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Mixed Methods Article

Evaluating a Prototype Curriculum for Specialty Green Coffee Production among Disadvantaged Farmers in Thailand

Kajornatthapol Pongwiritthon^{1*}, Wannatida Yonwilad², and Unyaparn Sinlapaninman²

Abstract

Background/ problem: Disadvantaged coffee farmers in Northern Thailand face challenges in meeting specialty green coffee quality requirements, particularly in post-harvest processing and quality management. Evidence concerning their production problems, competency needs, learning preferences, and contextual conditions is needed to inform curriculum development.

Objective/ purpose: This study assessed farmers’ production and learning needs, explored stakeholder perspectives on contextual conditions and curriculum development, and integrated quantitative and qualitative findings to derive evidence-based curriculum design requirements.

Design and Methodology: A convergent mixed methods design was employed within the analysis and exploration phase of educational design research (EDR). Quantitative data were collected from involved 15 disadvantaged coffee farmers using a 32-item needs assessment questionnaire, while qualitative data involved 20 stakeholders. Descriptive statistics and content analysis were conducted, and findings were subsequently integrated.

Results: Farmers reported very high production-related challenges ($M = 4.41$, $SD = 0.67$), high contextual readiness ($M = 3.91$, $SD = 0.86$), very high competency development needs ($M = 4.70$, $SD = 0.76$), and very high preferences for practice-oriented learning ($M = 4.74$, $SD = 0.87$). Qualitative findings identified technical knowledge gaps, motivation for quality improvement, experiential learning preferences, and context-responsive learning needs.

Conclusion and Implications: Four curriculum requirements emerged: competency-aligned content, experiential learning, expert-guided collaboration, and context-responsive community-based learning. From a behavioral science perspective, the findings emphasize how experiential, social, and contextual processes shape adult occupational learning through practice, interaction, problem solving, and locally relevant tasks. These findings provide an empirical basis for the subsequent curriculum design and construction phase of EDR.

Author Affiliation

¹ Faculty of Business Administration, Northern College, Thailand.
² Faculty of Education and Educational Innovation, Kalasin University, Thailand.

*Corresponding author e-mail: tok2029@gmail.com
https://orcid.org/0000-0001-5398-6537

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The global coffee industry increasingly emphasizes quality, traceability, and sustainability across the value chain, particularly as evolving market and regulatory requirements demand greater transparency regarding coffee origin and production practices (Food and Agriculture Organization of the United Nations [FAO], 2026; International Coffee Organization [ICO], 2024). This emphasis is especially important for smallholder producers: more than 30 million smallholder households worldwide rely directly on coffee income (Adong et al., 2024). Within this context, specialty coffee offers opportunities for producers to

differentiate their products through quality, traceability, distinctive production characteristics, and access to higher-value market segments (Specialty Coffee Association [SCA], n.d.). However, access to such opportunities is not automatic and depends on farmers' capacity to meet quality requirements, manage production and post-harvest processes, and respond to increasingly demanding market and sustainability expectations. In Northern Thailand, coffee cultivation serves as an important source of income for many rural households (Office of Agricultural Economics, 2020). Within the study context, participating smallholder coffee farmers were characterized by limited access to formal technical training and production-support resources relevant to specialty coffee production. Rather than assuming disadvantage solely on the basis of smallholder status, the present study operationalized disadvantage in relation to restricted access to educational, technical, and resource opportunities that could support improvements in production and post-harvest quality management. This definition was used to identify the target learner group and to inform the subsequent needs analysis and curriculum design process. Although these farmers possess valuable experiential knowledge from years of coffee cultivation, many continue to face challenges in selective harvesting, post-harvest processing, moisture control, defect management, and quality preservation. These challenges may limit their ability to consistently meet Specialty Coffee Association (SCA) standards and access higher-value markets (Borrella et al., 2015; Moon et al., 2024; Neilson & Pritchard, 2009). To address these educational and production-related challenges, a prototype curriculum consisting of seven learning modules was developed through an educational design research (EDR) process, which emphasizes the systematic analysis of educational problems and the iterative development of theoretically informed solutions in authentic learning contexts (McKenney & Reeves, 2019).

The curriculum is grounded in adult learning theory, emphasizing learners' prior experience, practical relevance, problem-centered learning, active participation, and application to authentic occupational contexts (Knowles, 1984; Knowles et al., 2015). The curriculum is the sentences have been revised to the present tense for consistency. Educational design research guided the context-responsive development of learning activities based on identified learner needs and authentic community conditions (McKenney & Reeves, 2012; Van Den Akker, 1999). In addition, principles of backward design informed the alignment of intended learning outcomes, learning activities, and assessment (Wiggins & McTighe, 1998). The curriculum is grounded in adult learning theory, which emphasizes prior experience, practical relevance, active participation, and problem-centered learning (Knowles et al., 2015). These principles are particularly relevant to disadvantaged farmers because they connect existing farming experience with practical production challenges and competency development. Accordingly, the study integrates adult learning principles with farmers' contextual conditions and specialty coffee competency requirements to inform a context-responsive curriculum.

The present study addresses this gap by integrating quantitative needs-assessment data with qualitative stakeholder perspectives to identify evidence-informed curriculum design requirements within the analysis and exploration phase of educational design research. This approach is consistent with adult learning theory, which emphasizes experience, relevance, and problem-centered learning (Knowles et al., 2015), and experiential learning theory, which emphasizes the transformation of experience through reflection and active experimentation (Kolb, 1984). This study integrates quantitative and qualitative evidence on disadvantaged smallholder coffee farmers' learning needs to inform the design of a context-responsive specialty green coffee production curriculum.

Literature Review

This section begins by reviewing the context of specialty coffee production competencies among disadvantaged farmers, followed by adult learning theory and its relevance to agricultural skill development, experiential learning and reflective practice, and educational design research as the theoretical and methodological foundations of the study. It then examines the four needs-assessment dimensions production-related challenges, contextual readiness, competency development needs, and preferred learning approaches and concludes by synthesizing previous research and the research gap to establish the conceptual foundation for deriving evidence-informed curriculum design requirements.

Specialty Coffee Production Competencies among Disadvantaged Farmers

In Northern Thailand, Arabica coffee production is closely associated with mountainous farming communities, where smallholder farmers develop substantial practical experience through their involvement in coffee cultivation and production (Pongwiritthon et al., 2025). However, differences in access to specialized knowledge, technical training, production resources, and quality-management practices may influence their readiness to develop the competencies required for specialty coffee production. These contextual conditions suggest that specialty coffee education should extend beyond the transmission of technical knowledge and connect farmers' existing experience with specialty coffee quality requirements and authentic production challenges. Such competency development is particularly relevant for adult learners because their prior experiences and occupational problems can serve as important foundations for meaningful and practically applicable learning. Accordingly, examining farmers' production-related challenges and contextual readiness, together with their competency development needs and preferred learning approaches, provides a contextual basis for the subsequent design of learning experiences responsive to specialty green coffee production.

Adult Learning Theory and Agricultural Skill Development

Adult learning theory, or andragogy, provides a theoretical foundation for understanding how adults engage in learning that is relevant to their experiences and practical needs. Knowles (1984) conceptualized adult learners as increasingly self-directed and experience-based, while later formulations emphasize prior experience, readiness to learn, problem-centered orientation, and practical relevance (Knowles et al., 2015). In this study, agricultural skill development refers to the process through which farmers strengthen the knowledge and practical competencies needed to address authentic production problems and improve farming practices. Adult learning principles support this process by enabling farmers to connect new technical knowledge with their existing experience and apply it directly in occupational settings. For disadvantaged smallholder farmers, differences in prior experience, access to training, and available resources may influence both their readiness to learn and opportunities to develop these skills (Velardi et al., 2021). Accordingly, adult learning theory provides a basis for examining farmers' competency development needs and preferred learning approaches in specialty green coffee production. In the present study, adult learning theory guides the examination of farmers' learning needs and preferences. Farmers' prior experiences and practical production problems are considered important sources for learning. These principles provide a basis for identifying learning appropriate for specialty green coffee production.

Experiential Learning and Reflective Practice

Experiential learning theory (ELT) conceptualizes learning as a process in which knowledge is created through the transformation of experience. Kolb (1984) describes this process through four interrelated modes: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Reflection is central to this process because it enables learners to examine prior experiences, reconsider existing practices, and apply new understanding to subsequent action (Schön, 1983). These principles are particularly relevant to farmer education because agricultural learning often involves observation, experimentation, reflection, and adaptation to practical production problems. Ochago et al. (2023) showed that coffee farmers developed knowledge through critical reflection, experimentation, and multidirectional knowledge exchange in response to authentic agricultural challenges. Marenja et al. (2021) similarly demonstrated the value of experiential and context-responsive approaches in connecting farmers' prior experience with agricultural problems and improved practices. Miiro et al. (2024) further identified relationships among training design, performance self-efficacy, motivation to transfer, and agricultural training transfer, emphasizing the importance of designing learning experiences that can be applied in practice. Experiential learning also occurs through social participation and knowledge exchange. From a community of practice perspective, learning develops through participation in shared practices and interaction among individuals with common concerns and activities (Okumah et al., 2021; Wenger, 1998). In farmer education, this perspective highlights the potential role of peer exchange, collaborative problem solving, observation, and interaction with experienced farmers and technical experts. Together, these

theoretical and empirical perspectives provide a basis for examining farmers' preferred experiential learning approaches. Experiential and reflective learning enables farmers to connect their production experiences with the competencies required for specialty green coffee production. Collaborative activities and problem-solving further support learning through practice and knowledge exchange. These approaches provide a basis for identifying appropriate learning activities for subsequent curriculum design.

Educational Design Research and Needs Analysis

Educational design research (EDR) provides a systematic approach to developing educational interventions through iterative processes that connect theoretical understanding with practical educational problems (McKenney & Reeves, 2012; Van Den Akker, 2023). Needs analysis is central to the analysis and exploration phase of EDR because it identifies learner needs, contextual conditions, and educational requirements before intervention design. In the present study, this phase is used to examine the educational and production-related needs of disadvantaged smallholder coffee farmers. The findings provide an empirical basis for subsequent curriculum design decisions. Quantitative needs-assessment data identify patterns across production-related challenges, contextual readiness, competency development needs, and preferred learning approaches, while qualitative perspectives provide contextual explanations of these needs (McKenney & Reeves, 2012). Integrating quantitative and qualitative evidence can provide a more comprehensive understanding of learner needs and their implications for subsequent curriculum design (Creswell & Plano Clark, 2018). The integrated findings identify farmers' learning needs and the conditions that should be considered in curriculum design. These findings will guide the development of learning objectives, content, learning activities, resources, and assessment methods in the next phase of EDR.

Needs-Assessment Dimensions

The needs-assessment framework in this study comprises four dimensions: production-related challenges, contextual readiness, competency development needs, and preferred learning approaches. Production-related challenges refer to farmers' difficulties in meeting specialty coffee production and quality requirements, particularly in processing, moisture management, defect control, and quality evaluation (Specialty Coffee Association, 2024). Contextual readiness concerns the community conditions, available resources, and opportunities for participation that may influence learning and the application of new practices. Competency development needs refer to the knowledge and practical skills farmers need to address identified production problems. Preferred learning approaches concern how farmers prefer to learn, including hands-on practice, reflection, peer exchange, collaborative problem solving, and learning from authentic production situations. The four dimensions are informed by two complementary theoretical perspectives. Adult learning theory explains the importance of farmers' prior experience, readiness to learn, practical relevance, and problem-centered learning (Knowles et al., 2015). Experiential learning theory explains how farmers can develop knowledge and skills through experience, reflection, conceptualization, and experimentation (Kolb, 1984). Studies of farmer learning also support experiential and context-responsive approaches to agricultural learning (Miirio et al., 2024; Ochago, Dentoni, & Mahdad, 2024; Sumani et al., 2023).

Previous Research and Research Gap

Previous research highlights the importance of experiential and context-responsive learning in farmer education. Ochago et al. (2023) showed that coffee farmers developed knowledge through critical reflection, experimentation, and multidirectional knowledge exchange while addressing authentic value-chain challenges. In Northern Thailand, Pongwirithon et al. (2025) developed specialty green coffee production training in Huai Kaeo Community and examined farmers' learning achievement and practical skills. Together, these studies demonstrate the relevance of experiential learning and practical competency development in agricultural and specialty coffee education. Despite these contributions, limited evidence explains how disadvantaged coffee farmers' production-related challenges, contextual readiness, competency development needs, and preferred adult learning approaches can be systematically examined together before curriculum design. This gap is important because context-responsive curriculum

development requires attention not only to technical competency requirements but also to learners' prior experiences, occupational problems, learning preferences, and contextual conditions (Ataei et al., 2022; Okumah et al., 2021; Twase, 2022; Velardi et al., 2021; Waddington et al., 2014). The present study addresses this gap by integrating these four needs-assessment dimensions within the analysis and exploration phase of educational design research. Rather than evaluating curriculum effectiveness, the study establishes an empirical foundation for identifying what farmers need to learn, how they prefer to learn, and which contextual conditions should inform the subsequent design of a specialty green coffee production curriculum.

Research Objectives

The objectives of this study were:

1. To quantitatively assess disadvantaged coffee farmers' production-related challenges, contextual readiness, competency development needs, and preferred adult learning approaches relevant to specialty green coffee production.
2. To qualitatively explore farmers' and relevant stakeholders' experiences and perspectives regarding specialty coffee production challenges, competency needs, learning preferences, contextual conditions, and considerations for curriculum development
3. To integrate the quantitative and qualitative findings to derive evidence-based curriculum design requirements for the subsequent design and construction phase of an adult learning-based specialty green coffee production curriculum.

Conceptual Framework

The conceptual framework integrates adult learning theory, experiential learning theory, educational design research (EDR), and specialty coffee production requirements to guide the assessment of farmers' learning needs. The needs assessment comprises four dimensions: production-related challenges, contextual readiness, competency development needs, and preferred learning approaches. Quantitative and qualitative evidence across these dimensions is integrated to identify farmers' needs and the conditions relevant to curriculum design. Within the analysis and exploration phase of EDR, the findings provide an empirical basis for developing learning objectives, content, learning activities, resources, and assessment methods in the subsequent curriculum design phase.

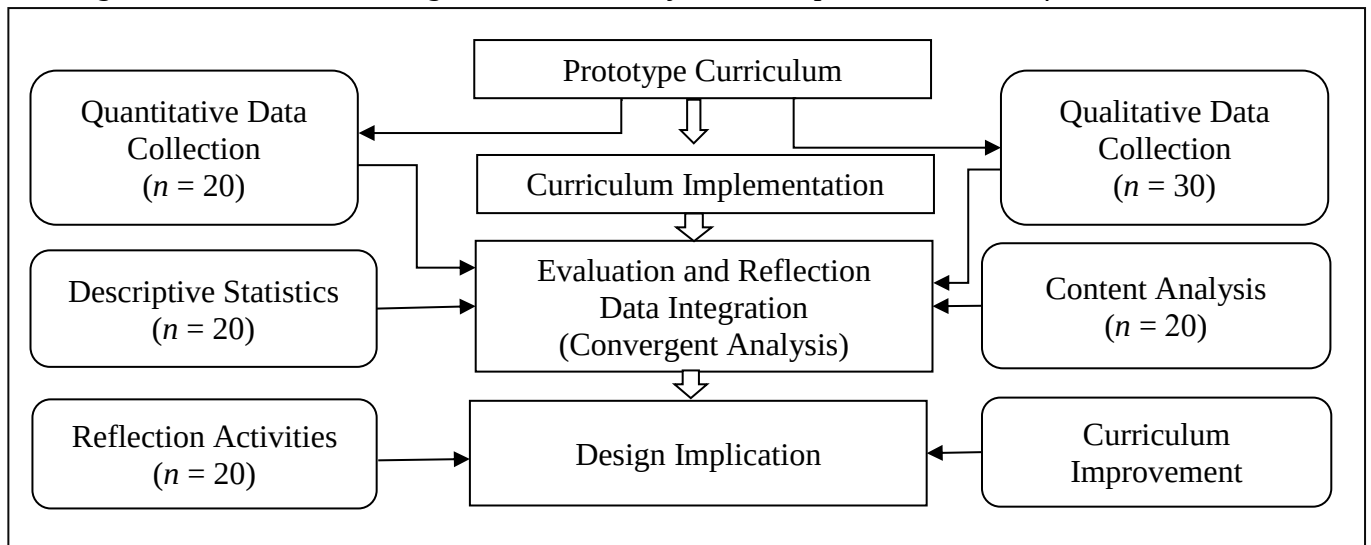
Methods

Design

This study employed a convergent mixed-methods design within the analysis and exploration phase of educational design research (EDR). Quantitative and qualitative data were collected concurrently, analyzed separately, and subsequently integrated to provide a comprehensive understanding of the research problem (Creswell & Plano Clark, 2018). Consistent with EDR, this phase examines educational problems, learner needs, and contextual conditions to inform subsequent intervention design (McKenney & Reeves, 2012). Data were collected between April and June 2026 in Huai Kaeo community, Mae On District, Chiang Mai Province, Thailand.

The quantitative strand involved 15 disadvantaged coffee farmers and used a needs-assessment questionnaire to examine production-related challenges, contextual readiness, competency development needs, and preferred adult learning approaches. The qualitative strand involved 20 stakeholders, comprising the same 15 farmers, three specialty coffee experts, and two curriculum and instructional experts. Semi-structured interviews, focus group discussions, and field notes explored production experiences, learning needs, contextual conditions, and curriculum recommendations. The two strands were integrated during interpretation to identify convergence, complementarity, and divergence across findings. The integrated evidence was used to derive evidence-based curriculum design requirements for the subsequent design and construction phase of EDR. Figure 1 illustrates the overall research design.

Convergent Mixed-Methods Design Within the Analysis and Exploration Phase of EDR



Note. Quantitative and qualitative data were collected during the same study phase, analyzed separately, and integrated during interpretation to derive evidence-based curriculum design requirements for the subsequent design and construction phase of EDR.

Setting

The study was conducted in Huai Kaeo Community, Mae On District, Chiang Mai Province, Northern Thailand. The community is characterized by smallholder Arabica coffee production, providing the local agricultural context for examining farmers' specialty green coffee production and learning needs (Pongwiritthon et al., 2025).

Sample/Participants

The quantitative strand included 15 disadvantaged coffee farmers selected through purposive sampling. Eligibility criteria included involvement in coffee cultivation or post-harvest production, experience in community-based agricultural activities, residence in the study communities, and willingness to participate. The participants constituted a context-specific needs-assessment group rather than a probability sample intended for population-level statistical generalization. The qualitative strand included 20 stakeholders purposively selected based on their relevant experience in specialty coffee production or curriculum and instructional development. Participants comprised the same 15 disadvantaged coffee farmers who participated in the quantitative strand, three certified Q Graders, and two curriculum and instructional experts. Including these stakeholder groups enabled the study to integrate farmers' experiential perspectives with technical and educational expertise relevant to identifying learning needs and informing subsequent curriculum development.

Instruments

Three data collection instruments were used: a needs-assessment questionnaire, a semi-structured interview guide, and a focus group discussion guide. The instruments were developed specifically for this study based on the research objectives and conceptual framework and were informed by adult learning theory, experiential learning theory, educational design research (EDR), and specialty green coffee production requirements. They were designed to generate complementary quantitative and qualitative evidence concerning farmers' learning needs and production contexts.

The needs-assessment questionnaire consisted of 32 items covering four dimensions: production-related challenges, contextual readiness, competency development needs, and preferred learning approaches. The items reflected the theoretical foundations of the study and practical competencies relevant to specialty green coffee production. Responses were recorded on a five-point Likert-type scale ranging

from 1 to 5, with higher scores indicating higher levels of the dimension assessed. Mean scores were interpreted as follows: 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 (Best, 1977). Content validity was assessed through expert review. The reviewers included specialty coffee professionals with relevant SCA certification, professional experience as coffee business operators, and recognition within the Thai coffee professional community, including recognition by the Coffee Association of Thailand. The items were reviewed for relevance, clarity, appropriateness, and alignment with the study objectives. Internal consistency was assessed using Cronbach's alpha, yielding an overall coefficient of .895, indicating good reliability.

Separate semi-structured interview and focus group discussion guides were developed for the qualitative strand. Although the two guides were distinct instruments, they addressed common domains: coffee production experiences, production-related challenges, competency development needs, learning preferences, contextual conditions, and recommendations for curriculum development. The semi-structured interview guide was designed to elicit participants' individual experiences and perspectives in greater depth, whereas the focus group discussion guide was designed to facilitate interaction and explore shared and differing perspectives among participants. Thus, the two guides addressed the same core domains but used questions and prompts appropriate to their respective data collection formats.

Procedures

Following ethical approval and informed consent, data were collected between April and June 2026 during the analysis and exploration phase of EDR. For the quantitative strand, the 15 participating farmers completed the questionnaire individually in community-based settings using standardized administration procedures. Clarifications were provided when necessary without directing participants' responses. Qualitative data were collected during the same period through semi-structured interviews and focus group discussions in community-based settings. Sessions lasted approximately 60–90 minutes, were audio-recorded with participants' permission, and were supplemented by field notes documenting contextual observations. Quantitative and qualitative data were collected concurrently and subsequently integrated to provide a comprehensive understanding of farmers' learning needs and contextual conditions relevant to subsequent curriculum design.

Data Collection

Quantitative data were collected between April and June 2026 using the 32-item needs-assessment questionnaire. The questionnaire measured four dimensions: production-related challenges, contextual readiness, competency development needs, and preferred adult learning approaches. All 15 participating farmers completed the questionnaire, and the responses were subsequently prepared for descriptive statistical analysis. Qualitative data were collected during the same period through semi-structured interviews, focus group discussions, and field notes. Interviews and focus group sessions lasted approximately 60–90 minutes and were audio-recorded with participants' permission. Data focused on participants' production experiences, production-related challenges, competency development needs, preferred learning approaches, contextual conditions, and recommendations for subsequent curriculum development. Field notes were used to document contextual observations and supplement the interview and focus group data.

Data Analysis

Quantitative data were analyzed using descriptive statistics, including frequency, percentage, mean (*M*), and standard deviation (*SD*). Analyses were conducted across the four needs-assessment dimensions: production-related challenges, contextual readiness, competency development needs, and preferred adult learning approaches. Mean scores were interpreted as follows: 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 (Best, 1977). Inferential statistics were not performed because the 15 participants constituted a small, purposively selected, context-specific sample. Accordingly, the findings were interpreted descriptively rather than generalized to a broader population. Qualitative data were analyzed using content analysis (Patton, 2015). Following Patton's (2015)

approach to qualitative analysis, the data were analyzed through an iterative process involving repeated reading to achieve familiarity with the data, identification of meaningful units, initial coding, organization of related codes into categories, comparison of recurring patterns across the dataset, and synthesis of the categories into higher-order themes. Themes were developed to explain participants' production challenges, competency development needs, motivations, preferred learning approaches, and contextual conditions relevant to subsequent curriculum development. Representative quotations were retained to maintain a clear connection between the interpretations and participants' accounts. Methodological rigor was supported through data-source and method triangulation, member checking with the 15 participating farmers, field notes, coding records, analytic memos, and documentation of category-development and interpretive decisions.

Rigor

Methodological rigor was addressed across the quantitative, qualitative, and mixed-methods components. For the quantitative strand, content validity was established through expert review, and internal consistency was assessed using Cronbach's alpha. For the qualitative strand, credibility was strengthened through data-source and method triangulation, including interviews, focus group discussions, field notes, and perspectives from farmers and experts (Creswell & Plano Clark, 2018; Lincoln & Guba, 1985). Member checking with the 15 participating farmers was used to verify the accuracy and relevance of interpretations. Dependability and confirmability were supported through systematic coding records, field notes, analytic memos, and documentation of interpretive decisions (Lincoln & Guba, 1985). For mixed-methods rigor, quantitative and qualitative findings were analyzed independently before integration, allowing convergence, complementarity, and divergence to be systematically examined. This process maintained the distinct contribution of each strand while strengthening the credibility of the integrated curriculum design requirements.

Results

This section presents the findings from the analysis and exploration phase of educational design research (EDR). Consistent with the convergent mixed-methods design, quantitative and qualitative data were analyzed separately and subsequently integrated to address the research objectives. The results are organized into four sections: (1) participant characteristics; (2) quantitative findings on the four needs-assessment dimensions; (3) qualitative findings derived from stakeholder perspectives; and (4) integrated mixed-methods findings leading to evidence-based curriculum design requirements for the subsequent design and construction phase of EDR.

Sample Quantitative with Qualitative Results

The quantitative strand included 15 disadvantaged coffee farmers from the study communities in Mae On District, Chiang Mai Province, Thailand. The same 15 farmers also participated in the qualitative strand, which comprised 20 stakeholders: 15 disadvantaged coffee farmers, three specialty coffee experts who were certified Q Graders, and two curriculum and instructional experts. The farmers ranged in age from 32 to 62 years, with a mean age of 46.30 years and an average of 11.80 years of coffee-farming experience. This overlapping sample allowed quantitative patterns in farmers' needs to be examined alongside qualitative perspectives from farmers and relevant experts.

Quantitative findings indicated very high production-related challenges ($M = 4.41$, $SD = 0.67$), high contextual readiness ($M = 3.91$, $SD = 0.86$), very high competency development needs ($M = 4.70$, $SD = 0.76$), and very high preferences for adult learning approaches ($M = 4.74$, $SD = 0.87$). Major challenges included limited knowledge of SCA standards, quality inspection, processing methods, and moisture control. The highest competency development needs were related to hands-on practice with experts, SCA standards, post-harvest quality control, and defect identification. The most strongly preferred adult learning approaches included learning by doing, experiential learning, peer knowledge exchange, and problem-based learning. The descriptive statistics for the four dimensions of the needs assessment are presented in Table 1.

The qualitative findings complemented these quantitative patterns through four themes: limited technical knowledge of specialty coffee standards; motivation to improve coffee quality and livelihood opportunities; preference for experiential and collaborative learning; and need for context-responsive, community-based learning. Participants emphasized practical training, peer exchange, expert guidance, and learning situated within authentic production contexts.

Table 1

Production-Related Challenges in Specialty Green Coffee Bean Production

Quantitative Dimension	Quantitative Result	Corresponding Qualitative Result
Production-related challenges	$M = 4.41$, $SD = 0.67$	Limited technical knowledge of specialty coffee standards and post-harvest quality management.
Contextual readiness	$M = 3.91$, $SD = 0.86$	Need for context-responsive, community-based learning reflecting local resources and conditions.
Competency development needs	$M = 4.70$, $SD = 0.76$	Strong motivation to improve coffee quality and develop practically relevant competencies.
Preferred adult learning approaches	$M = 4.74$, $SD = 0.87$	Preference for experiential and collaborative learning, including hands-on practice, peer exchange, and expert guidance.

Note. Quantitative and qualitative findings were analyzed separately before integration. The table presents corresponding patterns across the two strands rather than implying that the qualitative themes were quantitatively measured.

Qualitative Research Results

Qualitative analysis of the semi-structured interviews, focus group discussions, open-ended responses, and field notes identified four major themes related to farmers' specialty coffee production challenges, motivations for competency development, preferred learning approaches, and contextual conditions relevant to subsequent curriculum development.

Theme 1: Limited Technical Knowledge of Specialty Coffee Standards.

Farmers reported limited systematic knowledge of specialty coffee standards and post-harvest quality management despite substantial practical experience in coffee cultivation. Difficulties were particularly evident in quality evaluation, processing control, moisture management, and defect identification. One farmer stated, "We have grown coffee for many years, but we do not clearly understand how specialty coffee quality is evaluated." The findings demonstrated a gap between farmers' experiential knowledge and systematic specialty coffee quality requirements.

Theme 2: Motivation to Improve Coffee Quality and Livelihood Opportunities.

Participants expressed strong motivation to improve production competencies, coffee quality, and the economic value of their products. Specialty coffee knowledge was perceived as relevant to accessing higher-value markets and strengthening household livelihoods, indicating that competency development should be connected to authentic occupational goals and practical benefits.

Theme 3: Preference for Experiential and Collaborative Learning.

Participants preferred demonstrations, hands-on practice, peer knowledge exchange, problem solving, and direct interaction with specialty coffee experts rather than predominantly lecture-based instruction. Farmers emphasized opportunities to observe, practice, discuss results, and connect new knowledge with their previous production experiences.

Theme 4: Need for Context-Responsive, Community-Based Learning.

Participants emphasized that learning should reflect local production conditions, seasonal cycles, available resources, and community constraints. They preferred learning activities situated in authentic

coffee-production environments where knowledge and skills could be directly applied to existing production problems. The four qualitative themes, their key findings, and corresponding curriculum design considerations are summarized in Table 2.

Table 2

Qualitative Themes, Key Findings, and Curriculum Design Considerations

Qualitative theme	Key finding	Curriculum design consideration
1. Limited technical knowledge of specialty coffee standards	Gaps in systematic knowledge of quality standards and post-harvest quality management	Integrate specialty coffee standards, quality management, and practical quality-control competencies
2. Motivation to improve coffee quality and livelihood opportunities	Strong interest in improving product quality and creating greater economic value	Connect competency development with authentic occupational goals and quality improvement
3. Preference for experiential and collaborative learning	Preference for demonstrations, hands-on practice, peer exchange, problem solving, and expert guidance	Incorporate experiential, collaborative, problem-centered, and expert-guided learning
4. Need for context-responsive, community-based learning	Learning should reflect local resources, seasonal conditions, and authentic production problems	Situate learning activities within community and production contexts and support immediate practical application

Note. Curriculum design considerations were derived from the qualitative findings and were subsequently examined alongside the quantitative findings during mixed-methods integration.

Converged Quantitative Results with Qualitative Results

Integration of the quantitative and qualitative findings demonstrated strong convergence across the four needs-assessment dimensions. Quantitative results showed very high production-related challenges ($M = 4.41$, $SD = 0.67$) and competency development needs ($M = 4.70$, $SD = 0.76$), particularly regarding SCA standards, post-harvest quality control, processing methods, moisture management, defect identification, and hands-on practice with experts. These findings converged with qualitative evidence indicating that farmers possessed substantial practical experience but lacked systematic technical knowledge of specialty coffee standards and were strongly motivated to improve coffee quality and livelihood opportunities. Farmers also reported a very high preference for adult learning approaches ($M = 4.74$, $SD = 0.87$), particularly learning by doing, experiential learning, peer knowledge exchange, and problem-based learning. Qualitative findings reinforced these preferences through participants' emphasis on demonstrations, hands-on practice, collaborative problem solving, peer exchange, and expert guidance. Contextual readiness was high ($M = 3.91$, $SD = 0.86$), while qualitative findings further emphasized that learning should reflect local resources, seasonal cycles, community conditions, and authentic production problems. Overall, the converged findings generated four evidence-based curriculum design requirements: (1) competency-aligned technical content, (2) experiential and hands-on learning, (3) collaborative and expert-guided learning, and (4) context-responsive, community-based learning. These integrated requirements provide an empirical foundation for the subsequent design and construction phase of EDR.

Discussion and Conclusion

Discussion of Main Results

The discussion is organized according to the three research objectives. Regarding the first objective, the quantitative findings identified substantial needs across the four assessed dimensions. Competency development needs ($M = 4.70$, $SD = 0.76$) and preferred adult learning approaches ($M = 4.74$, $SD = 0.87$) were particularly high, while production-related challenges were also rated very high ($M = 4.41$, $SD = 0.67$).

Farmers reported difficulties with specialty coffee standards, post-harvest processing, moisture management, defect identification, and quality evaluation. These findings indicate that extensive farming experience does not necessarily provide the systematic technical knowledge required for specialty coffee production. Instead, curriculum development should connect farmers' existing experiential knowledge with explicit quality-management competencies. This interpretation is consistent with adult learning theory, which recognizes prior experience and immediate occupational relevance as important resources for adult learning (Knowles et al., 2015). Recent coffee-sector research similarly shows that farmers develop knowledge through reflection, experimentation, and responses to authentic value-chain challenges (Ochago, 2024).

The quantitative findings also demonstrated strong preferences for learning by doing, experiential learning, peer knowledge exchange, and problem-based learning. These preferences support learning activities that engage farmers directly with authentic production problems rather than relying predominantly on didactic instruction. Experiential learning theory explains this process through concrete experience, reflective observation, conceptualization, and active experimentation (Kolb, 1984). More recent evidence provides context-specific support Pongwiritthon et al. (2026) found that place-based, problem-based, and experience-oriented approaches connected farmers' previous experiences with contemporary agricultural problems, while Ochago (2024) highlighted reflection and peer interaction as important processes in coffee farmers' experiential knowledge development. Thus, subsequent curriculum activities should enable farmers to practice technical procedures, evaluate outcomes, exchange experiences, and apply revised knowledge to actual production situations.

Regarding the second objective, the qualitative findings provided deeper explanations of farmers' and stakeholders' perspectives. Four themes emerged: limited systematic knowledge of specialty coffee standards, motivation to improve coffee quality and livelihood opportunities, preference for experiential and collaborative learning, and the need for context-responsive community-based learning. These findings suggest that competency development is connected not only to technical deficiencies but also to farmers' occupational goals and learning environments. Farmers' emphasis on demonstrations, hands-on practice, peer exchange, and expert guidance further indicates that learning is socially and contextually situated. This interpretation is supported by research showing that agricultural learning is influenced by training design, motivation to transfer, social participation, and access to relevant resources (Miirio et al., 2024; Ochago, Dentoni, & Trienekens, 2024). Consequently, curriculum design should account for both individual learning needs and contextual conditions that facilitate or constrain participation and practical application.

Regarding the third objective, mixed-methods integration demonstrated substantial convergence and complementarity between the quantitative and qualitative findings. High quantitative competency needs corresponded with qualitative evidence of limited systematic technical knowledge, while strong quantitative preferences for experiential learning converged with qualitative preferences for demonstrations, hands-on practice, peer exchange, problem solving, and expert guidance. Contextual findings concerning resources, seasonal conditions, and community constraints further complemented the quantitative assessment of contextual readiness. These integrated findings generated four curriculum design requirements: competency-aligned content, experiential and hands-on learning, collaborative and expert-guided learning, and context-responsive community-based learning. These requirements are consistent with contemporary evidence emphasizing authentic problem solving, reflection, experiential learning, and training transfer in agricultural education (Ochago et al., 2023; Pongwiritthon et al., 2026).

Overall, the findings extend previous research by integrating technical needs, learning preferences, and contextual conditions within a single pre-design needs analysis. Consistent with the analysis and exploration phase of EDR, the results constitute design evidence rather than evidence of curriculum effectiveness (McKenney & Reeves, 2012; Van Den Akker, 1999). They therefore provide an empirical foundation for specifying learning outcomes, content, activities, resources, and assessment strategies during the subsequent design and construction phase.

Limitations

Several limitations should be considered when interpreting the findings. First, the study was conducted in a specific community context in Mae On District, Chiang Mai Province, with a small, purposively selected sample. The quantitative strand included 15 disadvantaged coffee farmers, while the qualitative strand included these farmers and five relevant experts. Consequently, the findings are context-specific and should not be statistically generalized to disadvantaged coffee farmers or coffee-producing communities in other settings. Second, the study was limited to the analysis and exploration phase of educational design research (EDR). It identified production-related challenges, contextual readiness, competency development needs, and preferred adult learning approaches to inform subsequent curriculum design. The study did not design, implement, or evaluate the effectiveness of a curriculum; therefore, no conclusions can be drawn regarding changes in knowledge, practical skills, behavior, or production performance. Subsequent EDR phases should develop and evaluate the proposed curriculum through appropriate learning and performance measures. Third, the quantitative findings were based on self-reported perceptions and may therefore be subject to response bias.

Although the inclusion of multiple stakeholder groups and data sources enhanced the credibility of the qualitative findings through triangulation (Lincoln & Guba, 1985; Patton, 2015), the study relied primarily on self-reported needs and stakeholder perspectives rather than objective measures of farmer competency or coffee quality. Future research should therefore incorporate performance-based competency assessments and objective coffee quality indicators to strengthen the evidence supporting curriculum development. In addition, the present study focused specifically on competencies related to specialty green coffee production. Previous research indicates that smallholder farmers' participation in higher-value agricultural markets is also shaped by broader contextual and market-related conditions (Ochago et al., 2023). Future studies should therefore examine how entrepreneurship, financial literacy, supply-chain relationships, and market access interact with competency development and farmers' participation in specialty coffee markets.

Implications for Behavioral Science

The findings contribute to behavioral science by illustrating how experiential, motivational, social, and contextual factors are associated with adult learning needs in community-based occupational settings. They highlight the importance of understanding learning behavior within the practical and social contexts in which occupational competencies are developed.

The findings suggest that the curriculum should emphasize hands-on practice, peer knowledge exchange, and problem-based learning. Learning activities should enable farmers to apply their prior production experience to authentic specialty coffee production problems and reflect on the outcomes of their practices. These approaches may strengthen the practical relevance of learning and support the development of occupational competencies required for specialty green coffee production (Knowles et al., 2015; Kolb, 1984).

Motivation to improve coffee quality and livelihood opportunities, together with peer interaction and expert guidance, emerged as important conditions for occupational learning. These findings are consistent with previous research emphasizing reflection, experimentation, knowledge exchange, and contextualized learning in agricultural settings (Ochago, Dentoni, & Trienekens, 2024; Sumani et al., 2023).

Future research should examine whether curriculum interventions developed from the identified design requirements contribute to changes in knowledge, practical competencies, self-efficacy, training transfer, and occupational practices. Longitudinal studies should further investigate whether these changes are sustained in authentic specialty coffee production contexts. The present findings should therefore be interpreted as evidence-informed requirements for subsequent curriculum design rather than as evidence of curriculum effectiveness.

For practice and policy, agricultural education providers, community organizations, and relevant agencies should prioritize accessible community-based training that integrates competency-aligned content,

experiential and hands-on learning, peer collaboration, expert guidance, and authentic production problems. Support for technical expertise, appropriate learning resources, and locally accessible training opportunities may strengthen the alignment between farmer education, community conditions, and sustainable specialty coffee competency development.

Conclusion

This study identified the learning needs of disadvantaged coffee farmers to inform specialty green coffee curriculum development. Integrated quantitative and qualitative findings highlighted production-related challenges, competency development needs, and preferences for experiential, collaborative, and context-responsive learning. These findings generated four curriculum design requirements: competency-aligned content, hands-on experiential learning, collaborative and expert-guided learning, and community-based learning responsive to farmers' contexts. The findings provide an empirical foundation for the subsequent design and construction phase of EDR; however, because the study was limited to the analysis and exploration phase, they should not be interpreted as evidence of curriculum effectiveness.

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Declarations

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Ethical Approval Statement: This study was conducted in accordance with the ethical principles of the Declaration of Helsinki and was approved by the Human Research Ethics Committee of Northern College, Thailand (Approval No. NREC 0044/2569; approved on January 19, 2026; expiration date: January 18, 2027). All participants were informed of the study objectives and procedures before participation, and written informed consent was obtained from all participants. Participant confidentiality and anonymity were maintained throughout the research process.

Declaration of Generative AI: During the preparation of this manuscript, the authors used ChatGPT (OpenAI) to assist with language editing, grammatical refinement, and the organization of academic writing. The tool was used solely to improve the clarity, readability, coherence, and academic English of the manuscript. All conceptualization, research design, data collection, data analysis, interpretation of findings, and formulation of conclusions were conducted by the authors. The authors critically reviewed, verified, and revised all AI-assisted content and take full responsibility for the accuracy, originality, integrity, and content of the manuscript. Generative AI was not used to generate research data, conduct data analysis, interpret findings, draw conclusions, or make scholarly judgments. Its use was limited to supporting the writing and editing process in accordance with the ethical and publication policies of the journal.

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