness was 4.73, indicating the highest level of suitability. The course was designed using the Green Beans concept and focuses on developing practical skills and industry-relevant knowledge.

2. Learning Achievement Comparison, After the course implementation, farmers who participated in the training showed a statistically significant increase in their post-training test scores compared to pre-training scores, with a significance level of 0.05. This result aligns with the approach of learning that emphasizes hands-on practice and active participation, using group activities and knowledge sharing.

3. Practical Skills Development, The experimental results demonstrate that the practical skills in raw coffee bean production among trained farmers significantly improved. After the training, the farmers were able to produce raw coffee beans according to Specialty Coffee Association standards with high quality. They also developed various skills, including agility, precision, creativity, and teamwork. This outcome is in line with the concepts of Experiential Learning and learner-centered teaching.

In conclusion, the implementation of this training course enabled farmers in the Huay Kaew community to effectively develop the necessary skills and knowledge to produce raw coffee beans according to the Specialty Coffee Association standards, with the ability to apply this knowledge in real-world settings.

Recommendations

1. Recommendations for Applying Research Findings

1.1 Curriculum Development

The research findings indicate that the training course for raw coffee bean production according to the Specialty Coffee Association standards is appropriate and aligns with international standards. The development of this curriculum took into account various components, including principles, objectives, training activities, and the use of effective instructional media. These elements can be applied to design training programs aimed at developing coffee production skills at the industrial level.

1.2 Learning Achievement Comparison

The learning outcomes of the farmers who participated in the training showed significant progress, with their average post-training scores being statistically higher than their pre-training scores at the 0.05 significance level. This reflects the effectiveness of the curriculum, which focuses on hands-on learning and group knowledge exchange, an approach consistent with experiential learning theory.

1.3 Practical Skills Development

The farmers who received training were able to develop high-quality raw coffee bean production skills according to Specialty Coffee Association standards. Skills such as agility, precision, creativity, and teamwork were significantly improved. This type of training aligns with the concepts of experiential learning and learner-centered curriculum design.

1.4 Application of Curriculum Design Concepts

This curriculum was designed to focus on practical skill development and the knowledge necessary for the coffee industry, using the Green Beans concept. It emphasizes a comprehensive learning process covering every stage of coffee production, from farm to cup, thereby enhancing understanding and skills related to global coffee production standards.

1.5 Training Outcomes

Farmers were able to effectively apply the knowledge and skills acquired from the training in their actual work. The training enhanced their understanding and skills in producing high-quality raw coffee beans according to Specialty Coffee Association standards, thereby strengthening essential skills in both agriculture and the coffee industry.

2. Recommendations for Future Research

2.1 Sustainable Training Curriculum Development

Future curriculum development should focus on flexibility, allowing adjustments based on the evolving coffee market and international standards. The incorporation of new technologies into the teaching process is essential to ensure farmers have access to up-to-date information and resources. The training should emphasize practical, field-based learning and establish an effective evaluation and monitoring system to guarantee sustainable outcomes.

2.2 Long-Term Learning Achievement Comparison

There should be a follow-up on the learning outcomes of farmers over the long term after training to assess whether the learning remains sustainable and if it can be applied effectively in actual coffee production. Conducting long-term comparative research will provide a comprehensive view of the course's effectiveness and help identify areas for continuous improvement.

2.3 Practical Skill Development in Coffee Production

The development of raw coffee bean production skills should focus on training that addresses the needs of the agricultural and coffee industries, which are highly competitive. Building networks or collaborations with businesses, such as coffee factories and exporters, will allow farmers to gain direct industry experience. Motivating and gaining acceptance from both the agricultural and industrial sectors will ensure the sustainability of skill development.

2.4 Curriculum Design Based on International Standards

The curriculum should be designed using concepts that align with international coffee production standards, such as the Green Beans concept. The learning process should cover all stages of coffee production, from farm to cup. Collaborating with organizations and institutions with expertise in coffee production will increase the credibility of the curriculum and training outcomes.

2.5 Enhancing Sustainability of Training Outcomes

To ensure sustainable development in raw coffee bean production, farmers should have access to ongoing resources and support from government or private organizations. Additionally, creating platforms for knowledge exchange and experience-sharing among farmers will strengthen the farming community and increase opportunities for expanding the market for high-quality coffee in line with international standards.

Implementing these recommendations will help create long-term sustainability in the training program's effectiveness and coffee production skills, enabling farmers to apply their knowledge to develop globally competitive, high-quality coffee products.

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