



## Blended learning through professional learning communities for water management curriculum among agriculture and technology college teachers

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### Abstract

This study aims to develop and evaluate the effectiveness of a blended learning model facilitated by a professional learning community for teachers of the Water Management Curriculum within agricultural and technology colleges. Although blended learning and professional learning communities have been widely applied in education, their combined use in technical and vocational curricula remains under explored. Data were gathered from key informants, including college directors and experts in educational technology and water management, using semi-structured interviews, small group discussions, and suitability assessment forms. Content analysis was employed alongside descriptive statistics to synthesize findings. The proposed model incorporates four blended learning components, knowledge understanding, collaboration, application, and training, and four professional learning community components, brainstorming, exchanging experiences, supporting, and transferring practical methods. Expert evaluations indicated a high level of suitability for the model, highlighting its potential to enhance instructional quality and foster collaborative professional growth among teachers in specialized technical fields.

**Keywords:** Blended Learning, Professional Learning Community, Community-Based Water Management

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## 1. INTRODUCTION

Conducting education on water management within vocational education in Thailand entails introducing a novel curriculum for which no prior preparation has been undertaken by any educational agency. Recognizing the significance of reform in water management education within vocational settings, the Ministry of Education, under the leadership of Dr. Kanlaya Sophonpanich, has taken proactive measures. This has led to the initiation of a vocational water management curriculum referred to as "Chonlakorn," as part of the royal initiative community-based water management project. The initiative is spearheaded by the College of Agriculture and Technology and has been piloted in five provinces, namely Ubon Ratchathani, Sisaket, Roi Et, Maha Sarakham, and Yasothon. Subsequently, a network of agricultural and technology colleges has expressed interest in adopting the "Chonlakorn" curriculum. This water management curriculum has been designed with a focus on agricultural vocational students and community and local participation, aiming to enhance the quality of life through the application of science, technology, and innovation (STI). Additionally, the project involves organizing activities for youth to promote awareness of water conservation through modern media channels. The endeavor can be regarded as an educational modernization initiative, leveraging technology to apply knowledge in science, technology, and innovation for community-based water education and management (Sarimanond & Viriyavejakul, 2021).

The College of Agriculture and Technology is positioned to serve as a pivotal institution for developing skilled entrepreneurs dedicated to future endeavors in water management. Equipped with a proficient faculty and active students, the college is prepared to take the lead in developing a prototype within its vicinity. This initiative is anticipated to extend to the neighboring communities, aligning with academic principles throughout the process. Notably, each college retains the freedom to tailor teaching and learning content to suit the unique characteristics and context of its specific area. Furthermore, the flexibility of the academic program ensures that graduates are well-prepared to apply their acquired knowledge in water management when residing in villages. This holistic approach not only enriches the educational experience but also empowers graduates to actively contribute to and support their communities in the realm of water management.

Hence, in the initial phase, the researcher developed a blended learning model for the water management curriculum within the professional learning community of agricultural and technology college teachers. The process involved the following steps: 1) studying and synthesizing relevant documents and reports, 2) crafting a blended learning model for the water management curriculum, 3) formulating the professional learning community model, 4) creating a blended learning model for the water management curriculum within the professional learning community, and 5) assessing the appropriateness of the blended learning model for the water management curriculum within the professional learning community. This included seeking input from water management and education experts. During the initial phase of the research, it was necessary to facilitate a focus group activity to gather comments and valuable suggestions from experts. This collaborative approach aimed to enhance the research process in subsequent stages. The research objectives are as follows:

1) To develop a blended learning model for the water management curriculum within the professional learning community of Agriculture and Technology College Teachers.

2) To evaluate the appropriateness of the blended learning model for the water management curriculum within the professional learning community of Agriculture and Technology College Teachers.

### 1.1. Literature review

#### 1.1.1. Blended learning

Blended learning is an educational approach that integrates diverse learning styles, combining a mix of traditional classroom instruction with online learning, eliminating the necessity for face-to-face interactions between students and teachers (Li & Ye, 2025). This methodology incorporates a range of learning resources, processes, and activities derived from various teaching and learning strategies, all aimed at facilitating learners in attaining their educational objectives (Han, 2024).

According to Allen and Seaman (2005), blended learning is characterized by a proportion of learning content delivered both online and in a traditional classroom setting, typically with a ratio of 30:70 percent. Blended learning entails a combination of online and face-to-face instruction, with the majority of the content being delivered through online means. This approach often incorporates online discussions and involves some in-person classroom sessions, effectively integrating the transmission of content through online platforms. In contrast, traditional classroom learning exclusively relies on in-person instruction without the incorporation of online content. Web-assisted learning delivers online content in the range of 1 - 29 percent, while online learning covers content delivery ranging from 80 - 100 percent. Graham (2012) defines blended learning as an instructional approach that integrates both face-to-face learning (classroom instruction) and teaching conducted through a computer network.

In the analysis of the educational expert's viewpoints, it can be concluded that blended learning is an educational approach deriving from diverse teaching and learning methods. This method considers the learner, environment, content, and situation, tailoring the learning experience to address individual differences. Blended learning facilitates instruction both within and beyond the traditional classroom, incorporating online and offline educational technologies. The aim is to motivate learners to acquire optimal learning skills and achieve their educational objectives. Blended Learning (BL) enables learners to acquire an independent learning experience through a computer network. It empowers individuals to exercise control over various learning variables, covering various aspects such as time, location, learning path, and self-paced learning rate (Horn & Staker, 2011).

As Saengrith et al. (2022) highlighted, Blended Learning (BL) proves to be a highly effective solution in addressing challenges by seamlessly integrating learning and working. It successfully combines knowledge delivery and support, complementing traditional classroom learning. Various literature sources define BL as the combination of instructional methods and delivery media, known by different terms such as flexible learning, blended learning, or distributed learning. Consequently, BL serves as a versatile tool for knowledge dissemination in workplace training, seamlessly integrating formal and informal learning, face-to-face and online learning, direct and self-directed learning, as well as digital reference, thereby connecting the college to achieve systematic learning objectives.

As outlined by Siripongdee et al. (2020), Blended Learning (BL) is an educational concept that integrates various technologies with traditional classrooms. In essence, a BL model synergizes the strengths of both teacher-led and self-directed learning, offering a framework for the application of the BL model in the context of Internet of Things (IoT)-based technologies.

Chachiyo et al. (2020) identified nine key components of Blended Learning (BL):

1. Learning Environment, Media, and Learning Resources: This includes considerations for the setting, media, resources, learning objectives, methodology, hierarchy, duration, and assessment.
2. Integration of Traditional and Online Learning: BL combines face-to-face classroom instruction with online learning, emphasizing practical training. Typically, 30-70 percent of instruction is conducted online, with most learning materials and resources delivered through online methods.
3. Flexibility in BL Activities: Depending on suitability, BL activities may commence and conclude with face-to-face interactions in the classroom.
4. Support for Teaching Activities: Teaching activities should be reinforced with individual practice, such as textbook exercises, which may involve online content. This necessitates the preparation of information technology skills and a support system.
5. Promotion of Cooperation and Interaction: Various teaching activities within BL foster cooperation and interaction among learners.
6. Preparation of Online Media and Learning Resources: Involves the readiness of online resources, such as digital content and downloadable documents.

7. Tools to Support Online Learning: The provision of tools for online communication, including chat rooms, web rooms, and email, enhances the online learning experience.

8. Student Autonomy and Self-Regulated Learning: Students have the freedom to choose and engage in self-regulated learning, focusing on feedback and constructivism.

9. Role of Teachers as Facilitators: Teachers act as facilitators, providing learning content and guidance on online resources while promoting open communication between students and teachers.

#### **1.1.2. Professional learning community**

A Professional Learning Community (PLC) is a collective effort wherein teachers, administrators, and educators collaborate and learn together within a culture of relationships. This collaboration is grounded in a shared vision, common values, goals, and missions, fostering teamwork (Lai & Lien, 2025; McKie, 2025). In this learning community, teachers lead collectively, and administrators provide support for learning and professional development (Su et al., 2023; Hoekstra, 2023). The emphasis is on cultivating a culture that underscores the success and effectiveness of learners, as well as fostering the happiness and collaboration of all members within the learning community.

Hord (2009) defines a Professional Learning Community as a method for administrators and teachers to collaboratively address challenges and develop learning management strategies to achieve mutually agreed-upon goals. The effectiveness of this approach benefits students, teachers, administrators, and schools, requiring the support of all stakeholders for the holistic development of learners and the ongoing professional growth of teachers.

According to Sergiovanni (1999), a Professional Learning Community serves as a space for interaction, reducing the isolation of teachers while working to enhance student learning outcomes and school academics. It is characterized by a community of generosity, founded on both professional and moral authority. DuFour (2004) proposes fundamental principles for a Professional Learning Community, which include ensuring that students learn, fostering a culture of collaboration, and maintaining a focus on results.

Hord (1997) synthesizes research findings, establishing that the implementation of a Professional Learning Community within a school yields positive effects on teachers and students. These benefits include a reduced sense of isolation among teachers, heightened commitment to the mission and goals of the school, increased motivation to achieve set objectives, shared responsibility for students, and a sense of shared power in learning. Consequently, teaching practices in the classroom evolve, discovering new methods, resulting in improved teaching quality. This, in turn, leads to higher academic achievement among students compared to traditional schools, lower rates of grade repetition, reduced student absenteeism, and a noticeable reduction in differences in academic achievement between student groups from diverse backgrounds.

#### **1.1.3. Community-based water management project under the royal initiative**

The Community-based Water Management project under the royal initiative is a collaborative effort involving the College of Agriculture and Technology. This project aims to develop a learning prototype for water management and rainwater storage within the college. It places a significant emphasis on knowledge development through Science, Technology, and Innovation (STI) for agricultural vocational students. Activities are organized wherein students selected from the College of Agriculture, mentored by seniors from universities, present the concept of "Our Water." Subsequently, this learning extends to surrounding communities, facilitating the integration of knowledge. The focus is on understanding water usage in daily life, occupations, income generation, and enhancing the overall quality of life for community members.

#### **1.1.4. Educational technology and innovation in water resource management**

In a study conducted by Sarimanond and Viriyavejakul (2021), an analysis and synthesis of documents and reports on education, particularly basic education in the northeast of Thailand, was conducted. The objective was to explore educational modernization and the utilization of technology in basic education in the region. The study identified four cases exemplifying educational modernization and technology use in the Northeast:

- a) A Model for Comprehensive STEM Education Upgrade
- b) Teaching via Distance Television
- c) The Principle of Three Innovations
- d) Community-based Water Management Education for Agricultural Vocational Students at the College of Agriculture and Technology.

## 1.2. Purpose of study

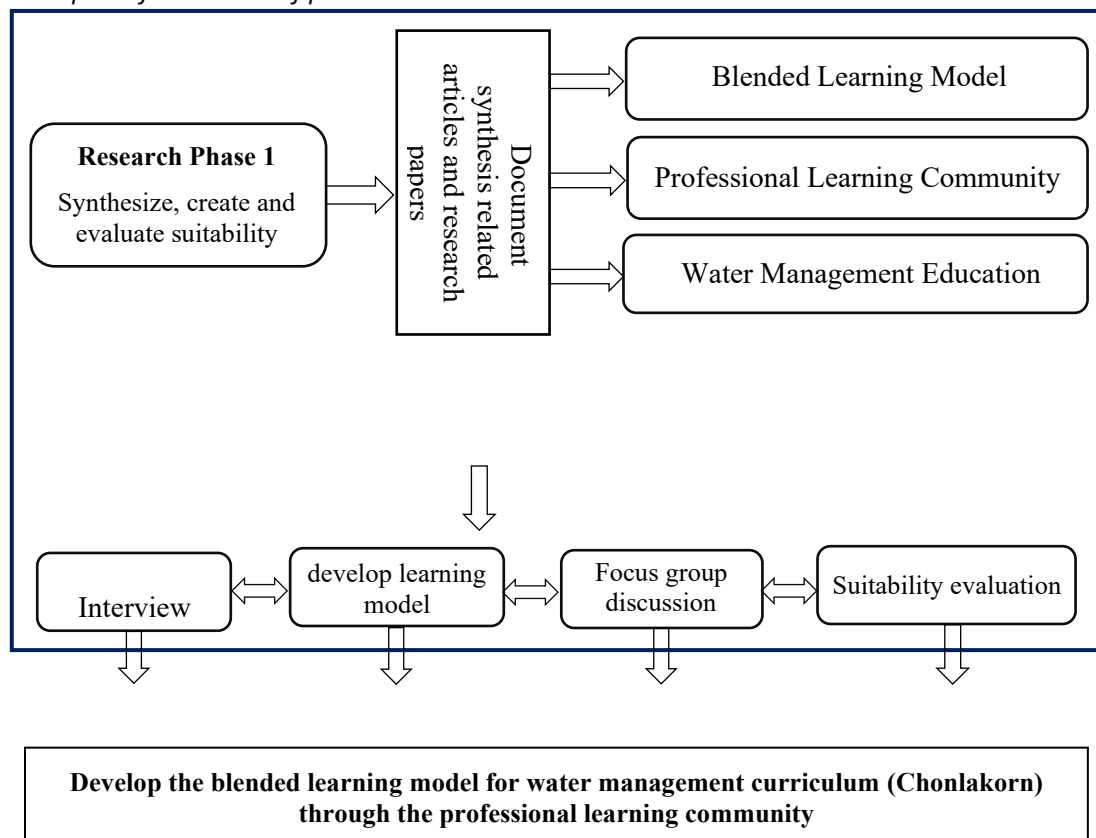
This study aims to develop and evaluate the effectiveness of a blended learning model facilitated by a professional learning community for teachers of the Water Management Curriculum within agricultural and technology colleges.

## 2. METHOD AND MATERIALS

The research methodology involved conducting interviews related to the establishment of a Professional Learning Community (PLC) for blended learning in the water management curriculum at the College of Agriculture and Technology. The objective was to formulate a blended learning model for the water management curriculum through the Professional Learning Community. Subsequently, a group discussion activity was organized to gather suggestions and recommendations from experts, and the developed model's suitability was evaluated. The conceptual framework is depicted in Figure 1.

**Figure 1**

*Conceptual framework of phase 1 research*



## 2.1. Research design

The research adopts a qualitative approach, utilizing interviews to explore the establishment of a Professional Learning Community (PLC) for blended learning in the water management curriculum at the College of Agriculture and Technology. The goal is to formulate a blended learning model tailored to the water management curriculum through the Professional Learning Community.

In the initial phase, the researcher synthesized the relevant principles, concepts, and theories from research documents, books, and various journals, both domestic and international. This involved studying the fundamental information of the target group, comprising educational institutions and teaching personnel, to establish members of the Professional Learning Community (PLC) within the College of Agriculture and Technology. The focus was on promoting learning and participation in water management within the Professional Learning Community, aiming to understand the existing problems, needs, and learning characteristics of students. This understanding, coupled with insights into learning conditions, was instrumental in developing an appropriate blended learning model. The knowledge gained in this phase laid the foundation for the subsequent development of a suitable teaching model for students.

Following the development of the blended learning model for the water management curriculum through the Professional Learning Community for Agriculture and Technology College teachers, the next step involved organizing a focus group activity. This activity aimed to gather recommendations and feedback on the developed learning model from experts, including professionals in water management and education.

## **2.2. Participants**

The individuals who provided information through interviews and offered recommendations and feedback for the developed learning model included the director of ten Colleges of Agriculture and Technology, three water management experts, and two education experts. Their insights contributed to refining and validating the learning model, ensuring it aligns with both disciplinary expertise and educational best practices.

## **2.3. Data collection tools**

The research utilizes qualitative research tools, specifically a semi-structured interview and a suitability evaluation of the blended learning model through the Professional Learning Community (PLC). Each of these research tools is described below:

1) The interview form for establishing a Professional Learning Community (PLC) serves the purpose of studying basic information about the target group and establishing PLC members. The information consists of three parts, detailed as follows:

Part 1: Personal information of interview respondents

Part 2: Information regarding the establishment of a Professional Learning Community for blended learning in water-based management for teachers at the College of Agriculture and Technology.

Part 3: Information related to the learning problem solutions in water-based management within the community through the Professional Learning Community process.

The validity of the interview form was assessed by five experts, resulting in an index of consistency (IOC) between 0.75-1.00, indicating satisfactory validity.

2) The suitability evaluation form of the blended learning model through the PLC is designed to create and develop a learning model. It comprises five measurement levels divided into two parts, as outlined below:

Part 1: Personal information of experts

Part 2: Subject concerning the blended learning model for the water management curriculum through the Professional Learning Community for College of Agriculture and Technology teachers. This part consists of four sections as below:

Section 1: Blended learning component in the Knowledge Understanding aspect (Knowledge Understanding: KU)

Section 2: Blended learning component in the Collaboration learning aspect (Collaboration: C)

Section 3: Blended learning component in the Application aspect (Apply: A)

Section 4: Blended learning component in the Knowledge Transfer (Training: T)



The validity of the evaluation form was assessed by five experts, resulting in an index of consistency (IOC) ranging between 0.60-1.00, indicating satisfactory validity.

## **2.4. Data collection procedure**

### **2.4.1 Interview for Establishing a Professional Learning Community**

The researcher initiated the data collection process by preparing a formal document requesting cooperation from the directors of the Agricultural and Technology Colleges. This document outlined the purpose of the interviews and requested their participation. Subsequently, appointments for individual interviews were scheduled. During these interviews, the researcher provided a comprehensive overview of the questions to be addressed. Information was then obtained from the Colleges of Agriculture and Technology, and the details were recorded and collected as part of the interview process.

### **2.4.2 Focus group discussion**

The data was collected from the interviews, and the criticism was provided by the expert through a focus group discussion held on December 16, 2022, from 9:00 a.m. to 12:00 p.m. The session, spanning three hours, used open-ended questions to facilitate a constructive exchange of ideas. Experts were invited to critique, provide comments, and offer suggestions aimed at enhancing the blended learning model through the Professional Learning Community (BL-PLC Model). The moderator began the focus group session by informing the purpose and providing a comprehensive overview of the discussion's structure, according to a systematic sequence of concepts and issues. Following this introduction, the focus group discussion commenced, with the moderator requesting experts' opinions on specific subjects. Participants were encouraged to express their views, engage in thoughtful discussions, and contribute valuable insights. This interactive process facilitated the collection of information and perspectives from the experts involved.

### **2.4.3 Evaluation of the suitability of the learning model**

In evaluating the suitability of the developed blended learning model for the water management curriculum through the Professional Learning Community for College of Agriculture and Technology teachers, the researcher gathered evaluation data from experts in educational technology and water management education.

## **2.5. Data analysis**

The data collected from the interviews conducted for the establishment of the professional learning community and the subsequent focus group discussions were analyzed through content analysis and synthesis. This process involved summarizing the responses obtained from both the interviews and the focus group discussion activity. Upon the completion of the group discussion process, the moderator summarized the key insights derived from the discussions, presented them to the participants for confirmation, and rechecked the information. Subsequently, the researcher carefully collected, examined, and analyzed the commendations and suggestions obtained from the group discussions.

The model's suitability is assessed utilizing the mean ( $\bar{X}$ ) and standard deviation (SD) as criteria to determine the weight for evaluating its suitability. The rating scale comprises five levels, following Likert guidelines, outlined as follows:

- a) 4.50 – 5.00: Most Suitable
- b) 3.50 – 4.49: Very Suitable
- c) 2.50 – 3.49: Moderately Suitable
- d) 1.50 – 2.49: Less Suitable
- e) 1.00 – 1.49: The Least Suitable

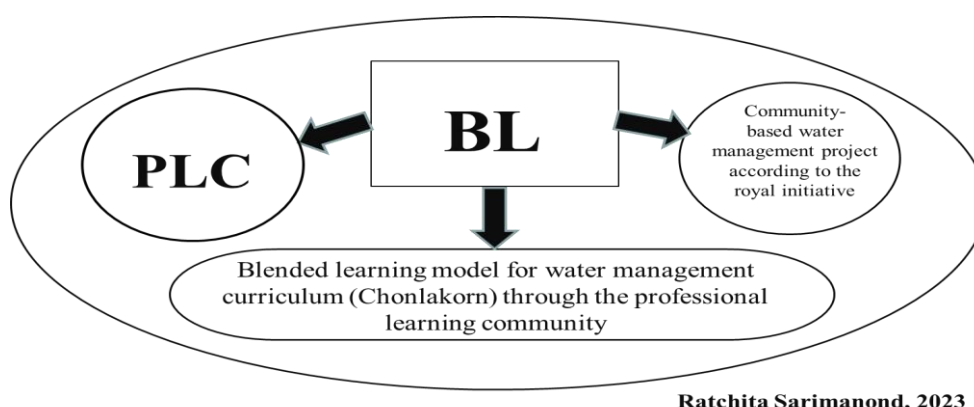
### 3. RESULTS

#### 3.1. Development of a blended learning model for water management curriculum (Chonlakorn) through the professional learning community

The study's outcomes refer to the development of a blended learning model for the water management curriculum through the Professional Learning Community involving three primary components: 1) blended learning, 2) professional learning community, and 3) community-based water management project in alignment with the Royal Initiative (Figure 2).

**Figure 2**

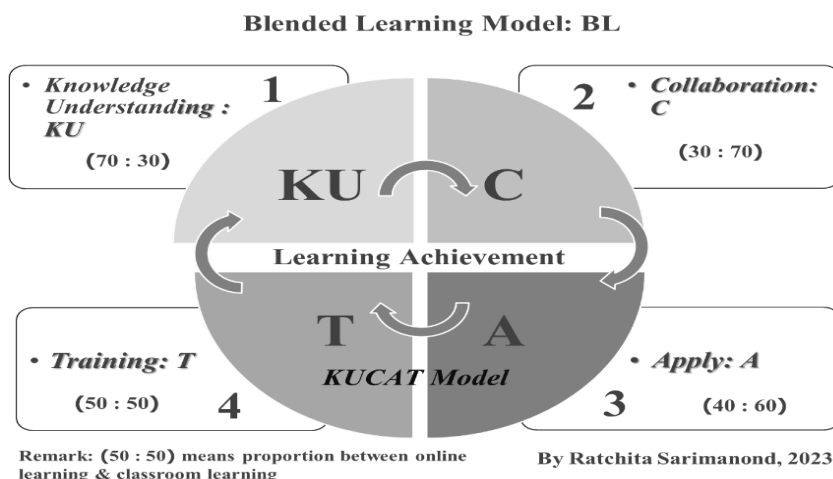
*Components of development of a blended learning model for water management curriculum (Chonlakorn) through the professional learning community*



Based on the obtained results from the study, researchers formulated a blended learning model for water management, which consists of four key blended learning (BL) elements: 1) Knowledge Understanding (KU), 2) Collaborative learning (C), 3) Application (A), and 4) Knowledge transfer (Training: T). This model is designated as the KUCAT Model (Figure 3). Furthermore, based on the interview insights gathered for the establishment of a professional learning community dedicated to community-based water management for College of Agriculture and Technology teachers, the researchers developed a professional learning community learning model. This model comprises four essential elements: 1) Brainstorming (Brainstorm: B), 2) Experiences Exchange (Experience: E), 3) Supporting (Support: S), and 4) Transferring practice methods (Transfer: T). The model is titled the BEST Model (Figure 4).

**Figure 3**

*The blended learning model, "Kucat model"*

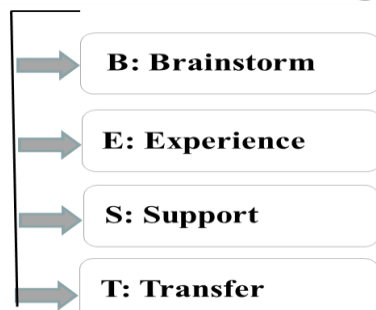




**Figure 4**

*The professional learning community model "best model"*

### Professional Learning Community

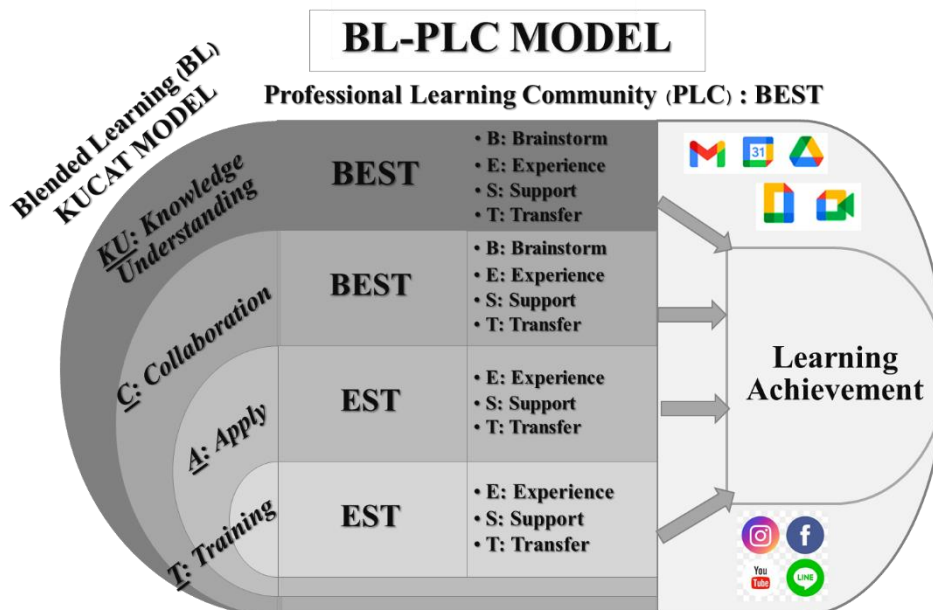


By Ratchita Sarimanond, 2023

When integrating the elements of blended learning (BL) and the professional learning community (PLC), a relationship is established between BL (KUCAT Model) and PLC (BEST Model). This integration gives rise to a blended learning model through a professional learning community (BL-PLC Model), as shown in Figure 5, and is named the "KUCAT-BEST Model." This model is proposed for use in designing and developing the teaching and learning aspects of the water management curriculum in subsequent steps.

**Figure 5**

*Blended learning model through the professional learning community (BL-PLC model)*



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### 3.2. Suitability evaluation of the blended learning model for water management through a professional learning community

The suitability evaluation results of the blended learning model for the water management curriculum through the professional learning community, for the College of Agriculture and Technology teachers, are shown in Table 1.

**Table 1**

*Mean and standard deviation, and the suitability level of the blended learning model for the water management curriculum (Chonlakorn) through the professional learning community*

Components	$\bar{x}$	S	Suitability
Knowledge Understanding: KU & PLC: BEST	4.59	0.39	Most
Collaboration: C & PLC: BEST	4.40	0.44	Very
Apply: A & PLC: EST	4.52	0.53	Most
Training: T & PLC: EST	4.46	0.52	Very
<b>Summary</b>	<b>4.49</b>	<b>0.45</b>	<b>Very</b>

Referring to Table 1, it is evident that the experts agreed that the blended learning model for the water management curriculum through the professional learning community reaches an overall high suitability ( $\bar{x}$  = 4.49, S = 0.45). A detailed examination of each component shows that they were suitable at the highest level. Notably, Knowledge Understanding achieved the highest mean, followed by Application, with Collaborative Learning receiving the lowest rating.

### **3.3 Suggestions/comments on the blended learning model for water management through the professional learning community (from focus group discussion)**

1) Experts express their opinions, noting that the learning model developed in research step 1 is perceived as clear but lacks clarity in terms of application. It is suggested to consider crafting a learning plan that can be practically implemented in real situations, incorporating various social media platforms for enhanced practicality.

2) When designing blended learning management, careful consideration should be given to determining the proportion of online learning activities versus classroom learning. Additionally, the allocation of percentages for academic (Knowledge) and practical (Technical) activities should be precisely defined for an optimal learning experience.?

3) Regarding each component of the Professional Learning Community (PLC), it is recommended that the researcher explore deeper into determining the tools and models suitable for both classroom and online learning environments.

4) The researcher is encouraged to include contemporary educational keywords in the study, including but not limited to hard skills, soft skills, mindset, etc., to enhance the modern relevance of the research.

5) When planning data collection using the researcher's learning plan, careful consideration should be given to ensuring alignment with the teaching plan of the Chonlakorn curriculum in each college and respective semesters. This alignment is crucial for collecting data towards the specified goals.

## **4. DISCUSSIONS**

The development and evaluation of the blended learning (BL) model for the water management curriculum within the professional learning community (PLC) of Agriculture and Technology College teachers demonstrated both practical and theoretical significance. The model integrates four core BL elements: Knowledge Understanding (KU), Collaborative Learning (C), Application (A), and Knowledge Transferring (T), with four PLC components: Brainstorming (B), Exchanging Experiences (E), Supporting (S), and Transfer of Practice Methods (T). The convergence of these two frameworks aims to support teachers in assimilating new water management content while simultaneously fostering collaborative professional growth.

The overall high suitability rating of the model ( $\bar{x}$  = 4.49, S = 0.45) aligns with previous literature emphasizing the effectiveness of blended learning in enabling flexible, learner-centered experiences. As Graham (2012) and Saengrith et al. (2022) highlighted, BL promotes both direct instruction and self-directed learning, allowing learners to control time, pace, and learning pathways. In this study, teachers were able to

access content online at their convenience while engaging in collaborative activities, reflecting this flexibility and reinforcing the blended nature of knowledge acquisition.

Similarly, the integration of the PLC components mirrors findings from Hord (2009) and Sergiovanni (1999), which underscore that professional learning communities reduce teacher isolation, foster collaboration, and enhance teaching effectiveness. In the present study, the PLC facilitated brainstorming, experience exchange, and guided practice, which enabled teachers to collectively navigate the challenges of implementing a novel curriculum in water management. This approach resonates with DuFour's (2004) principles of PLCs, which emphasize collaborative problem-solving, shared responsibility, and a focus on student outcomes, thereby demonstrating corroboration between the present findings and established literature.

Despite these consistencies, notable differences emerge in the prioritization of BL components. Knowledge Understanding (KU) was rated highest, whereas Collaborative Learning (C) ranked lowest. This contrasts with some prior studies on BL in vocational or higher education, which often emphasize collaborative learning as a central benefit of blended approaches (Chachiyo et al., 2020; Horn & Staker, 2011). The divergence can be attributed to the novelty of the water management curriculum for vocational teachers, many of whom have diverse academic backgrounds unrelated to water management. Consequently, foundational knowledge acquisition was emphasized by experts as a prerequisite before meaningful collaboration could occur. This finding highlights an important contextual distinction: the sequence of BL components may require adaptation depending on the novelty and complexity of subject matter.

Furthermore, the model's emphasis on the application and transfer of knowledge aligns with experiential learning principles and community-based education initiatives in Thailand (Sarimanond & Viriyavejakul, 2021). The model not only facilitated theoretical comprehension but also ensured that teachers could implement knowledge in local community contexts, bridging the gap between vocational training and societal impact. This extends previous findings on blended learning by demonstrating its potential to support community-oriented professional practices, an aspect less commonly addressed in standard BL studies.

Finally, the structured support provided by the PLC, through mentoring, shared experiences, and practice transfer, reinforces the critical role of institutional and peer support in BL adoption, echoing Hord's (1997) findings on improved teacher motivation and instructional quality in PLC settings. The present study thus contributes a nuanced perspective on how blended learning can be tailored to vocational contexts where subject novelty and practical application intersect, emphasizing the importance of sequential integration of knowledge, application, and collaborative elements.

In conclusion, the study corroborates prior literature on the flexibility, adaptability, and collaborative benefits of blended learning and professional learning communities while highlighting context-specific distinctions in component prioritization due to curriculum novelty. The findings underscore the need for pedagogical strategies that integrate foundational knowledge acquisition with collaborative and applied practices, particularly in vocational education settings, addressing emerging societal needs, such as community-based water management.

## 5. CONCLUSION

The present study successfully developed and evaluated a blended learning (BL) model for the water management curriculum within the professional learning community (PLC) of Agriculture and Technology College teachers. The model effectively integrates four BL components: Knowledge Understanding, Collaborative Learning, Application, and Knowledge Transferring, with four PLC elements: Brainstorming, Exchanging Experiences, Supporting, and Transfer of Practice Methods. Experts rated the model as highly suitable overall ( $\bar{x} = 4.49$ ,  $S = 0.45$ ), with particular emphasis on the importance of foundational knowledge acquisition, reflecting the novelty of water management as a vocational subject.

The study demonstrates that combining blended learning with a professional learning community enhances both teacher knowledge and collaborative capacity. Teachers can access learning materials flexibly,

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engage in peer-supported problem-solving, and apply theoretical concepts to community-based water management practices. These findings align with previous literature on blended learning and PLCs while highlighting context-specific adaptations necessary for introducing novel content in vocational education settings.

In summary, the BL model developed in this study offers a robust framework for enhancing vocational education in water management. It provides a practical approach for teacher development, supports community-oriented learning applications, and lays a foundation for broader adoption of innovative water management curricula across agricultural and technology colleges in Thailand. Future research may explore the long-term impacts of this model on student outcomes and community water management practices.

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**Ethical Approval:** The study adheres to the ethical guidelines for conducting research.

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