The Development of Virtual Professional Learning Community Platform with Experiential Design Thinking Process to Enhance Digital Teacher Competency

Surasak Srisawat and Panita Wannapiroon

Abstract—**In an era of digital transformation, technology has a strong influence on educational organizations. It is a huge challenge for teachers to deal with digital technology. A professional learning community platform integrated with technology is a powerful tool that can improve the digital competency of teachers to manage that challenge. The purpose of this research is to 1) develop a virtual professional learning community platform (VPLC platform) based on an experiential design thinking process, 2) to develop a training course for building digital teacher competency using an experiential design thinking process, and 3) to assess the digital competency of teachers using the VPLC platform in conjunction with the experiential design thinking process. Thirty teachers were selected by multi-stage sampling. The architectures used were the VPLC platform, the experiential design thinking process, and digital teacher competency. The research instrument was a digital competency assessment form for teachers with regard to the VPLC platform and an experiential design thinking process to enhance digital teacher competency. The findings revealed that 1) the VPLC platform model consisted of three components: 1) the VPLC platform, 2) the experiential design thinking process, and 3) digital teacher competency, brought together in four modules: 1) User management module, 2) Content management module, 3) Learner management module, and 4) Analytics management module and five processes: 1) Empathize the Concrete experience, 2) Define the Problem and Reflective observation, 3) Ideate the Abstract conceptualization, 4) Prototype, and 5) Test and Evolution and Active experimentation. The overall result of the quality of a training course in building digital teacher competency with an experiential design thinking process was at the highest quality value (Mean= 4.90, S.D.= 0.31). 3) The overall resulting digital competency of teachers was at the highest level (Mean= 4.80, S.D.= 0.40).**

Index Terms—**Design thinking, digital teacher competency, experiential learning, virtual professional learning community (VPLC).**

I. Introduction

The trend towards digital transformation has had a strong influence and has caused change in all sectors. As a result, the learning process has rapidly transformed from a traditional classroom environment to the inclusion of more digital technologies via online learning. The widespread adoption of digital devices, applications, and learning platforms makes digital teacher competence and skills increasingly important. Thailand realizes the importance of the development of digital technology and digital skills. Thailand's Digital Government Development Plan A.D. 2020-2022 is now established. It focuses on developing new attitudes, digital competencies and skills on the part of individuals to prepare them for supporting digital technology and innovation advancement in the future [1]. As part of the Ministry of Education's Strategic Action Plan 2020-2022, the Ministry identifies the need for strategic planning to develop teachers and educational personnel with proficiency in terms of professional standards and increased digital competency [2]. This is consistent with the duties of the Office of the Basic Education Commission which established a digital competency level for teachers and educational personnel when it came to organizing groups and improving digital competency to a more advanced level, and supporting the increasing adoption of digital technology in education management. Digital teacher competency also relates to their ability to apply digital technologies to improve teaching. It includes professional interactions with learners, colleagues, and the educational community [3]. However, the need to facilitate learning in a digital environment and make use of digital devices presents a challenge for teachers in terms of their digital competency in professional learning management [4]. In addition, learning platforms are an essential aspect of the technology being increasingly used in teaching and learning. They can encourage students to learn and improve time management skills. Furthermore, it creates relationships that make learning more enjoyable [5] and provides an opportunity to share resources and a variety of teaching and learning experiences between students and teachers. Eventually, it supports and motivates learners to learn independently [6]. This is because there is flexibility when it comes to choosing the time and workload. Such flexibility allows learners to feel less dependent on their schedules or teachers [7].

Therefore, because of the importance of these issues, a VPLC platform based on the experiential design thinking process is a useful tool to enhance digital teacher competency. It is also advantageous to develop the associated teacher skills. In addition, such a platform supports the adoption of digital technology to create a learning community and assists learning management that reduces problems or constraints in terms of location and time. This is because the VPLC platform could manage flexibility in time and place for cooperation and the exchange of knowledge [8].

Manuscript received May 11, 2022; revised June 27, 2022.

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doi: 10.18178/ijiet.2022.12.12.1753

II. Purpose

1) Develop a VPLC platform with an experiential design thinking process.
2) Develop a training course to building digital teacher competency with an experiential design thinking process.
3) Evaluate the digital teacher competency of teachers using a VPLC platform with an experiential design thinking process.

III. Scope of Research

1) The population consists of primary school teachers under the Office of the Basic Education Commission, Ministry of Education.
2) The sample consists of 30 primary school teachers under the Office of the Basic Education Commission, Ministry of Education chosen by multi-stage sampling from five regions of Thailand.
3) The independent variable is the development of teachers using a VPLC platform with an experiential design thinking process and the dependent variable is digital teacher competency.
4) The period for collecting data is four weeks and the content of this research is a digital teacher competency training course - "NEXT Normal Innovative & Digital Teacher Reimagine".
5) The conceptual framework of the VPLC platform with an experiential design thinking process has been synthesized by several researchers. See Fig. 1.

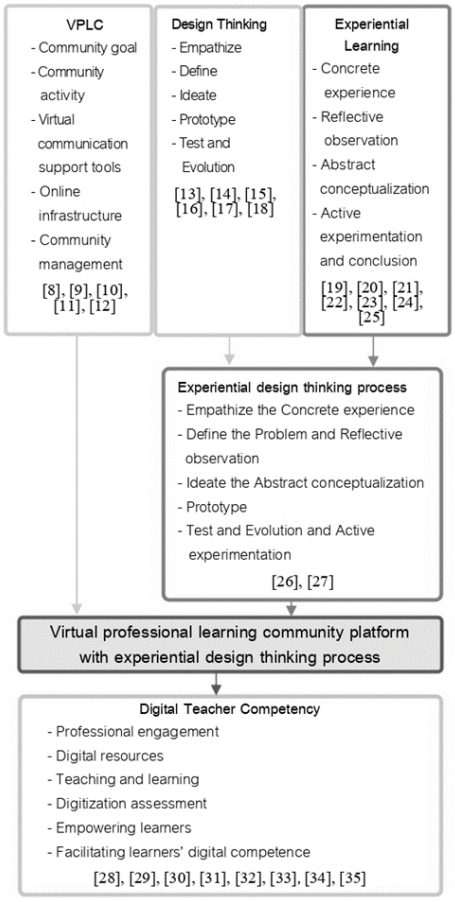

Fig. 1. Conceptual framework.

IV. Literature Review

A. Learning Platform

A learning platform refers to applications, software, web technologies, integrated interactive online services, or application packages. The platforms have been developed for use through a website on an internet network. They are used to plan, implement, and evaluate specific learning processes. As part of this, teachers design methods to create and present content, check students' participation and assess student performance. Students can also use interactive features such as dialogue, video conferencing, and group discussion [36], [37]. The features are flexible, easy to use, accessible, user-friendly, integrated with other systems, and able to evaluate capabilities [7]. The components of the learning platform can consist of user-friendly: both asynchronous and synchronous communication using email or discussion forums, construction of course content: various learning resources, curriculum connection: the initial planning of the content from the enrollment of the learner to the student's activities and online tracking, learner engagement tools: the use of interactive content and multimedia, and learner communication and assessment tools: the use of online multiple-choice questions or collaborative tasks [6]. In addition, the learning platform can also consist of blended learning, virtual classrooms, language diversity, course management, content management, course evaluation, test or task, ready-to-use multimedia, graphs and charts, authentication systems, user access control, registration management, and reporting systems [38].

B. Virtual Professional Learning Community (VPLC)

A VPLC is a group of people with similar interests and goals in terms of learning together through using digital materials and technology and facilitating collaborative learning involving clear objectives to improve performance. These reduce time constraints and improve safety or other factors. A VPLC enhances a community of knowledge sharing, learning management processes, a sense of connection, practices, skills, and new conceptual techniques. It also develops teacher self-efficacy and improves learners' efficiency [10], [11]. The VPLC is also an independent group sharing values, goals and interests to build knowledge using online media, computer-mediated communication and global resources through conversation, interaction and collaboration [9]. The VPLC components are community goals, community activities, virtual communication support tools, online infrastructure, and community management [12].

C. Design Thinking

Design thinking involves thinking to develop new and innovative ideas and solve problems. The purpose is to find solutions that focus on the user's perspective when it comes to providing solutions or introducing innovations that meet the user's needs and circumstances. It is a thinking process that promotes a deep understanding of a problem, and which brings about a consideration of different perspectives and creativity on the part of individuals to generate ideas. Moreover, it uses different approaches to improve and test a particular solution or innovation that meets the user's needs.

Furthermore, it is a way to understand problems and propose innovative solutions. It also offers a systematic perspective to help the individual to perceive the nature of a problem. In addition, it offers solutions that relate to the user's needs [13]. It is also a creative process to solve unclear problems requiring participants to design, think and create prototypes for testing. Design thinking consists of five steps: empathize, define, ideate, prototype, and test [15].

D. Experiential Learning

Experiential learning refers to the learning process associated with understanding new information and changing perceptions based on experience [25]. It is a process of transferring experience into knowledge. People have concrete experiences because of their natural interactions with others and with the environment. They reflect on these experiences in different ways, and these experiences play a guiding role in later learning [20]. Experiential learning is a continual process. Learners bring their learning experiences into their learning environment. The knowledge acquired through the transformation of concrete experiences might form new abstract experiences and applications. This process causes a changed level of behavior, attitude, and cognition on the part of the learner. In addition, it also provides opportunities to apply knowledge gained in real-life situations by simulating proper behaviors and procedures [24]. Experiential learning can be categorized into four steps: concrete experience – participation in specific situations, observing and immersing in an experience or a new situation, reflective observation – reflection on the idea, understanding the significance of experience through observation, thinking, discussing with friends and accepting suggestions, abstract conceptualization – advanced thinking skills to find a deeper understanding of the explicit knowledge and summarizing principles to come up with guidelines for self-application, and active experimentation – applying new knowledge to real-life situations to test or prove the theory [24], [39].

E. Digital Teacher Competency

Digital teacher competency refers to the sets of knowledge, skills, abilities, and attitudes on the part of teachers when it comes to using technology and digital media to support creative, effective, and awareness instruction to achieve objectives and goals aimed at promoting the development of learners' digital competencies. Moreover, it includes self-improvement, creativity, using, innovation, and the quality of life. It relates to instruction as well as to the ability to use tools and technologies, communication, and coordination, problem-solving, information management, cooperation, creation, and content sharing, and accumulating knowledge efficiently, appropriately, ethically, and reflectively for working, learning and communication [4], [40]. The Office of the Basic Education Commission specifies three digital competency levels for teachers: Basic digital competency, Intermediate digital competency, and Advanced digital competency. In addition, the European Framework for the Digital Competence of Educators defines six digital competency levels for educators: newcomer, explorer, integrator, expert, leader, and pioneer [28].

V. Research Methodology

For research purposes, the research methodology consists of three phases as follows:

A. Phase 1

The development of a VPLC platform based on the experiential design thinking process by analyzing and synthesizing 25 articles describing research related to digital teacher competency, the design thinking process, the experiential learning process, and the experiential design thinking process published in international journals and databases from 2019 to 2021. This includes the following six steps:

Step 1. Synthesize the digital teacher competency

Step 2. Synthesize the design thinking process

Step 3. Synthesize the experiential learning process

Step 4. Synthesize the experiential design thinking process

Step 5. Develop the VPLC platform based on the experiential design thinking process to enhance digital teacher competency as follows:

1) Study, analyze, and synthesize concepts, research, and the literature related to the meaning, components, and details of the learning platform, the virtual professional learning community, design thinking, experiential learning, and digital teacher competency.
2) Design a draft version of the VPLC platform based on the experiential design thinking process in order to enhance digital teacher competency by making use of Microsoft Community Training software. The platform model consists of three main components: the VPLC platform, the experiential design thinking process, and digital teacher competency, brought together in four modules: user management, content management, learner management, and analytics management. Each module has sub-functions.
3) Propose the model to an advisor giving recommendations and revising in order to obtain recommendations for revision purposes.

Step 6. Use 10 experts to evaluate the appropriateness of the VPLC platform based on the experiential design thinking process to enhance digital teacher competency. These experts will be divided into groups: seven Technical and Technology specialists in digital technology, computer and educational technology with at least five years' experience, and three Content specialists with at least five years of teaching experience using an assessment form that uses a 5-point Likert scale. The assessment form consists of three main components and 15 elements of the VPLC platform, the experiential design thinking process, and digital teacher competency. Standard deviation (S.D.) and average values will be used to analyze the results. The revised VPLC platform is then applied in a training course to build digital teacher competency.

B. Phase 2

An evaluation of the quality of a training course to build digital teacher competency based on the experiential design thinking process consists of three steps as follows:

Step 1. Develop a training course to build digital teacher competency based on the experiential design thinking

process. The course outline consists of seven parts: objectives, contents, period, process, resources and platform, evaluation, and target group. The content of the course includes six main topics based on digital teacher competency: professional engagement, digital resources, teaching and learning, digitization assessment, empowering learners, and facilitating learners' digital competence.

Step 2. Design a training course assessment form concerning the quality of the training course in terms of building digital teacher competency. This consists of measuring seven aspects using a 5-point Likert scale and applying standard deviation (S.D.) and average values to analyze the results.

Step 3. Evaluate the quality of the training course with the help of the 10 experts divided into groups: Technical and Technology specialists and Content specialists using the course assessment form. The results will be used to improve the effectiveness of the training course.

C. Phase 3

An evaluation of the digital competency of teachers using the VPLC platform based on the experiential design thinking process which consists of the following three steps:

Step 1. Design a digital teacher competency assessment form for teachers using the VPLC platform based on the experiential design thinking process which consists of six components of digital teacher competency using a 5-point Likert scale.

Step 2. Evaluate the appropriateness of the assessment form with the help of the 10 experts. This stage investigates the validity of the connection between items and objectives by using the Index of Item-Objective Congruence (IOC) to improve the assessment form for greater efficiency. The evaluation criteria are divided into six areas according to the components of digital teacher competency. The result of the IOC values is in the range of 0.8-1.

Step 3. Provide a training course to build digital teacher competency by using the VPLC platform integrated with experiential design thinking process. This is where the VPLC platform is used by 30 teachers who attended the training course and trainers. The revised assessment form is used with 30 teachers for pre-test and post-test assessment purposes to compare the digital teacher competency before and after the course using the VPLC platform based on experiential design thinking process.

VI. Findings

A. Phase 1: The Development of a VPLC Platform with Experiential Design Thinking Process

1) The synthesis of digital teacher competency from documents and research related to digital teacher competency in international journals and databases by several researchers. It consists of six components as shown in Table I.

The Table I shows that digital teacher competency consists of 6 components: professional engagement, digital resources, teaching and learning, digitization assessment, empowering learners, and facilitating learners' digital competence.

2) The synthesis of design thinking process from relevant documents and research in international journals and databases by several researchers. It consists of five steps as shown in Table II.

The Table II shows that design thinking process consists of five steps: empathize, define, ideate, prototype, test and evolution.

TABLE I: Synthesis of Digital Teacher Competency

Digital Teacher Competency	Darazha et al. [4]	Ghomi & Redecker [28]	Rubach & Lazarides [29]	Lucas et al. [30]	S ánchez-Prieto et al [31]	Wild & Schulze Heuling [32]	Reisoğlu [33]	Caena & Redecker [34]	Roll & Ifenthaler [35]
Professional Engagement	✓	✓	✓	✓	✓	✓	✓	✓	✓
Digital Resources	✓	✓	✓	✓	✓	✓	✓	✓	✓
Teaching and Learning	✓	✓	✓	✓	✓	✓		✓	✓
Digitization Assessment	✓	✓	✓	✓	✓	✓	✓	✓	
Empowering Learners	✓	✓	✓	✓	✓	✓	✓	✓	
Facilitating Learners' Digital Competence	✓	✓	✓	✓	✓	✓	✓	✓	✓

TABLE II: Synthesis of Design Thinking Process

Design Thinking Process	Naghshbandi [13]	Kelley & Brown [14]	Shahrasbi et al. [15]	Balakrishnan et al. [16]	Severino et al. [17],	Cleminson & Cowie [18]
Empathize	✓	✓	✓	✓	✓	✓
Define	✓	✓	✓	✓	✓	✓
Ideate	✓	✓	✓	✓	✓	✓
Prototype	✓	✓	✓	✓		✓
Test and Evolution	✓	✓	✓	✓	✓	✓

3) The synthesis of the experiential learning process from relevant documents and research in international journals and databases by several researchers. It consists of four steps as shown in Table III.

TABLE III: Synthesis of Experiential Learning Process

Experiential Learning Process	Brahmawong [19]	Evin Gencel et al. [20]	Idris et al. [21]	Sathe & Yu [22]	Hsiao et al. [23]	Villarroel et al. [24]	Mc Pherson-Geyser et al. [25]	Li [39]
Concrete experience	✓	✓	✓	✓	✓	✓	✓	✓
Coping experience	✓	✓	✓	✓	✓	✓	✓	✓
Reflective observation	✓	✓	✓	✓	✓	✓	✓	✓
Reflect experience	✓	✓	✓	✓	✓	✓	✓	✓
Abstract conceptualization	✓	✓	✓	✓	✓	✓	✓	✓
Conceptualization	✓	✓	✓	✓	✓	✓	✓	✓
Active experimentation	✓	✓	✓	✓	✓	✓	✓	✓
Making conclusion	✓	✓	✓	✓	✓	✓	✓	✓

Table III indicates that the experiential learning process consists of concrete experience, reflective observation, abstract conceptualization, and active experimentation and conclusion.

TABLE IV: SYNTHESIS OF EXPERIENTIAL DESIGN THINKING PROCESS

Design Thinking Process [13], [14], [15], [16], [17], [18]	**Experiential Learning Process** [19], [20], [21], [22], [23], [24] [25], [39]	**Experiential Design Thinking Process** [26], [27]
1. Empathize	1. Concrete experience	1. Empathize Concrete experience
1.1 Observing		1.1 Observe
1.2 Engaging (interviewing) and empathizing with people	1.1 Engaging in a learning activity	1.2 Engage and empathize with people in a learning activity
1.3 Immersing in the physical environment		1.3 Immerse in the physical environment
2. Define	2. Reflective observation	2. Define and Reflective Observation
2.1 Analyze and synthesize	2.1 Reviewing what occurred during the activity	2.1 Analyze and synthesize and review what happened during the activity
2.2 End up with a human-centered problem statement	2.2 Reflect experience from multiple perspectives and factors	2.2 Reflect on experience and summarize with a human-centered problem statement
3. Ideate	3. Abstract conceptualization	3. Ideate and abstract conceptualization
3.1 Brainstorm and come up with creative solutions	3.1 Integrate the experience	3.1 Brainstorm and integrate the experience and come up with creative solutions
3.2 Identify new solutions (think outside the box)	3.2 Concluding	3.2 Summarize and identify new solutions
4. Prototype		4. Prototype
4.1 Share and test		4.1 Share and test
4.2 Build a solution		4.2 Create a solution
4.3 Identify the best solution		4.3 Identify the best solution
5. Test and Evolution	4. Active experimentation	5. Test and evolution and active experimentation
5.1 Redefine	4.1 Planning	5.1 Redefine and plan
	4.2 Formulate a hypothesis	5.2 Hypothesize
5.2 Understanding the user (user feedback)	4.3 Action out by making decisions and solving problems	5.3 Understand the user and act with decision-making and problem-solving

4) The synthesis of the experiential design thinking process from relevant documents and research in international journals and databases by several researchers. It consists of five processes as shown in Table IV.

Table IV shows the experiential design thinking process. There are five processes with details as follows.

Process a.) Empathize the Concrete experience has three steps: observe, engage, and empathize with people in a learning activity, and immerse in the physical environment.

Process b.) Define the Problem and Reflective observation has two steps: analyze, synthesize, and review what happened during the activity, and reflect on experiences and summarize with human-centered problem statement.

Process c.) Ideate the Abstract conceptualization has two steps: brainstorm and integrate the experience and come up with creative solutions, and summarize and identify new solutions.

Process d.) Prototype has three steps: share and test, create a solution, and identify the best solution.

Process e.) Test and Evolution and Active experimentation has three steps: redefine and plan, hypothesize, and understand the user and act with decision-making and problem-solving.

5) The development of the VPLC platform based on the experiential design thinking process to enhance digital teacher competency.

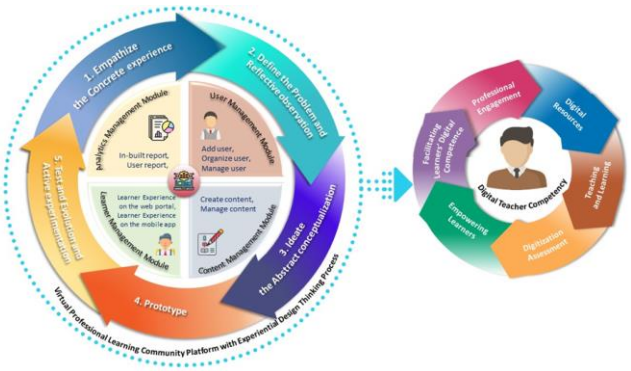

Fig. 2. VPLC platform with an experiential design thinking process to enhance digital teacher competency.

Fig. 2 shows the platform of VPLC with an experiential design thinking process to enhance digital teacher competency representing components as follows:

a) The VPLC platform consists of four modules: User Management Module, Content Management Module, Learner Management Module, and Analytics Management Module.

i) User Management Module consists of three functions: add users, organize users, and manage user.

ii) Content Management Module consists of two functions: create content and manage content.

iii) Learner Management Module consists of two functions: learner experience on the web portal and learner experience on the mobile app.

iv) Analytics Management Module consists of two functions: in-built report and user report.

The data is stored in a cloud database system.

b) An experiential design thinking process is the process of building knowledge, skills, attitudes, and problem-solving that integrates prior experiences to create creative innovation or new learning styles consists of the following five steps:

i) Empathize the Concrete experience

ii) Define the Problem and Reflective observation

iii) Ideate the Abstract conceptualization

iv) Prototype

v) Test and Evolution and Active experimentation

Fig. 3 shows the five steps of the experiential design thinking process as follows:

Step 1. Empathize the Concrete experience consists of observing, engaging, and empathizing with people in the learning activity and immersing in the physical environment.

Step 2. Define the Problem and Reflective observation consists of analyzing and synthesizing and reviewing what happened during the activity and reflecting on the experience and summarizing with human-centered problem statement.

Step 3. Ideate the Abstract conceptualization consists of brainstorming and integrating the experience and coming up with creative solutions, and summarizing and identifying new solutions.

Step 4. Prototype consists of sharing and testing, creating a solution, and identifying the best solution.

Step 5. Test and Evolution and Active experimentation consist of redefining and planning, hypothesizing and understanding the user and acting with decision-making and problem-solving.

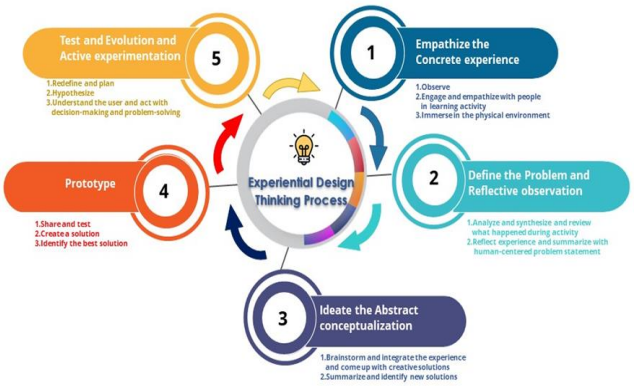

Fig. 3. The experiential design thinking process.

6) Evaluate the appropriateness of the VPLC platform with an experiential design thinking process to enhance digital teacher competency.

TABLE V: APPROPRIATENESS EVALUATION OF VPLC PLATFORM WITH EXPERIENTIAL DESIGN THINKING PROCESS TO ENHANCE DIGITAL TEACHER COMPETENCY

Components	*Mean*	*S.D.*	Description
VPLC platform	**4.93**	**0.27**	**Highest**
User Management Module	4.80	0.42	Highest
Content Management Module	5.00	0.00	Highest
Learner Management Module	5.00	0.00	Highest
Analytics Management Module	4.90	0.32	Highest
Experiential Design Thinking Process	**4.82**	**0.39**	**Highest**
Empathize the Concrete experience	4.90	0.32	Highest
Define the Problem and Reflective observation	4.80	0.42	Highest
Ideate the Abstract conceptualization	4.80	0.42	Highest
Prototype	4.80	0.42	Highest
Test and Evolution and Active experimentation	4.80	0.42	Highest
Digital Teacher Competency	**4.90**	**0.30**	**Highest**
Professional Engagement	4.90	0.32	Highest
Digital Resources	4.90	0.32	Highest
Teaching and Learning	5.00	0.00	Highest
Digitization Assessment	4.90	0.32	Highest
Empowering Learners	4.80	0.42	Highest
Facilitating Learners' Digital Competence	4.90	0.32	Highest
Overall	**4.88**	**0.33**	**Highest**

Table V indicates the appropriateness of the VPLC platform with experiential design thinking process to enhance digital teacher competency. The specialists commented that the appropriateness overall had the highest value (Mean= 4.88, S.D.= 0.33). When considering each component, the VPLC platform had the highest appropriateness value (Mean= 4.93, S.D.= 0.27), followed by digital teacher competency (Mean= 4.90, S.D.= 0.30), and experiential design thinking process (Mean= 4.82, S.D.= 0.39).

B. Phase 2: The Evaluation of the Quality of a Training Course for Building Digital Teacher Competency with Experiential Design Thinking Process

TABLE VI: QUALITY EVALUATION REGARDING A TRAINING COURSE OF BUILDING DIGITAL TEACHER COMPETENCY WITH EXPERIENTIAL DESIGN THINKING PROCESS

	Components	*Mean*	*S.D.*	Description
1	The objectives of the training course are to develop digital teacher competency in 6 areas	4.93	0.26	Highest
2	The content of the training course consists of 6 lessons.	4.94	0.23	Highest
3	The duration of the training course is 14 hours.	4.56	0.73	Highest
4	The training course process through the experiential design thinking process	4.95	0.22	Highest
5	Resources and learning platform	4.79	0.41	Highest
6	Measurement and evaluation through TPACK lesson plan	5.00	0.00	Highest
7	The sample consists of thirty primary school teachers under the Office of the Basic Education Commission, Ministry of Education chosen by multi-stage sampling from teachers in 5 regions of Thailand	5.00	0.00	Highest
	Overall	**4.90**	**0.31**	**Highest**

As shown in Table VI, the quality of a training course in building digital teacher competency with experiential design thinking process. The specialists commented that the quality overall had the highest value (Mean= 4.90, S.D.= 0.31). When considering each component, the measurement and evaluation through TPACK lesson plan and the sample had the highest quality value (Mean= 5.00, S.D.= 0.00), followed by the training course process through the experiential design thinking process (Mean= 4.95, S.D.= 0.22, and the contents of the training course (Mean= 4.94, S.D.= 0.23).

C. Phase 3: The Evaluation of the Digital Teacher Competency of Teachers Using a VPLC Platform with Experiential Design Thinking Process

TABLE VII: COMPARISON OF THE PRE-EXPERIENCE AND POST-EXPERIENCE OF DIGITAL TEACHER COMPETENCY USING VPLC PLATFORM WITH EXPERIENTIAL DESIGN THINKING PROCESS

Digital Teacher Competency	Posttest		Pretest		Development
	Mean	*S.D.*	*Mean*	*S.D.*	
Digitization Assessment	**4.76**	**0.43**	**3.23**	**0.61**	**1.53**
Assessment strategies	4.74	0.44	3.23	0.62	1.51
Analyzing evidence	4.74	0.44	3.19	0.60	1.55
Feedback and planning	4.81	0.40	3.26	0.63	1.55
Digital Resources	**4.80**	**0.41**	**3.29**	**0.54**	**1.51**
Selecting digital resources	4.77	0.43	3.32	0.60	1.45
Creating and modifying	4.81	0.40	3.23	0.50	1.58
Managing, protecting, and sharing	4.81	0.40	3.32	0.54	1.49
Teaching and Learning	**4.82**	**0.39**	**3.33**	**0.52**	**1.49**
Teaching and Guidance	4.81	0.40	3.29	0.53	1.52
Collaborative learning	4.81	0.40	3.32	0.54	1.49
Self-regulated learning	4.84	0.37	3.39	0.50	1.45
Facilitating Learners' Digital Competence	**4.80**	**0.42**	**3.35**	**0.52**	**1.45**
Instructional design and learning experiential design	4.77	0.43	3.35	0.49	1.42
Communication and	4.84	0.37	3.35	0.49	1.49

collaboration					
Digital content creation	4.84	0.37	3.32	0.54	1.52
Safety and security	4.84	0.37	3.39	0.56	1.45
Problem-solving	4.71	0.53	3.35	0.55	1.36
Professional Engagement	**4.82**	**0.39**	**3.38**	**0.57**	**1.44**
Organizational communication	4.77	0.43	3.39	0.56	1.38
Professional collaboration	4.90	0.30	3.39	0.62	1.51
Digital continuous professional development	4.77	0.43	3.35	0.55	1.42
Empowering Learners	**4.82**	**0.39**	**3.39**	**0.55**	**1.43**
Accessibility and inclusion	4.81	0.40	3.32	0.54	1.49
Differentiation and personalization	4.77	0.43	3.35	0.55	1.42
Actively engaging learners	4.87	0.34	3.48	0.57	1.39
Overall	**4.80**	**0.40**	**3.33**	**0.55**	**1.47**

Table VII indicates the comparison of pre-test and post-test of digital teacher competency using the VPLC platform with an experiential design thinking process. The overall comparison had a different development value (Mean= 1.47). When considering competency, digitization assessment had the highest different development value (Mean= 1.53), followed by digital resources (Mean= 1.51) and teaching and learning (Mean= 1.49). The result gives support to the research hypothesis.

VII. Conclusion and Discussion

Developing a VPLC platform based on an experiential design thinking process involves the adoption of an experiential design thinking process that the researcher has synthesized to develop digital competency on the part of the teacher and has used the platform in the training course. The experiential design thinking process consists of five steps: empathize the concrete experience, define the problem and reflective observation, ideate the abstract conceptualization, prototype, and test and evolution and active experimentation. This is consistent with the work of [26] who researched a conceptual framework for an experiential design thinking learning model. The researcher developed the experiential design thinking model that used the elements mentioned. In addition, [27] designed learning activities for experiential learning in a design thinking course. They applied experiential learning and design thinking in various learning activities that used similar elements to those mentioned above.

Evaluating the appropriateness of a virtual learning community platform based on the experiential design thinking process to enhance digital teacher competency approved by the specialists, indicated that overall it had the highest value in terms of appropriateness. When implementing the VPLC platform to develop digital teacher competency, it was identified that teachers who used this platform displayed digital teacher competency at the highest level. The research findings revealed that the VPLC platform based on the experiential design thinking process could be used to develop digital teacher competency. This is consistent with the work of [41] who researched understanding informal learning in virtual professional communities on the part of teachers in Kazakhstan. The research indicated that virtual professional communities are an area for generating useful informal learning because of the opportunity to obtain knowledge, and to share information related to the teaching profession or for professional development.

VIII. Recommendations and Suggestions

Based on the research findings of the development of virtual professional learning community platform with an experiential design thinking process to enhance digital teacher competency, the following is suggested:

1) To use a virtual professional learning community platform with an experiential design thinking process to enhance digital teacher competency in the professional learning community process, there should be a clear explanation about the components of a virtual professional learning community platform, the tools used in the platform, and guidelines during activity including assessment and follow-up to ensure process run effectively.
2) For other educational organizations interested in implementing a virtual professional learning community platform with an experiential design thinking process to enhance digital competency, or for other fields to improve performance in their organizations, there should be a survey of personnel about the level of digital competence. In addition, it is possible to group people with similar abilities to participate in the professional learning community process. Moreover, the organization or individuals involved in the process should be aware of the need for high-speed internet and a stable connection.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Surasak Srisawat conducted the research, analyzed the data and wrote the paper, and Panita Wannapiroon done the research consulting; all authors had approved the final version.

Acknowledgment

The researchers would like to thank the Office of the Basic Education Commission, Ministry of Education and King Mongkut's University of Technology North Bangkok, which supported this research. Special thanks to the Innovation and Technology Management Research Center, King Mongkut's University of Technology North Bangkok, which supported the tools for the research.

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