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Design of the Architecture of the Virtual Learning Community: VLC via Metaverse to Promote Digital Teacher's Competency

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Abstract

The architecture of the virtual learning community via metaverse, or VLC via metaverse, to promote digital teacher's competency is related to the application of the concepts of virtual learning community integrated with virtual reality technology to promote the competency of teachers in the digital age. This is also to equip these teachers with comprehensive digital competency in order that they can apply it in the instruction management in a more efficient manner. In addition, this competency is believed to encourage teachers to have a step-by-step thinking process and enable them to use information technology media more practically with more understanding and creativity. The objectives of this study are (1) to synthesize the conceptual framework of the VLC via metaverse to promote digital teacher's competency, (2) to design the architecture of the VLC via metaverse to promote digital teacher's competency, and (3) to study the results of the design of the architecture of the VLC via metaverse to promote digital teacher's competency. The participants in this research are 7 experts from different institutions, all of whom are specialized in the design and development of instruction systems. The research tools include (1) the architecture of the VLC via metaverse, and (2) the assessment form on the suitability of the architecture of the VLC via metaverse. The results of this research show that (1) the overall suitability of the design of the architecture of the VLC via metaverse (overall elements) is at the highest level (Mean = 4.71, SD. = 0.57), and (2) the overall suitability of the design of the architecture of the VLC via metaverse is at the highest level (Mean = 4.70, SD. = 0.52).

Keywords: VLC via metaverse, virtual learning, virtual learning community, metaverse, digital teacher's competency

1. Introduction

The policy of Thailand 4.0 is becoming such a social trend that it has received wide attention from all sectors. This is because this policy is expected to transform Thailand's traditional agricultural economy into the so-called innovation-driven economy. The government, therefore, has emphasized the policy of Thailand 4.0 and set it as the main policy for national reform, aiming to enhance Thailand's economy, society and culture to be on par with those of other countries. The development of human potential and capacity building in terms of digital technology, including the improvement of the quality of education by means of information technology and learning media, has been provided in the National Strategic Plan. Thereby, the policies relevant to these issues have been assigned to the government agencies with an expectation for efficient implementation. For instance, Ministry of Digital Economy and Society has been giving precedence to the development of "digital literacy" for citizens and the enhancement of the country's information technology system (Ministry of Digital Economy and Society, 2016).

The 21st century learning management is education management intended to equip human beings with life skills, and this kind of learning management is also aimed to elevate the quality of Thai youths to be in line with such skills. Thus, teachers must be able to prepare the learning management with the aid of a variety of media technologies, which will allow learners to access information in a quick and efficient manner. Accordingly, learners can use technologies to search for information, perform self-learning, analyze data, and manage data systematically (Silaphon & Kongmanat, 2016).

The advancement of technology and the significance of knowledge sharing have brought about the so-called "virtual learning environment", which concerns the use of technology to assist in teaching. The virtual learning

environment is considered one of the most important factors that affect Thailand 4.0, especially in terms of learning designs and digital learning platforms (Chookusol & Wannapiroon, 2021). This is because a virtual learning environment will allow learners to learn anywhere and anytime, while teachers are responsible for providing appropriate environments for students (Chatwattana, 2022).

A learning community refers to a group of people who are aware of the importance and necessity of learning that shall lead to the development of skills about the thinking process, analysis, problem solving, and utilization of knowledge. Everyone in the community thinks and acts together as partners, sharing the same targets. These people live their life while learning, accumulating knowledge, and creating new bodies of knowledge in order to develop themselves and their community at the same time (Lohitwiset, 2016). For this reason, a virtual learning community is seen as a community established through a network system, in which everyone therein works together to study and learn what they are interested in, using different technologies as channels for communication and learning (Nuchmee, 2011).

The principles of VLC mostly refer to the contexts of social media, or the collaborative processes of community learning and collaboration, which are conducted by means of web-based collaboration platforms. The core of such a community has a great impact on the learning behaviors of users. This refers to the ability of such a community to continually attract and protect users at the same time, with an intention to promote the development and the relationships across social networks. The communities of this kind have provided good opportunities for education and online learning, and in the meantime, it is thought to improve collaboration and communication skills (Areepong, Nilsook, & Wannapiroon, 2022).

The term metaverse comes from the word META, which means great, and the word Universe. Therefore, “metaverse” means a great universe (Bunlue, 2022) that is a virtual world created by humans. In the metaverse, users can do various activities through their avatars with the aid of technologies and devices that enable them to access such a virtual world (Moy & Gadgil, 2022). Once participating and interacting with others in the metaverse, users can share their learning experiences with others in the immersive digital environments (Kye et al., 2021).

As to the education policies assigned by the Minister of Education, the Office of the Basic Education Commission has determined that digital competency (DC) is indispensable for teachers and educational personnel. The said quality policies focus mainly on the development of teachers and educational personnel so that they can become the modern and competent teachers who are able to facilitate the learning management in line with the competency-based curriculum. Meanwhile, these teachers and educational personnel are expected to possess skills that enable them to perform effective duties, have knowledge and ability to use digital technology, achieve professional development, and acquire the spirit of teacher (Office of the Basic Education Commission, 2021). Accordingly, digital competency is one of the competencies that are significant to digital literacy among the 21st century learners.

Digital competence refers to the use of information technology with discretion in working, communication, or daily life. Digital competence is related to basic skills in information and communication technology (ICT), or the use of computers to search, evaluate, store, create, present, and exchange information with an intention to communicate and collaborate via internet. Digital competence is an emerging concept concerning the development of technology as well as the expectation to be the citizen of knowledge society. Digital competence consists of 1) technical skills in using digital technology, 2) ability to use digital technology digital technology, 3) ability to critically evaluate the appropriateness of using digital technology, and 4) the motivation to participate in digital cultures (Ilomäki, Kantosalo, & Lakkala, 2011).

According to the principles and the theories above, the researchers have had an idea to design the architecture of the VLC via metaverse for use as a guideline to promote digital teacher’s competency so that these teachers can possess the basic knowledge skills along with ability to use technologies in order to pass on knowledge effectively in the classroom. It is expected that this VLC shall encourage teachers to have step-by-step thinking process and enable them to use information technology media more practically with more understanding and more creativity.

2. Research Objectives and Hypotheses

1) To synthesize the conceptual framework of the VLC via metaverse to promote digital teacher’s competency

2) To design the architecture of the VLC via metaverse to promote digital teacher’s competency

3) To study the results of the design of the architecture of the VLC via metaverse to promote digital teacher’s competency

According to the results of evaluation on the suitability of the design an architecture of the virtual learning community via metaverse to promote digital teacher's competency (VLC via metaverse) is at a high level.

3. Research Methodology

This research is related to the design the architecture of the virtual learning community via metaverse to promote digital teacher's competency (VLC via metaverse), and the research methodology is as follows.

3.1 Participants

The participants in this research are 7 experts from different institutions, all of whom are specialized in the design and development of instruction systems.

3.2 Research Instruments and Statistics Used in Data Analysis

The tools employed in this research consist of (1) the architecture of the VLC via metaverse, and (2) the evaluation form on the suitability of the architecture of the VLC via metaverse to promote digital teacher's competency. The statistics used for data analysis are mean and standard deviation.

3.3 Research Methodology

The research methodology designated to design and develop this architecture is based on the system approach (Khemmani, 2010; Utranan, 1982), which can be divided into 3 stages as shown in Figure 1.

Stage 1: Synthesis of the documents and the researches relevant to the VLC via metaverse. In order to establish the conceptual framework of this research, the researchers had studied and analyzed the documents and the researches, which are concerning learning community, virtual community, virtual learning community, metaverse, digital competency, and digital teacher's competency.

Stage 2: Design of the architecture of the VLC via metaverse. In this stage, the researchers based the design and the development of this architecture on the principles of system approach and SDLC technique (Robert et al., 2013).

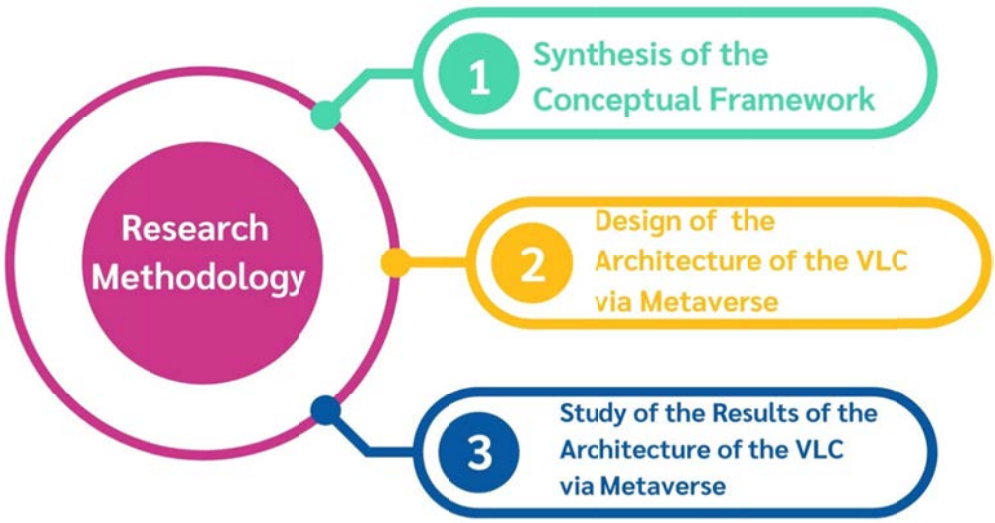

Figure 1. Research methodology

Stage 3: Study the results of the design of the architecture of the VLC via metaverse. The researchers employed the research tools to find out the results after having the participants use the said architecture. There are 7 experts in this research who were derived by means of purposive sampling. All of them are experts from different institutions, who are specialized in the design and development of instruction systems. The criteria for evaluation and the interpretation of results (Kanasutra, 1995) are shown in Table 1.

Table 1. Mean score range and interpretation of results.

Range of average score	Interpretation of suitability
4.50–5.00	Highest
3.50–4.49	High
2.50–3.49	Moderate
1.50–2.49	Low
0.00–1.49	Lowest

4. Results

The results of the design of the architecture of the VLC via metaverse to promote digital teacher's competency can be summarized as follows:

4.1 Results of the Synthesis of the Conceptual Framework of the VLC via Metaverse to Promote Digital Teacher's Competency

After the study, analysis, and synthesis of the documents and the researches relevant to the VLC via metaverse, especially in terms of learning community, virtual community, virtual learning community, metaverse, digital competency, and digital teacher's competency, the researchers obtained the conceptual framework of this research as shown in Figure 2.

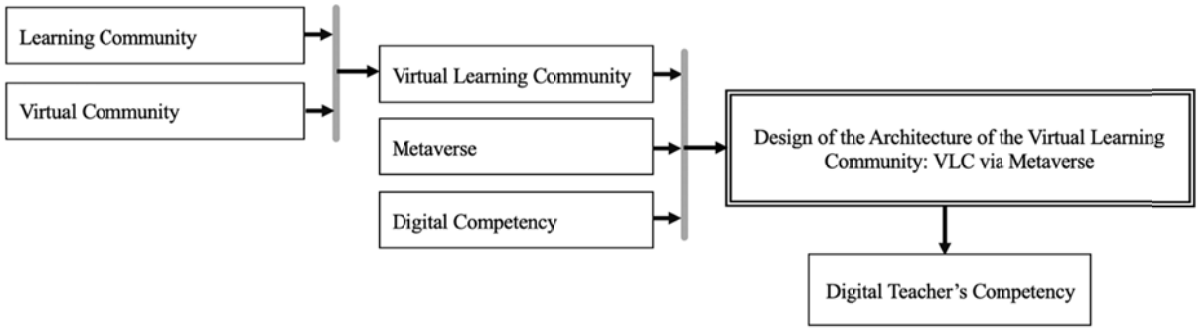

Figure 2. Conceptual framework of the VLC via metaverse

4.2 Results of the Design of the Architecture of the VLC via Metaverse to Promote Digital Teacher's Competency

The design of the architecture of the VLC via metaverse is based on the integration of the system approach and SDLC principles (Robert et al., 2013). Additionally, the researchers applied the principles of a virtual learning community combined with metaverse technology to design the architecture of a virtual learning community that can promote digital teacher's competency, as shown in Figure 3.

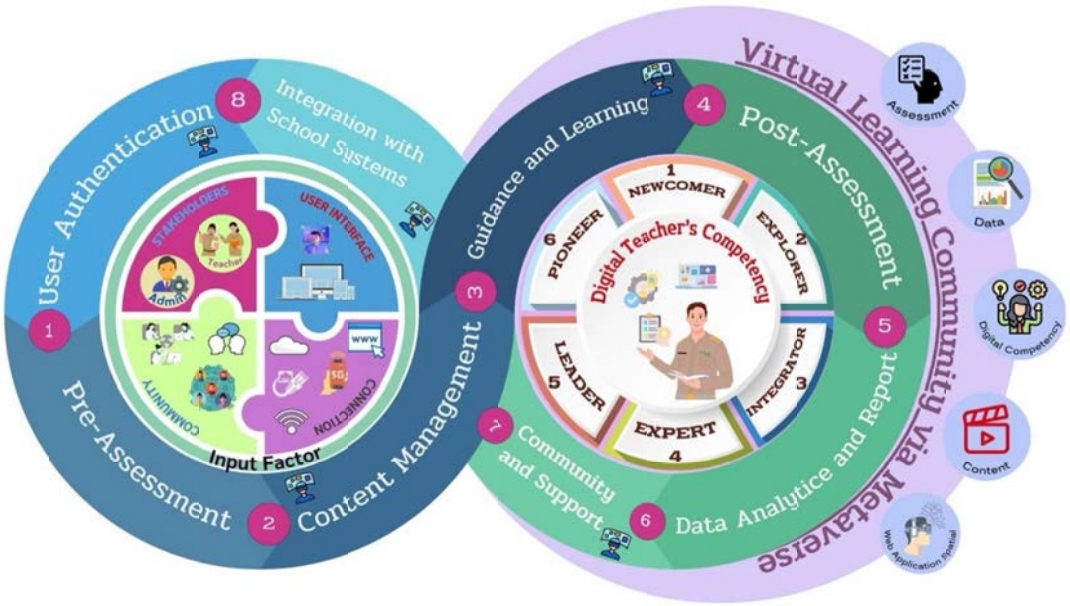

Figure 3. The architecture of the VLC via Metaverse

Figure 3 represents the architecture of the VLC via metaverse, which consists of 4 main elements as below.

1) Input factor: This element is composed of the sub-elements involved in the design of the architecture of the VLC via metaverse, which include:

- Stakeholders: (1) administrator, whose responsibilities are to take care of the virtual community, inspect the system functions, develop and create media for use in the system, and make reports based on the acquired information; and (2) teachers, or a group of users in the virtual community, who study the information and do the tests in the learning units.
- User interface: This refers to the ability to access and use the virtual learning community on such devices as smartphones, personal computers, tablets, etc.
- Community: It is a group of individuals or teachers who gather to study and learn specific issues of the same interest together and then exchange their knowledge with one another.
- Connection: This refers to the use of an internet network system to access the virtual learning community so that it can be accessed both wired and wireless, or through the private mobile network.

2) Learning process: This element involves a learning process and a collaboration process, which proceeds through a web-based collaboration platform, leading to a virtual learning community. There are 8 steps in this element as follows:

- User authentication is the division of levels of users, which includes two main groups, i.e., system administrators and teachers.
- Pre-assessment is a step designated to test and measure the basic knowledge of each teacher about the digital teacher's competency before letting them start the learning process.
- Content management is related to the management of contents and scopes of learning.
- Guidance and learning is the introduction of the steps to enter the virtual learning community, i.e., sign up, create an avatar, enter the classroom, and do the tests.
- Post-assessment is an evaluation process to test the knowledge of digital teacher's competency after learning, and the test results will be used for further study.
- Data analytic and report is the step in which the data derived from the tests and satisfaction assessment are calculated to find out the accurate reports that can be used further.
- Community and support refers to the virtual learning community that users will acquire after

completing their learning; thereby, this community is the place where users are able to exchange their knowledge and share their experiences derived from their main learning sources.

- Integration with school systems is the application of this platform to further develop other learning communities of different contexts, which are significant and in demand. In addition, this step is to follow up on the teachers' abilities, which are parts of their professional development and are also beneficial for the development of competency or knowledge in other related fields.

3) Metaverse: It is an element in the digital environment, which consists of assessment, data, digital competency, contents, and the metaverse platform.

4) Output: This element refers to digital teacher's competency, which is the use of information technology, by teachers in particular, with discretion in working, communication, or daily life. Digital competence is related to basic skills in information and communication technology (ICT), or the use of computers to search, evaluate, store, create, present, and exchange information with an intention to communicate and collaborate via internet. Digital competence is an emerging concept concerning the development of technology as well as the expectation to be the citizen of the knowledge society. Digital teacher's competency are divided 6 levels, i.e., newcomer, explorer, integrator, expert, leader, and pioneer.

4.3 Study the Results of the Design of the Architecture of the VLC via Metaverse to Promote Digital Teacher's Competency

The study results of the design of the architecture of the VLC via metaverse with 7 experts in this research who were derived by means of purposive sampling are shown in Tables 2 and 3.

Table 2. Results of evaluation on the suitability of the design of the architecture of the VLC via metaverse (overall elements)

Items for evaluation	Assessment results		Interpretation of results
	Mean	SD.	
1. The design of the architecture of the VLC via metaverse contains principles and concepts that can be used as the basis for developing the instruction systems.	4.71	0.49	Highest
2. The elements of the architecture of the VLC via metaverse are as comprehensive as the main elements of the instruction systems.	4.86	0.38	Highest
3. The design of the architecture of the VLC via metaverse has appropriate and comprehensive theories, which can be used to promote digital teacher's competency.	4.71	0.49	Highest
4. The sequence of steps and activities in the design of the architecture of the VLC via metaverse is clear and consistent, which can be used to promote digital teacher's competency.	4.57	0.79	Highest
5. The overall elements of the design of the architecture of the VLC via metaverse is complete and it can be used as a guideline to develop the design of the VLC via metaverse platform to promote digital teacher's competency in the future.	4.71	0.76	Highest
Overall average	4.71	0.57	Highest

As to Table 2, it is found that the overall suitability of the design of the architecture of the VLC via metaverse (overall elements) is at the highest level (Mean = 4.71, SD. = 0.57). This can be concluded that the architecture of the VLC via metaverse contains all required elements and it can be used as a guideline to further develop other platforms of VLC via metaverse in order to promote digital teacher's competency, especially the competency of the primary school teachers. Thereby, digital competency is considered one of the essential skills that the Office of the Basic Education Commission has provided to develop digital teacher's competency at present.

Table 3. Results of evaluation on the suitability of the design of the architecture of the VLC via metaverse

Items for evaluation	Assessment Results		Interpretation of results
	Mean	SD.	
1. Input factor			
1.1 Stakeholder	4.57	0.53	Highest
1.2 User interface	4.29	1.11	High
1.3 Community	4.71	0.49	Highest
1.4 Connection	4.86	0.38	Highest
2. Learning process			
2.1 User authentication	4.57	0.53	Highest
2.2 Pre-assessment	4.86	0.38	Highest
2.3 Content management	4.71	0.49	Highest
2.4 Guidance and learning	4.29	0.76	High
2.5 Post-assessment	4.71	0.49	Highest
2.6 Data analytics and report	4.71	0.49	Highest
2.7 Community and support	4.57	0.79	Highest
2.8 Integration with the school system	4.57	0.53	Highest
3. Metaverse			
3.1 Assessment	4.86	0.38	Highest
3.2 Data	4.71	0.49	Highest
3.3 Digital competency	4.71	0.49	Highest
3.4 Content	4.86	0.38	Highest
3.5 Web Application Platform	4.71	0.49	Highest
4. Output			
4.1 Ability of digital technology to profession	5.00	0.00	Highest
4.2 Communication and interaction	4.57	0.53	Highest
4.3 Management of digital resources for education	4.71	0.49	Highest
4.4 Evaluation assessment	4.86	0.38	Highest
4.5 Teaching and learning	4.86	0.38	Highest
4.6 Promote convenience for student	4.71	0.49	Highest
4.7 Ethics and safety	4.86	0.38	Highest
Overall	4.70	0.52	Highest

In reference to Table 3, it is evident that the overall suitability of the design of the architecture of the VLC via metaverse is at the highest level (Mean = 4.70, SD. = 0.52). So, it can be summarized that the architecture of the VLC via metaverse contains all necessary elements and it can be employed as a guideline to further develop other platforms of VLC via metaverse in order to promote digital teacher's competency, especially the competency of the primary school teachers. It is believed that digital competency shall lead to new bodies of knowledge that can be applied, with the aid of digital technology and virtual reality technology, in the instruction management in an efficient manner.

5. Conclusion & Discussion

The architecture of the VLC via metaverse was developed based on the concepts of learning community and virtual world technology with an intention to promote digital teacher's competency today. It is necessary for these teachers to develop and update their digital competency so that they can improve and manage the instruction media as well as the information related to learning through digital devices.

The architecture of the VLC via Metaverse is composed of 4 main elements, i.e., 1) input factor, which includes of stakeholder, user interface, community, and connection; 2) learning process, which consists of 8 steps, i.e., user authentication, pre-assessment, content management, guidance and learning, post-assessment, data analytic and report, community and support, and integration with school systems; 3) metaverse, which consists of assessment, data, digital competency, content, and metaverse platform; and 4) output, which includes digital teacher's competency.

As indicated in the assessment results, it is found that (1) the overall suitability of the design of the architecture of the VLC via metaverse (overall elements) is at the highest level (Mean = 4.71, SD. = 0.57), and (2) the overall suitability of the design of the architecture of the VLC via metaverse is at the highest level (Mean = 4.70, SD. = 0.52). Therefore, it can be summarized that the architecture of the VLC via metaverse covers all appropriate elements and it can be used as a guideline to further develop other platforms of VLC via metaverse in order to promote digital teacher's competency, especially for the primary school teachers. This is in compliance to the

research of Antonio et al. (2023), who stated that teachers in the 21st century should be able to integrate digital technology with daily life and apply the experiences from this in the instruction management that can pave ways to endless learning. It is also consistent with the study of Wannapiroon et al. (2021), who said that the application of learning technologies in the virtual world combined with those of the physical world in learning management is regarded as a new dimension of educational media. Such educational media can make students feel more interested and eager to learn new things, create new experiences, and engage more in learning. In addition, it is in line with the research by Sreejun and Chatwattana (2023), who mentioned that the use of virtual media in the instruction management along with the use of computer technology and information technology enables students to learn and control their work independently, leading to the real-time outcome.

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Authors contributions

Mr. Sriwichai Netniyom develops the main idea of this research, wrote and compose the manuscript, developing the model and studied the results. The research methodology was developed by Assoc. Prof. Dr. Pinanta Chatwattana and review the manuscript. The two authors have approved the final version of this manuscript for publication.

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Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Canadian Center of Science and Education.

The journal’s policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

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Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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