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Development of Digital Literacy and Digital Empathy with Micro-learning via Activities on Metaverse

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Abstract

This research is related mainly to the study of the results on the development of digital literacy and digital empathy with micro-learning via activities on metaverse. The main concept of this study is based on the integration of micro-learning process with metaverse technology in order to encourage and provide learners with opportunities to create bodies of knowledge and engage in joint activities through the network system that can be accessed anywhere and anytime. The objectives of this research are (1) to synthesize the conceptual framework of the micro-learning via activities on metaverse, (2) to design the micro-learning process via activities on metaverse, and (3) to study the results of the development of digital literacy and digital empathy with the micro-learning via activities on metaverse. Thereby, this study relies on the pre-experimental research method with one-shot case study, in which the research participants are 30 undergraduate students of Pakse Teacher Training College, Lao People's Democratic Republic, who were derived by means of cluster sampling and well protected under the policy of confidentiality and anonymity. The research results show that (1) the students' digital literacy and digital empathy, after learning with the micro-learning via activities on metaverse, are at very good level (mean = 43.20, SD = 2.35), and (2) the overall satisfaction towards the micro-learning via activities on metaverse is at high level (mean = 4.42, SD = 0.78). In reference to the above research results, it is evident that the micro-learning via activities on metaverse enables the students to quickly develop their digital literacy and digital empathy after receiving new experiences and new knowledge because the knowledge gained from the learning of this style is easy to remember and can be applied in an effective manner.

Keywords: Micro-learning, learning activities, metaverse, digital literacy and digital empathy

1. Introduction

The integration of virtual world technologies with instruction management has been more and more evident and concrete during the outbreak of COVID-19, especially in the Lao People's Democratic Republic for the past 5 years. The instruction management of all levels designated for modern learners needs to integrate the use of different technologies so as to provide more opportunities to create bodies of knowledge and facilitate the exchange of knowledge and collaboration. This is thought to elevate the quality of social services, particularly those in terms of education, which can be accessed via the network system anywhere and anytime (Sapliyan, Chatwattana & Nilsook 2023). This approach is in line with education management in the 21st century, which usually focuses on preparing students for the dynamic world's situations by promoting digital literacy, problem-solving skills, and collaboration skills in the cyber world (Tuntirojanawong, 2017).

For this reason, education worldwide in the 21st century must be managed in such a way that can equip learners with essential skills that enable them to cope with the dynamic changes in both society and the world so that they are able to live their agreeable life while having appropriate knowledge, skills, abilities, and competencies.

Micro learning is a style of learning that focuses on self-learning with small units of contents and learning activities that can be accomplished within a short period of time. In addition, once completing the learning, learners can evaluate their learning immediately (Leela, Chookeaw & Nilsook, 2019). The learning of this kind is said to help learners not only acquire new knowledge quickly but also easily adjust their learning according to their own needs. Micro learning consists of 4 steps as follows:

- Defining the learning objectives that focus mainly on a specific subject.
- Presenting the contents as to the specified objectives, which can be conducted either by instructors or through learning sources in electronic media.
- Doing the micro-learning activity as to a specific learning topic separated from the main topic or the main content so that learners can focus their learning on only one topic.
- Evaluation after learning, which is conducted after completing the learning process in order to measure the learning achievement of learners.

Thereby, the said evaluation may cover only a small unit of contents or the whole learning unit (Nikou & Economides, 2018; Busse & Schumann, 2021; Yan et al., 2022).

Metaverse is a virtual reality platform created with digital technology. In metaverse, the human agents or "Avatars" are able to interact with the environments therein. In other words, in this virtual world, users can interact and do activities together as if they were in the real world (Kongpha & Chatwattana, 2023). Moreover, users can personalize their avatars to reflect their individual expressions, which is said to increase their engagement and their interest in learning (Mystakidis, 2022). Learning through metaverse is regarded as a new dimension of education management that can enhance the ability to access resources on the network system, leading to deep learning through the real experiences (Wannapiroon, 2022).

Digital literacy and digital empathy are the skills related to the understanding and the use of digital technology in an ethical manner, knowing how to communicate and interact with other users with good manners. It is believed that both digital literacy and digital empathy, aided with the use of information technology, can lead to a learning and sharing society. Additionally, these skills are considered the 21st century skills that students need to learn (Chatwattana et al., 2022; Friesem, 2016; UNESCO, 2018). Overall, digital literacy and digital empathy have an important effect on equality in the access to information, services, social groups, opportunities to learn new things, communication, and interaction with other users.

Regarding the aforementioned principles and concepts, the researchers have had an idea to design the micro-learning via activities on metaverse so that it can be employed as a guideline to develop digital literacy and digital empathy among the undergraduate students of Pakse Teacher Training College, Lao People's Democratic Republic. Whereby, the said learning style is integrated with metaverse technology in order to provide opportunities to create bodies of knowledge, exchange knowledge, and work together with others via the network system that can be accessed freely anywhere and anytime. All of these are said to correspond to the 21st century instruction management.

2. Research Objectives

This research places an emphasis on the exploration of perspectives towards the development of digital literacy and digital empathy of the participants after learning with the micro-learning via activities on metaverse. This is to verify whether the micro-learning via activities on metaverse designed herein is efficient or not. Hence, this research includes the objectives as follows:

OB1: To synthesize the conceptual framework of the micro-learning via activities on metaverse.

OB2: To design the micro-learning process via activities on metaverse.

OB3: To study the results of the development of digital literacy and digital empathy with the micro-learning via activities on metaverse.

This study also relies on the pre-experimental research method with one-shot case study, in which all the research participants were willing to complete the questionnaire and the evaluation form under the policy of confidentiality and anonymity.

3. Research Methodology

The design of this study is based on the systems approach (Khemmani, 2010; Utranan, 1982), which is usually employed to manage the elements like input, process, control, output, and feedback.

3.1 Scope of the Study

The research participants include 30 undergraduate students of Pakse Teacher Training College, Lao People's Democratic Republic, who were derived by means of cluster sampling and well protected under the policy of confidentiality and anonymity.

3.2 Research Instruments

The instruments employed in this research consist of (1) the conceptual framework of the micro-learning via activities on metaverse, (2) the micro-learning process via activities on metaverse, (3) the evaluation form on digital literacy and digital empathy after learning with the micro-learning via activities on metaverse; thereby, the said form is an authentic assessment with 4 rating scales (0-3 levels), and (4) the evaluation form with 5 rating scales on the satisfaction towards the micro-learning via activities on metaverse. The statistics used in data analysis are mean, standard deviation, and percentage. The criteria for evaluation and the interpretation of an authentic assessment are shown in Table 1.

Table 1. Mean score range and interpretation of an authentic assessment

Range of average score	Interpretation
43.00 – 54.00	Very good
27.00 – 42.99	Good
11.00 – 26.99	Moderate
0.00 – 10.99	Improve

The hypotheses in this research are mostly related to the study on the development of digital literacy and digital empathy with the micro-learning via activities on metaverse, including:

H_1: The results of evaluation on the development of digital literacy and digital empathy after learning are at good level.

H_2: The satisfaction towards the micro-learning via activities on metaverse is at high level.

3.3 Research Methodology

This study is in the format of research and development (R&D) and the research methodology is divided into the following 3 stages according to the objectives.

Stage 1: Synthesize the documents and researches relevant to the micro-learning via activities on metaverse in order to find out the conceptual framework for use in the development of digital literacy and digital empathy.

Stage 2: Design the micro-learning via activities on metaverse. This stage is concerning the synthesis of the micro-learning based on the relevant academic studies and researches, and then the results thereof were applied to devise the learning process via activities on metaverse.

Stage 3: Study the results of the development of digital literacy and digital empathy with the micro-learning via activities on metaverse. In this stage, the researchers examined the development of digital literacy and digital empathy as well as the satisfaction of the participants, who gave their consent to complete the questionnaire and the evaluation form under the policy of confidentiality and anonymity. The average score and the interpretation thereof (Kanasutra,1995) are shown in Table 2.

Table 2. Mean score range and interpretation of results

Range of average score	Interpretation
4.50 – 5.00	Very High
3.50 – 4.49	High
2.50 – 3.49	Moderate
1.50 – 2.49	Low
0.00 – 1.49	Very low

4. Results

The results of the development of digital literacy and digital empathy with the micro-learning via activities on metaverse are as follows:

4.1 Results of the Synthesis of the Conceptual Framework of the Micro-learning via Activities on Metaverse

The conceptual framework of the micro-learning via activities on metaverse was synthesized from the documents and researches related to Bachelor's Degree of Secondary Teacher Education Program, micro-learning, metaverse, digital literacy and digital empathy. The conceptual framework of this research is illustrated in Figure 1.

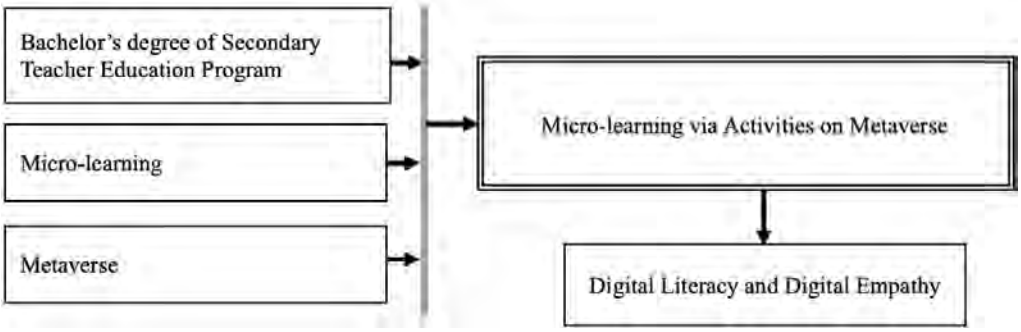

Figure 1. Conceptual framework of the micro-learning via activities on metaverse

4.2 Results of the Design of the Micro-learning via Activities on Metaverse

The micro-learning via activities on metaverse is a kind of learning model that was developed with the concept of learning little by little, in which the contents were broken down into small units with simple and short steps or processes. The objective of this learning style is to encourage students to learn by themselves and do group activities under the virtual environments created with Spatial.io platform, which can be accessed via smartphones and compatible with a variety of user interfaces and display screens. The micro-learning via activities on metaverse in this study was developed from the synthesis of micro-learning processes in varied academic documents and researches with an intention to promote digital literacy and digital empathy of learners. Thereby, the results of the design of the micro-learning via activities on metaverse are presented in Table 3.

Table 3. Synthesis of the micro-learning process

Learning process	Boonyab enjarit (2020)	Nikou & Economide s (2018)	Leela, Chookeaw & Nilsook (2019)	Busse & Schuman n (2021)	Yan, Wang & Lei (2022)	Arnab et al. (2021)	Ibarra-Cabrera et al. (2021)	Goschlbe rger et al. (2022)	Results of synthesis
Single issue	✓								
On time	✓								
Defining a single objective		✓	✓	✓	✓	✓			✓
Presenting the main points briefly	✓	✓	✓	✓	✓	✓	✓	✓	✓
Subject-specific activities	✓	✓	✓	✓	✓	✓	✓		✓
Evaluation on summary		✓	✓	✓	✓	✓	✓		✓
Science of teaching								✓	
Technology	✓								

Table 3 represents the micro-learning process that the researchers has synthesized from the relevant documents and researches. The said micro-learning process can be concluded into 4 steps as below.

- Defining the objectives: In this step, a single learning objective is determined in order for learners to focus on only one topic.
- Studying the contents via metaverse: This step emphasizes the presentation of the main contents according to the specified objectives, which are presented by instructors or through electronic media so that learners can learn by their own.
- Doing the micro-learning activity on metaverse: The activities in this stage are organized as to the specified objectives, and the main topics are broken down into small units of learning topics so that learners can focus on only desired topics. During this process, learners are able to assess their learning outcome by doing the tests.
- Evaluation after learning: The evaluation in this stage is conducted after completing the learning process in order to measure the learning achievement of learners; thereby, the said evaluation may cover only a small unit of contents or the whole learning unit.

Table 4. Synthesis of the components of digital literacy and digital literacy

Components	Martin (2006)	Kempster (2008)	UNESCO (2018)	Hobbs (2021)	Hoechsmann & DeWaard (2015)	Friesem (2016)	Results of synthesis
Access	✓	✓	✓	✓	✓		✓
Understanding			✓		✓		✓
Creation	✓	✓	✓				✓
Use			✓				✓
Analysis/Synthesis	✓			✓			
Evaluation	✓	✓					
Critical thinking							
Creative thinking		✓		✓	✓		
Communication		✓	✓	✓	✓		✓
Collaboration			✓			✓	✓
Integration	✓	✓					
Ethics				✓			

Table 4 illustrates the synthesis of the elements of digital literacy and digital empathy. The researchers synthesized them from the relevant documents and researches and found out 6 elements as below:

- Access: This element refers to the ability to access technologies in an efficient manner.
- Understanding: It is the ability to understand, interpret, and learn about technologies in an effective manner.
- Creation: This element is the ability to use technologies to produce learning media in an efficient manner.
- Use: This refers to the ability to use technologies to search for the desired information both skillfully and effectively.
- Communication: This element is the ability to communicate and exchange knowledge with others in social network.
- Collaboration: It refers to the ability to work smoothly with others in social network and finally achieve the targets successfully.

4.3 Results of the Study of Digital Literacy and Digital Empathy with the Micro-learning via Activities on Metaverse

Digital literacy and digital empathy are regarded as necessary skills for the 21st century learners, or digital learners, who usually employ different technologies to promote their learning. Both digital literacy and digital empathy are seen as the skills about understanding and using digital technology effectively and ethically in social network. This includes the understanding to communicate and interact with users with good manners, which is believed to create the online learning society that can be accessed anywhere and anytime.

The study of the development of digital literacy and digital empathy with the micro-learning via activities on metaverse was conducted with the 30 undergraduate students of Pakse Teacher Training College, Lao People's Democratic Republic, who were well protected under the policy of confidentiality and anonymity. These research participants were asked to complete the evaluation form, which had already been proved for index of item objective congruence (IOC) by experts, and the results thereof are presented in Table 5.

Table 5. Results of the development of digital literacy and digital empathy (N=30)

Number of students	Full score	Mean	SD	Interpretation
30	54	43.20	2.35	Very good

Table 5 shows the results of evaluation on the development of digital literacy and digital empathy with the micro-learning via activities on metaverse, which were acquired by the use of an authentic assessment form containing 18 questions with 4 rating scales and rubric score. It is found that the average score of the students after learning is at very good level (mean = 43.20, SD = 2.35), which is corresponding to the hypothesis 1. Also, the results above indicate that the micro-learning via activities on metaverse can be employed as an approach to enhance students' digital literacy and digital empathy as well as their confidence in practical skills.

Table 6. Results of the satisfaction towards the micro-learning via activities on metaverse

Items for evaluation		Mean	SD	Interpretation
Design	1. Convenient and easy to use and understand	4.47	0.72	High
	2. Images and languages	4.73	0.44	Very high
	3. Fonts and colors	4.83	0.37	Very high
	4. Design of elements	4.47	0.76	High
	5. Design of classroom on metaverse	4.70	0.59	Very high
	6. Design of tools to support and exchange learning	4.43	0.72	High
	7. Design of learning tools to enhance digital literacy and digital empathy	4.53	0.72	Very high
	8. Design of micro-learning activities	4.50	0.72	Very high
	9. Access to knowledge to enhance digital literacy and digital empathy	4.57	0.67	Very high
	10. Referring to overall design, the micro-learning via activities on metaverse covers all demands	4.67	0.54	Very high
Efficiency	11. Ability to log in to the system	4.07	1.06	High
	12. Functionality	4.17	1.04	High
	13. Usability	4.37	0.87	High
	14. Work performance	4.17	0.97	High
	15. Response to learning	4.47	0.76	High
	16. Ease and convenience to use	4.13	0.99	High
	17. Response to user's demand	4.33	0.87	High
	Overall	4.42	0.78	High

According to the results in Table 6, it is evident that the satisfaction towards the micro-learning via activities on metaverse in 17 items is at high level (mean = 4.42, SD = 0.78), which is complying to the hypothesis 2. Also, the results above indicate that the micro-learning via activities on metaverse can be employed as an approach to enhance students' digital literacy and digital empathy, which are regarded as necessary skills for the 21st century learners, or digital learners, who usually rely on varied technologies to promote their learning in social network anywhere and anytime.

5. Discussion

The micro-learning via activities on metaverse is a kind of learning model that was developed with the concept of learning little by little to encourage students to learn by themselves and do group activities under the virtual environment. The results of the study of digital literacy and digital empathy with the micro-learning via activities on metaverse, that an interesting point that the learning steps and learning activities in the micro-learning via activities on metaverse encouraged the students to engage in small group activities. The contents were presented in small units via micro-learning processes, allowing the students to spend less time learning, remember the contents easily, and apply their knowledge effectively. In addition, the learning activities were established in virtual world environment in order to transfer knowledge and facilitate collaboration. It is believed that this can boost the students' interest and at the same time develop their digital literacy and digital empathy. This is consistent with the research of Iasha et al. (2023), who stated that the application of technologies that provide realistic learning environment and immersive learning environment to provide interaction in learning management can arouse learners' enthusiasm and interest to learn as well as their confidence in practical skills.

6. Conclusion

This research is related mainly to the development of digital literacy and digital empathy with the micro-learning via activities on metaverse. The main objective of this research is to employ the micro-learning via activities on metaverse to enhance digital literacy and digital empathy of the students so that they can elevate their proficiency and transfer bodies of knowledge by means of appropriate and efficient technologies. Furthermore, the students herein, after learning with the micro-learning via activities on metaverse, are expected to make the ultimate use of digital innovations and technologies along with virtual environments in the instruction management at Pakse Teacher Training College, Lao People's Democratic Republic.

This study shows that (1) digital literacy and digital empathy of the students who learned with the micro-learning via activities on metaverse, considering from 18 items for evaluation, are at very good level (mean = 43.20, SD = 2.35), which is in accordance to the hypothesis 1, and (2) the students' satisfaction towards the micro-learning via

activities on metaverse in 17 items for evaluation is at high level (mean = 4.42, SD = 0.78), which is complying to the hypothesis 2. It is obvious from the aforementioned results that this research can develop digital literacy and digital empathy among the students after letting them learn with the micro-learning via activities on metaverse, which employes virtual environment technologies to support learning, promote engagement, and increase the students' interest. Not only that, this study also increases the ability to access resources on network, which is thought to create deep learning at every step.

This research can be employed as a guideline in the design and development of the micro-learning via activities on metaverse, which can elevate their proficiency and transfer bodies of knowledge by means of appropriate and efficient technologies through self-study. However, there are still some limitations in this study, the number of research participants is too small. As a result, the findings derived herein are considered merely the findings from a pilot study, which can be used as a guideline for future development. Therefore, the suggestions for future studies should be conducted the analyses with a larger sample group to explore how different aspects of the metaverse and micro-learning activities specifically contribute to developing digital literacy and empathy.

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Authors contributions

Aphinanh Suvandy develops the main idea of this research, wrote the manuscript, developing the research tools and studied the results. Assoc. Prof. Dr. Pinanta Chatwattana, and Prof. Dr. Prachyanun Nilsook revised and compose the writing quality of the manuscript, developing the research methodology, and rechecked the manuscript before it was to be submitted. All authors read and approved the final manuscript.

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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.

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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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