The Learning Model in the Metaverse for Promoting Collaborative Learning on the Thai MOOC Platform

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Abstract
This study has two primary objectives: 1) to explore the components and learning models within the metaverse that promote collaborative learning on the Thai MOOC platform, and 2) to develop and refine this metaverse-based learning model. The study identified four key components of the metaverse: 1) People, 2) Learning Strategies, 3) Media, and 4) Technology. The learning process is structured into four stages: 1) Preparation and Immersion, 2) Mission/Quest, 3) Assessment, and 4) Repetition/Reflection. Evaluation results indicate that the learning model is highly suitable for enhancing collaborative learning on the Thai MOOC platform, with an overall mean score of 4.43 and a standard deviation of 0.53. The components and learning stages received the highest appropriateness ratings, each with a mean score of 4.57 and standard deviations of 0.49 and 0.51, respectively. Among the components, Media was rated the most appropriate, with a mean score of 4.71 and a standard deviation of 0.49. The People and Technology components were equally rated, each with a mean score of 4.57 and a standard deviation of 0.53. For the learning stages, Preparation and Immersion, Mission/Quest, and Assessment all received equally high ratings, each with a mean score of 4.57 and a standard deviation of 0.53, except for Repetition/Reflection, which had a standard deviation of 0.79.

Keywords: Metaverse, Collaborative Learning, Thai MOOC, Learning Model

Introduction

Metaverse is a virtual community that seamlessly integrates environments and various elements through technologies such as the Internet of Things (IoT), Augmented Reality (AR), and Virtual Reality (VR). It plays a crucial role in transforming communication, society, and learning patterns. Users can create avatars as their representatives to interact with the environment and objects through 3D computer graphics, allowing abstract concepts to be visualized, making it easier to understand content related to science, social sciences, and the environment. Additionally, it can simulate high-risk or unlikely real-world scenarios for skill training and mastery. Importantly, the Metaverse also creates virtual classrooms that connect learners from around the world, promoting cross-cultural education and effective international collaborative learning (Na Songkhla, 2022).

Thai MOOC is a platform that supports the delivery of open online education (Thailand Massive Open Online Course), under the supervision of the Thailand Cyber University Project. Its objective is to provide Thai citizens with access to high-quality learning opportunities, allowing them to learn for free and access educational resources anytime and anywhere through online learning. The platform aims to promote lifelong learning among the Thai population (Thailand Cyber University Project, 2021).

As mentioned, this has led to the idea of integrating the Metaverse with the Thai MOOC platform as a key approach to enhancing online learning in Thailand. The focus is on studying the components and learning models within the Metaverse that are suitable for creating a virtual learning environment that fosters interaction and collaborative learning among students. Additionally, the learning model will be developed by integrating AR, VR, and IoT technologies with the course content on the Thai MOOC platform to make learning more engaging, easily accessible, and responsive to the lifelong learning needs of Thai citizens. This integration will help create an effective learning experience, promote knowledge exchange, and develop essential skills through collaborative activities in virtual spaces. This aligns with the goal of Thai MOOC to be an open and high-quality online learning resource accessible to all.

Key Components for Utilizing the Metaverse in Education

Based on the review of related documents and research, several scholars have studied the use of the metaverse for education. The summary of their findings is presented in Table 1 below.

Table 1: Summary of Key Components for Utilizing the Metaverse in Education

Component	Author					Article
	Lee, H.; Woo, D.; Yu, S.(2022)	Díaz, J. E. M., Saldaña, C. A. D., & Ávila, C. A. R. (2020)	Hirsh-Pasek, K. et al (2022)	Woong Suh and Seongjin Ahn (2022)	Mustafa, B. (2022)	
1.Virtual classrooms or learning environments	/	/	/	/	/	/
2. 3D simulations or models for experiential learning	/	/	/	/	/	/
3. VR AR MR XR or 360 degree	/	/	/	/	/	/
4. Social and collaborative tools	/	/	/	/	/	/
5. Virtual teachers	-	/	/	/	/	/
6. Digital content and resources	/	/	/	/	/	/
7. Virtual assessment and evaluation	/	-	-	-	/	-
8. Tracking and Analytics System	-	/	-	-	/	-
9. Integration with traditional classroom	/	/	/	-	/	/
10. Accessibility	-	/	/	/	/	/

From Table 1, the researcher summarized the essential components for utilizing the metaverse in education into eight key elements: 1) Virtual classrooms or learning environments, 2) 3D simulations or models for experiential learning, 3) Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), Extended Reality (XR), or 360-degree content, 4) Social and collaborative tools for communication and teamwork, 5) Virtual teachers, 6) Digital content and learning resources, 7) Integration with traditional classroom instruction, and 8) Accessibility to accommodate learners with diverse skills and devices.

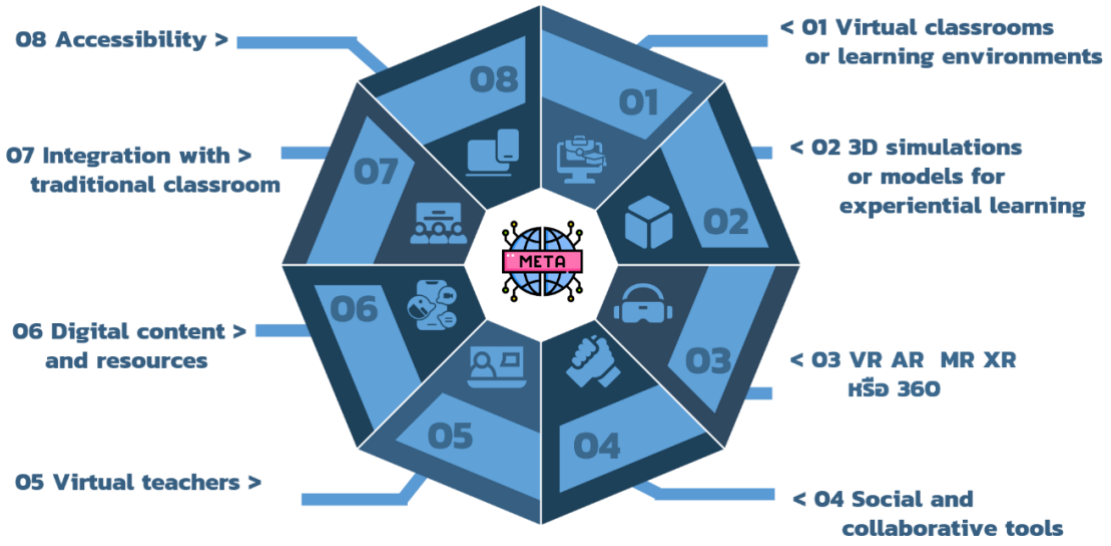

Figure 1: The Eight Components of the Metaverse
for Promoting Collaborative Learning on the Thai MOOC Platform

Based on the figure, the author provides explanations for each of the eight components as follows:

1. Virtual classrooms or learning environments: These are digital spaces where learners and educators can interact, communicate, and learn together in a remote or online setting. These environments typically include features such as video conferencing, document sharing, and interactive tools that engage learners with the content and foster collaboration.
2. 3D simulations or models for experiential learning: These are computer-generated 3D representations of real-world environments or objects that enhance experiential learning. Simulations and models can be used to mimic real-life scenarios, allowing learners to experience and interact with situations in a safe and controlled environment. This is particularly useful in fields like medicine, nursing, engineering, and architecture, where such experiences might be difficult, impossible, or unsafe in the real world.
3. Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), Extended Reality (XR), or 360-degree:
   - Virtual Reality (VR) is a computer-generated 3D environment that users can interact with using devices like headsets with screens and handheld controllers. Learners are fully immersed in a simulated environment, and their actions in the virtual world reflect their movements in the real world.
   - Augmented Reality (AR) is a technology that overlays digital information—such as graphics, text, or audio—onto a user's view of the real world, which can be experienced through devices like smartphones, tablets, or special AR glasses.
   - Mixed Reality (MR) combines elements of VR and AR, integrating virtual objects into the real world seamlessly, allowing interaction with digital content to create a more realistic experience.
   - Extended Reality (XR) is an umbrella term that encompasses all forms of virtual technologies, including VR, AR, and MR, designed to provide immersive and interactive experiences for learners.
   - 360-degree media is technology that allows learners to explore environments or objects from a 360-degree perspective and can be used in combination with VR, AR, or MR to create a more realistic learning experience.
4. Social and collaborative tools: These are software applications that support social learning and collaboration by facilitating communication and teamwork among learners. They allow multiple participants to work together on projects or tasks in real-time, regardless of location. Examples include social media platforms like Facebook, Twitter, and LinkedIn; online discussion boards for knowledge sharing; project management tools such as Trello, Asana, and Basecamp; video conferencing platforms like Zoom, Meet, and Teams; and cloud file-sharing services like Dropbox, Google Drive, and OneDrive, which allow learners to share files and collaborate.
5. Virtual teachers: These refer to educators who use technology to conduct teaching activities, such as video conferencing, online platforms, and other digital tools, to teach learners remotely. Also known as online or digital teachers, virtual teachers employ a variety of methods, including live online classes, prerecorded videos, and interactive learning activities.
6. Digital content and resources: These include any type of information or educational media that is created, stored, and distributed in digital form. It can include diverse types of content such as text, images, videos, audio, and interactive media. Examples of digital content and resources include online articles, blog posts, e-books, digital textbooks, online courses (MOOCs), digital images, videos, audio files, interactive simulations, VR/AR games, online databases, and research resources. Digital content and resources can be accessed and used via various digital devices, such as computers, smartphones, and tablets.

7. Integration with traditional classroom: This refers to incorporating digital content and resources with traditional teaching methods to enhance and support the learning process. It includes various strategies and techniques, such as using interactive simulations or videos to augment instruction, leveraging online resources, digital textbooks, or educational games to complement traditional lessons.
8. Accessibility: This involves designing and developing systems with accessibility in mind, such as using clear and simple language, providing alternative text for images, using headings and lists for content organization, and ensuring easy navigation. It also includes designing responsive interfaces compatible with various devices and screen sizes, adding captions to videos, and using contrasting colors and large font sizes for readability. These considerations ensure that learners with diverse skills and devices can access and participate effectively.

A synthesis of studies on metaverse-based learning demonstrates among other things the transformative potential of metaverse across various domains, economics, learning outcomes, and engagement. Danylec and colleagues (2022) have found that the training of metaverse would cut the expenses and time by 95% for train drivers with real-time automated assessments. Also, the efficiency of the latter rises by 93%. Pigultong (2022) found cognitive gains among students with internet access were uneven, with Wi-Fi users having the highest improvement. Among the factors Almarzouqi and colleagues (2022) discovered that metaverse users inter alia must be satisfied with the service, they should also have sufficient awareness, and they must be technologically compatible to allow stakeholders to stratify the most optimal integration strategies. Kim and colleagues (2022) argued that the user-friendly design and attractive experiences will rise up the intention of using metaverse platforms among higher education students that will possibly transform the university model. Jeong and colleagues (2022) besides other fields, pointed out the integration of the metaverse with learning management systems as one of the regions, where it can be useful in education, local governance, and workforce development, also significantly contributing to the validation of student learning histories. Chen and colleagues (2022) thus checked the metaverse research to main domains including service-oriented and technology-oriented and also did the layering of its architecture. The results, the metaverse's capacity, bring out the learning process, bridge digital divides, and innovate educational ecosystems, offering great pieces of advice for future development and application.

Based on the review of related documents and studies, the researcher identified that the form of the metaverse to be applied in education can be divided into different "spaces." In this study, the "spaces" are divided into six distinct spaces based on usage characteristics: 1) Lobby Space, 2) Learning Space 3) Lab Space 4) Architecture Space 5) Show Space and 6) Joy Space (Café Space). Each of these spaces has different forms and usage characteristics, as described below.

1. Lobby Space: This is the initial space that users enter in the system. It serves as a location with guides or media for system use. Users can meet and make appointments here before moving to other spaces within the system. It includes discussion boards or announcements from system administrators or instructors, providing important information that learners and users need to be aware of.
2. Learning Space: This is the area designated for learning and includes classrooms of three sizes: 1) Small - accommodates up to 30 learners or users, 2) Medium - accommodates 31 to 100 learners, and 3) Large - accommodates over 100 learners. The classrooms are

arranged with tables and different spaces to promote learning, including group table setups to facilitate knowledge sharing and group discussions.

3. Lab Space: This space is designed for learning in a laboratory setting relevant to specific subjects and courses. Examples include nursing labs, physics, chemistry, or biology experiment labs. It uses media like VR, AR, MR, or XR to help learners have an experience as close to reality as possible.
4. Architecture Space: This learning space contains architecture related to specific subjects, allowing learners to visualize objects as close to reality as possible. Examples include the architecture of Wat Mahathat or Wat Chaiwatthanaram in Ayutthaya province.
5. Show Space: This space is intended for displaying the works of students and academics in the Thai MOOC project. Exhibitions are scheduled on a weekly or monthly basis and include art exhibits or exhibitions for both public and private sectors.
6. Joy Space (Café Space): This is a space for knowledge exchange, or a coffee corner, allowing instructors, learners, and general users to converse and share their experiences in learning on the ThaiMOOC platform. It also provides advice on career development, further studies, credit transfers, and applying acquired knowledge in daily life. This space is divided into smaller rooms, with five rooms accommodating up to 6 people and another five rooms accommodating 7 to 10 people.

Figure 2: The Six Types of Space Arrangements Within the Metaverse to Promote Collaborative Learning on the Thai MOOC Platform

Subsequently, the author conducted brainstorming sessions with nine experts in instructional design, metaverse applications, and content development regarding the "Model of Learning in the Metaverse" to promote collaborative learning on the Thai MOOC platform. The findings were categorized into three main points: 1) Components of the Metaverse, 2) Learning Process in the Metaverse, and 3) Concerns and Recommendations from the Experts.

1. Components of the Metaverse
    1) User Access to the Metaverse: Accessibility for users to enter and interact within the metaverse.
    2) Selection of Appropriate Platforms and Technology: Choosing suitable platforms and technologies for effective learning.
    3) Learner Motivation and Readiness: Learners are motivated, specific in their interest to learn, and have readiness in terms of accessibility.

4) Content and Subject Matter: Content should focus on subjects that have an impact on society and can expand collective knowledge.
5) Preparing Learners and Personnel: Prepare instructional designers and other personnel to support and expand learning through the ThaiMOOC platform. Most learners have some online learning experience, but preparation is needed for those new to the ThaiMOOC platform.
6) Instructor Assessment Skills: Instructors must have the skills to assess collaborative learning and teamwork among learners, designing evaluation processes to be conducted online. In some cases, practical assessments may need to be separated and conducted in a blended manner.
7) Adjust Visual and Language Elements: Remove arrows pointing to different components, and adjust symbols and icons to better align with the content, such as instructional strategies, tasks, and their implementation.
8) Task Assignments and Scheduling: Include a schedule of activities, duration of system use, and both synchronous and asynchronous collaboration formats.
9) Using Media and Technology for Collaboration: Use media and technology to support learners in working together, ensuring effective connectivity between technologies.
10) Implementing DNA (Device, Network, Application): Design the platform using DNA (Device, Network, Application) to ensure users are fully prepared and can access and use the platform seamlessly.
11) Use of Coins or Tokens for Rewards: Implementing a system of coins, tokens, or points as rewards for completing activities to motivate learners.
12) User-Friendly System Design: Design the system, content, and navigation so that users can easily access and use the system without confusion or losing their way.

2. Learning Process in the Metaverse
1) Orientation, Guidance, Preparation: Design effective orientations, guidance, preparation, immersion, and familiarization processes.
2) Readiness for Learning: Prepare learners with suitable equipment and ensure accessibility for learning.
3) Enhancing Learning Spaces: Adjust different learning spaces to create a more defined learning environment and set clear tasks with distinct starting and ending points that align with the various spaces.
4) Add English Terms in Processes: Include English terms in the learning process, such as "Formative Assessment" and "Summative Assessment," with additional explanations.
5) Examples of Reflective Practices: Provide examples of different ways to reflect on learning.

3. Concerns and Recommendations From Experts
1) Promote Events and Environment Design: Encourage the creation of events, such as simulations and learning activities with famous figures or influencers, to make the metaverse an integral part of users' lives. Design environments that make the metaverse feel like another social space that users interact with daily.
2) Platform Investment and Development: Consider why learners would want to spend time together on the platform, potentially including notification systems, creative outputs, and synchronized simulations. Setting shared tasks for target groups will be a key factor in ensuring the successful development of the metaverse.

3) Examples from Thai Studies: For a subject like Thai Studies, creating a metaverse where actors, influencers, or experts teach history, architecture, and art could increase interest in the metaverse.
4) Support and Funding from Universities: Support from universities through funding and promotion can help make the metaverse known, engaging, and foster greater interest, leading to increased participation and awareness.
5) Creating an Engaging Metaverse: Develop the metaverse to be beneficial and interesting to users, which will be another factor that promotes the effective use of the metaverse as part of the learning process.
6) Balanced Use of the Metaverse: Experts recommend that the use of the metaverse should be balanced. Excessive time spent by learners in the metaverse could have negative long-term effects on their well-being.

Based on the information provided, the author proposed a model of learning in the metaverse to promote collaborative learning on the Thai MOOC platform. This model includes components of the metaverse and the learning process within the metaverse, as detailed below.

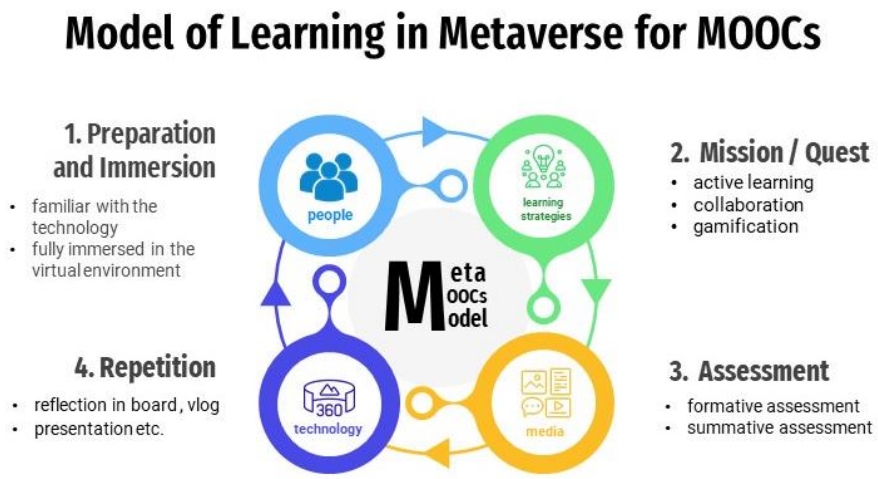

Figure 3: Model of Learning in Metaverse for MOOCs

Components of the Metaverse to Promote Collaborative Learning on the Thai MOOC Platform. The components of the metaverse include: 1) People, 2) Learning Strategies, 3) Media, and 4) Technology.

1. People: This includes instructors, instructional designers, learners, system administrators, system developers, and technical support personnel, all of whom need to be equipped with the necessary hardware and software to utilize metaverse technology effectively.
    1.1 Instructor: Responsible for delivering knowledge and experiences through various media, providing guidance, consulting, and assessing learners.
    1.2 Instructional Designer: Responsible for designing learning activities and creating an environment that facilitates learning.
    1.3 Learner: Learners must be prepared to access the internet and use metaverse technology to complete learning missions/quests, undergo assessment, and apply their knowledge through reflection.
    1.4 Administrator: Responsible for managing servers and ensuring the metaverse operates smoothly.

1.5 Developer: Develops learning environments in the metaverse and various media as defined and designed by instructors and instructional designers.

1.6 Technician Support: Provides guidance and support to personnel in using the technology.

2. Learning Strategies: These are methods and processes used to effectively manage learning through various instructional techniques. Learners can self-direct their learning, with instructors or instructional designers creating and facilitating learning activities that respond to different instructional formats—online, blended, and supplementary. Appropriate teaching methods and techniques are applied, such as Active Learning, Collaborative Learning, Gamification, Role-playing, and Simulation.
3. Media: The means used to convey content, information, knowledge, experiences, and messages from the instructor to the learner, enabling learning through various forms of media such as text, still images, animations, video clips, sound, multimedia, 360-degree images, 3D media or learning models, Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), and Extended Reality (XR).
4. Technology: Refers to tools that support instructional management, communication, learning management systems, and learning assessment. Examples include virtual classrooms or learning environments, social and collaborative tools to promote teamwork, social media like Facebook, Twitter, and LinkedIn, project management tools like Trello, Asana, and Basecamp, video conferencing platforms like Zoom, Meet, and Teams, and cloud file-sharing services like Dropbox, Google Drive, and OneDrive.

Learning Process in the Metaverse to Promote Collaborative Learning on the Thai MOOC Platform. The learning process in the metaverse consists of four steps: 1) Preparation and Immersion, 2) Mission/Quest, 3) Assessment, and 4) Repetition/Reflection. Each step is detailed as follows:

1. Preparation and Immersion: Learners should familiarize themselves with the technology and interfaces before entering the metaverse. This allows them to fully immerse themselves in the virtual environment to gain the maximum benefit from the metaverse experience.
2. Mission/Quest: Refers to tasks assigned to learners that must be completed to achieve goals within the virtual environment. These missions are designed to encourage learner participation and interaction, reflecting different scenarios. Missions play a key role in developing learners' knowledge and skills, often used in conjunction with instructional strategies like Active Learning, Collaborative Learning, and Gamification. Learners complete missions within the virtual spaces where instructors have designed the learning activities.
3. Assessment: Assessment should align with the learning objectives of the learners. It is divided into Formative Assessment—used to provide feedback, support, and opportunities for learners to review and make improvements—and Summative Assessment, which is conducted at the end of the learning process to evaluate knowledge and skills. Instructors can use technology to support assessment, such as automated grading, real-time interaction, and feedback for learners.
4. Repetition/Reflection: Learners review and reflect on their learning, expressing their understanding through various formats like journal entries, blogs, infographics, video vlogs, or other presentation formats. They can share and communicate their experiences through different forms of media.

Results and Discussion

Subsequently, the researcher presented The Learning Model in the Metaverse for Promoting Collaborative Learning on the Thai MOOC Platform to experts for evaluation. The results of the evaluation are shown in Table 2.

Table 2: Evaluation of the Learning Model in the Metaverse for Collaborative Learning on the Thai MOOC Platform

Evaluation Items	Mean	SD	Appropriateness Level
Components of the Metaverse			
1) People	4.57	0.53	very high
2) Learning Strategies	4.43	0.79	high
3) Media	4.71	0.49	very high
4) Technology	4.57	0.53	very high
Average	4.57	0.49	very high
The learning process			
1) Preparation and Immersion	4.57	0.53	very high
2) Mission / Quest	4.57	0.53	very high
3) Assessment	4.57	0.53	very high
4) Repetition/Reflection	4.57	0.79	very high
Average	4.57	0.51	very high
Overall Average	**4.43**	**0.53**	high

The overall evaluation of the learning model in the metaverse to promote collaborative learning on the Thai MOOC platform found that it was appropriate at a high level, with a mean of 4.43 and a standard deviation of 0.53. The average ratings for the components of the metaverse and the learning process in the metaverse were rated as very high, both with a mean of 4.57 and standard deviations of 0.49 and 0.51, respectively.

In considering the components of the metaverse, the media component was rated the highest in appropriateness, with a mean of 4.71 and a standard deviation of 0.49, indicating a very high level of appropriateness. This was followed by the People and technology components, both rated equally at a very high level, with a mean of 4.57 and a standard deviation of 0.53.

Regarding the learning process in the metaverse, all steps—including Preparation and Immersion, Mission/Quest, and Assessment—were rated equally at a very high level, with a mean of 4.57 and a standard deviation of 0.53 for each. The Repetition/Reflection step had a mean of 4.57 with a standard deviation of 0.79, also indicating a very high level of appropriateness.

The feedback from instructional designers highlights the importance of developing interactive and engaging learning spaces within the Metaverse, aligning with research that demonstrates how immersive technologies such as VR and AR can promote collaborative skills through realistic simulated environments (Kim et al., 2022; Hirsh-Pasek et al., 2022). Studies have shown that the Metaverse provides opportunities for learners to practice teamwork and critical thinking in a structured way, making learning experiences more impactful (Jeong et al., 2022). Additionally, researchers emphasize the integration of appropriate assessment tools within the Metaverse to ensure comprehensive evaluation of both knowledge and teamwork skills (Danylec et al., 2022; Pigultong, 2022). This feedback

from instructional designers reflects a future trend in education that leverages virtual technologies to create sustainable learning experiences, in line with the skills required for the 21st century.

Conclusion

This study indicated that the integration of the metaverse into the Thai MOOC platform significantly enhanced collaborative learning in immersive technologies such as VR, AR, and interactive 3D environments. The proposed learning model covered structured stages of preparation and immersion, mission/quest, assessment, and repetition/reflection, highly rated for effectiveness in fostering engagement and teamwork. The six specified virtual spaces further facilitate different learning interactions, from formal instruction to informal discussions and exhibitions. Expert assessments confirm the model's appropriateness, and media provides a much-needed enhancement in learning. However, ensuring accessibility, user engagement strategies, and institutional support guarantees that there are several concerns to be faced before its long-term success is ensured. This study, in the end, epitomizes the dimensions of metaverse that could revolutionize online education by making learning dynamic, collaborative, and adaptive to 21st-century digital advancement.

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