

# Metaverse Virtual Learning Management Based on Gamification Techniques Model to Enhance Total Experience

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## Abstract

This research aimed to develop metaverse virtual learning management based on gamification techniques model (MVLM-Gt model) and to evaluate the appropriateness of the model. The research methodology was divided into two parts in accordance with these aims. The first part was the design of the learning step using metaverse virtual learning management and gamification techniques based on the gamification process and active learning theory. The second part consisted of an evaluation of the appropriateness of the model. The MVLM-Gt model was submitted to seven experts followed by an appropriateness questionnaire. The MVLM-Gt model had four core components: the inputs, the learning process, the evaluation, and the feedback. The learning process had five steps: motivation and setting goals, constructing content, discussion and interaction, practice and mission, and summarizing and feedback. After evaluation of the appropriateness of the MVLM-Gt model, the experts said that it was excellent (Mean=4.82, S.D.=0.38). After considering each component, the feedback component had the highest appropriateness value (Mean=5.00, S.D.=0.00), followed by the learning process component (Mean= 4.86, S.D.=0.38), and the evaluation component (Mean=4.71, S.D.=0.49). The results showed that this MVLM-Gt model could be adopted to enhance total experience of students.

**Keywords:** gamification, metaverse, total experience, virtual learning management

## 1. Introduction

Nowadays, digital disruption influences the economy, society, and education. Thailand's Digital Government Development Plan (2020–2022) emphasizes the importance of education to keep up with this disruption by preparing human resources with digital skills and new perspectives. The perspective is a belief in developing dynamic capabilities through learning to prepare for future digital technology progression (Digital Government Development Agency [DGA], 2020). In addition, the Ministry of Education's Strategic Action Plan (2020-2022) regarding the promotion and development of the educational technology system aims to increase learning channels by using digital technology in the instruction process. These learning channels will familiar students with digital technology, enhance their abilities, create learning platforms, and encourage them to use digital technology as a learning tool. The learning process section of the plan focuses on the essential skills for the 21st-century related to age group (Office of the Permanent Secretary Ministry of Education, 2020). However, the COVID-19 pandemic has affected education and schools have had to manage teaching practices, reduce regular classes and increase social distancing. Therefore, the need for digital technology in educational management has become more urgent. Virtual learning management is learning management that combines knowledge with learning innovations and modern technologies in various styles. It is a tool that makes the learning process more student-centered, innovative, and flexible. Moreover, it is a learning experience in synchronous or asynchronous environments using devices with internet access. Students can learn and interact with teachers and other students from anywhere and at any time (Dhawan, 2020). It is also a method of conveying content, including images, videos, and various multimedia and facilitating discussion using electronic devices, platforms, and modern technology. Students are able to access different learning resources (Wayo, Charoennukul, Kankaynat, & Konyai, 2020). The metaverse is actually a space which allows people to interact and participate in activities together, both virtual and non-virtual, in various aspects including politics, economy, society, and culture. An avatar can be used for meetings, teaching, and to visit exhibitions. The avatar is a representative to each person who carries out an activity in the metaverse. It

uses various by technologies and devices in a virtual world, known as Augmented Reality (AR) and Virtual Reality (VR) (Suh & Ahn, 2022). The metaverse can be used for instruction and skills training as a network of connected experiences and applications, devices, tools, and infrastructure to create a learning environment for interaction, entertainment, motivation, curiosity, and self-expression (Khansulivong, Wicha, & Temdee, 2022). Students use avatars adapted to their personalities in new situations. Gamification is the adoption of elements used in gaming, and the styles and concepts that can be applied in a range of situations and contexts. It encourages and improves the motivation and participation of students by adopting of the motivation techniques used in games playing to achieve educational objectives (Yamani, 2021). Using gamification concepts in instruction engages students and helps them to learn through their efforts to obtain a specific goal. Most gamification is in the style of simulations which allows the students to play and learn simultaneously. Students enjoy the gaming experience which encourages them to learn further (Boyinbode, 2018). The concept of a total educational experience that is applied and developed is based on Gartner's concept of creating an excellent experience for students. Moreover, the total educational experience focuses on creating learning experiences that can be accessed at any time and from anywhere. This includes integrating materials and technology, access to learning resources, interactions between learners and learners and learners with teacher, learning by doing, supporting and helping each other, and recognizing the benefits of these learning experiences. The information mentioned previously indicates the importance of and necessity for developing the MVLM-Gt model to support instruction in the "new normal" society. Moreover, the MVLM-Gt model helps to develop skills for the 21st-century. It reduces learning problems or restrictions related to location and time, creates new learning experiences, and uses technology that helps students enjoy learning.

### *1.1 Research Objectives*

- 1) To develop a metaverse virtual learning management based on gamification techniques model.
- 2) To evaluate the appropriateness of the development of a metaverse virtual learning management based on gamification techniques model.

### *1.2 Research Hypothesis*

The MVLM-Gt model should be evaluated by experts and get a rating of "good".

### *1.3 Expected Results*

- 1) The metaverse virtual learning management based on gamification techniques model will be designed.
- 2) Guidelines for applying the metaverse virtual learning management based on gamification techniques model for designing instruction styles in other contexts will be provided.
- 3) A master model to increase students' digital technology capabilities for the 21st-century and the "new normal" will be designed.

### *1.4 Scope of the Research*

For the learning model, the population is a group of experts in the field of learning models, educational evaluation, and metaverse technology. The sample consists of a group of seven experts chosen by purposive sampling: three experts graduated with a doctoral degree and have at least five years teaching experience, two are experts in educational evaluation who graduated with a doctoral degree and have at least five years' experience, and two are experts in metaverse technology with at least five years' experience. Then, the independent variable is the MVLM-Gt model. The dependent variable is the result of the appropriateness of the MVLM-Gt model as assessed by experts. The instruments of the research are the MVLM-Gt model and the questionnaire about the appropriateness of the MVLM-Gt model. The data was collected from the questionnaire about the MVLM-Gt model. It was evaluated by three experts in developing learning models, two experts in educational evaluation, and two experts in metaverse technology. In addition, the results were analyzed and by the Standard Deviation (SD) and average values applied.

## **2. Literature Review**

### *2.1 Gamification*

Gamification is the concept of using elements of game playing but in a non-game context, such as education. It can help to improve the experience of learning and motivate students to continue learning (Boyinbode, 2018). Gamification refers to the use of game mechanics to encourage learners to concentrate on non-gaming activities. Many games consist of various game mechanics and other stimuli. Gamification is the application of such mechanisms to encourage learners to concentrate (Werbach & Hunter, 2012). Gamification consists of two components: the first is the game mechanics, and the second is the game dynamics. Each component contains

several sub-elements as follows: the game mechanics has six elements, which are points, levels, challenges, virtual goods and spaces, leaderboards, and gifts and charity. The game dynamics has six elements: reward, status, achievement, self-expression, competition, and altruism (Bunchball, 2010). The process of applying gamification in education consists of five steps: identify the target group and the content, setting the objectives, organizing the learning experience structure, defining the educational resources, and applying the game mechanics (Hsin-Yuan & Soman, 2013). Therefore, gamification refers to the application of game mechanics, game dynamics in a non-game context, and game components to create a learning environment for learners that motivates and encourages them to continue learning. Before adopting gamification in education and defining the mechanics, the target learners should be analyzed, the content and learning objectives should be set and the learning experience structured.

### 2.2 Metaverse

The Metaverse is concept taken from the science fiction novel, *Snow Crash*. It is a combination of Meta and Verse, from the universe. The universe is a place beyond imagination, where users in the form of avatars can interact with each other in a virtual space (Duan, Li, Fan, Lin, Wu, & Cai, 2021). The metaverse is an immersive digital environment in which people can create their own avatar and engage and interact in activities with others (Suh & Ahn, 2022). Users create an avatar to represent who they are and to carry out activities in a virtual world by using technologies and devices such as AR and VR. The metaverse is a blended innovation of various technologies and features, including AR, AR Cloud, Internet of Things, 5G technology, Artificial Intelligence (AI), and spatial technology (Gartner, 2022). The COVID-19 pandemic has made teaching in a regular classroom problematic. So, the metaverse has been use instead as a new social communication space. It is a virtual space which allows for a high degree of freedom to create and share learning activities and where learners can immerse themselves. It is a new experience which can be more advantageous than face-to-face learning (Kye, Han, Kim, Park, & Jo, 2021). The metaverse is where the real world environment is combined with technology to create a virtual world community by using AR and VR. The metaverse can easily be used to simulate a range of different places and connections in various formats.

### 2.3 Total Experience

Total Experience is an experience that combines a range of experiences, such as, customer experience, employee experience, and user experience and which can transform business outcomes. The goal is to develop the overall experience. Each experience – technology, employee, customer, and user – is connected to create a sustainable competitive advantage. This can enable organizations to take advantage of remote working, mobile working, and virtual and distributed customers (Panetta, 2020). The next generation of experiences to be designed will include the experiences of customers and employees. In the age of social distancing, design that helps service providers to keep their business going is essential (Ruangdej, 2020). Therefore, the total experience will combine a variety of experiences, including customers, employee, and user. The technology can be used to improve results and experiences for everyone involving customers, users, and employees. However, this research focuses on the total experience in education that has been applied and developed based on Gartner's concept of creating a total excellent experience for students. It focuses on creating learning experiences and resources that can be accessed from anywhere at any time and on integrating materials and technology, creating interactions between learners and learners and learners with teachers, learning by doing, supporting, and helping each other.

### 2.4 Virtual Learning Management

Virtual learning management is a tool that is used to make the teaching process more student-centered, innovative, and flexible. It is a learning experience in synchronous or asynchronous environment using devices with internet access. In these environments, students can learn from anywhere and at any time and interact with teachers and other students (Dhawan, 2020). Virtual learning management has five components: learners, content, environment, application, and support (Rodriguez, 2021). It integrates knowledge with learning innovations and modern technologies. There are a variety of learning styles that are student-centered, innovative, and more flexible when using learning platforms and devices with internet access. When learner can learn and interact with teachers and other learners at any time and from anywhere it increases educational opportunities.

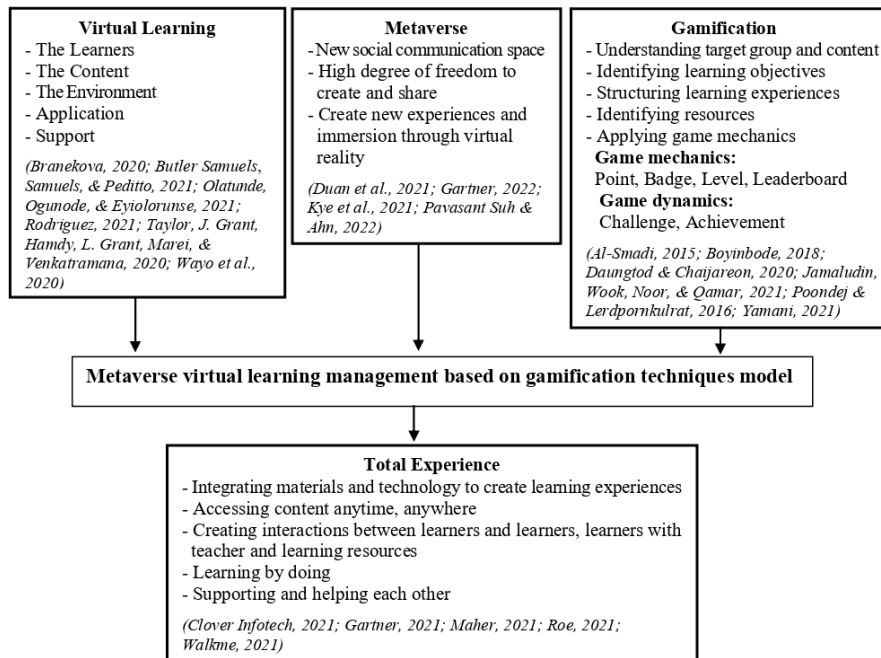


Figure 1. Conceptual framework

### 3. Research Methodology

The research is divided into two phases as follows:

Phase 1: The development of the MVLM-Gt model by analyzing and synthesizing 17 documents, including articles and research related to virtual learning management, the metaverse, gamification, and total experience published from 2015 to 2022. This includes the following steps:

- Step 1. Synthesizing the elements of virtual learning management.
- Step 2. Synthesizing the elements of gamification.
- Step 3. Synthesize the features of total experience.
- Step 4. Designing the MVLM-Gt model as follows:

- 1) The study, analysis, and synthesis of the concepts, and literature related to the meaning, elements, and details of virtual learning management, the metaverse, gamification, and the total experience.
- 2) The design of a draft version of the MVLM-Gt model to enhance total experience. The model consists of four main components: the inputs, the metaverse learning management based on gamification techniques process, the evaluation, and the feedback.
- 3) Proposal of the model to an advisor recommendations and revision.

Phase 2: The evaluation of the appropriateness of the MVLM-Gt model as follows:

- 1) The creation of a 5-point Likert scale questionnaire about the appropriateness of the MVLM-Gt model. The questionnaire consists of four main components and 20 elements of the inputs, the metaverse learning management based on gamification techniques process, the evaluation, and the feedback. Then, the analysis of the results by applying Standard Deviation (SD) and average values.
- 2) The evaluate of the MVLM-Gt model by seven experts, divided into groups: three experts in the learning model, two experts in educational evaluation, and two experts in metaverse technology.

### 4. Results

Phase 1: The results of the development the MVLM-Gt model in terms of enhancing total experiences are as follows:

The synthesis of the virtual learning management elements with content analysis techniques from articles and

research papers (Branekova, 2020; Butler Samuels et al., 2021; Olatunde et al., 2021; Rodriguez, 2021; Taylor et al., 2020; Wayo et al., 2020). This consists of five elements as shown in Table 1.

Table 1. Synthesis of the elements of virtual learning management

Elements of Virtual Learning Management	(Branekova, 2020)	(Butler Samuels et al., 2021)	(Olatunde et al., 2021)	(Rodriguez, 2021)	(Taylor et al., 2020)	(Wayo et al., 2020)
The Learners	✓	✓	✓	✓	✓	✓
The Content	✓	✓	✓	✓	✓	✓
The Environment	✓	✓	✓	✓	✓	✓
Application	✓	✓	✓	✓	✓	✓
Support	✓	✓	✓	✓	✓	✓

Table 1 shows that the virtual learning management consists of five elements: learners, contents, environment, application, and support. The details for each element are as follows:

- 1) The learners are the receivers of content and knowledge. They must be ready to use information technology, be media literate, be able to search and analyze data, and systematically evaluate content.
- 2) The content is structured according to learning objectives which are clear, concise, easy to understand, and up-to-date.
- 3) The environment involves developing an environment that supports and facilitates learning and improves skills by using technology tools such as blended learning, simulation-based learning, augmented reality, and gamification platform.
- 4) The application involves providing opportunities for learners to apply their understanding of the content and skills in various activities. The activities must include the construction of knowledge, the development of skills, feedback, using a virtual platform, and developing content proficiency at a higher level.
- 5) Support is the learning support provided during and after learning as forums, learning groups, web discussions, face-to-face meetings, online friends, expert advice, technology, materials, software, and platforms.

The synthesis of the gamification elements with content analysis techniques from articles and research papers (Al-Smadi, 2015; Boyinbode, 2018; Daungtod et al., 2020; Jamaludin et al., 2021; Poondej et al., 2016; Yamani, 2021). This consists of two main elements and eleven sub-elements as shown in Table 2.

Table 2. Synthesis of the elements of gamification

Elements of Gamification	(Al-Smadi, 2015)	(Boyinbode, 2018)	(Daungtod et al., 2020)	(Jamaludin et al., 2021)	(Poondej et al., 2016)	(Yamani, 2021)
Game Mechanics	✓	✓	✓	✓	✓	✓
Points	✓	✓	✓	✓	✓	✓
Levels	✓	✓	✓	✓	✓	✓
Challenges	✓	✓	✓	✓	✓	✓
Virtual goods and spaces	✓	✓	✓	✓	✓	✓
Leaderboards	✓	✓	✓	✓	✓	✓
Game Dynamics	✓	✓	✓	✓	✓	✓
Reward	✓	✓	✓	✓	✓	✓
Status	✓	✓	✓	✓	✓	✓

Achievement	✓	✓	✓	✓	✓
Competition	✓	✓	✓	✓	✓
Badges	✓	✓	✓	✓	✓

Table 2 indicates that gamification consists of game mechanics (points, levels, challenges, virtual goods and spaces, and leaderboards) and game dynamics (reward, status, achievement, competition, and badges).

The synthesis of the total experience features with content analysis techniques are from articles and papers (Clover Infotech, 2021; Gartner, 2022; Maher, 2021; Roe, 2021; Walkme, 2021). This consists of six features as shown in Table 3.

Table 3. Synthesis of the features of total experience

Features of Total Experience	(Clover Infotech, 2021)	(Gartner, 2022)	(Maher, 2021)	(Roe, 2021)	(Walkme, 2021)
Integrating materials and technology to create experiences	✓	✓	✓	✓	✓
Creating an internal and external integrated approach	✓	✓	✓	✓	✓
Using technology and interactions to empower and encourage	✓	✓	✓	✓	✓
Using well-designed tools to provide the best experience across all channels and touchpoints	✓	✓	✓	✓	✓
Using different formats, digital touchpoints, applications, and devices to design and develop seamless experiences	✓	✓	✓	✓	✓
Creating an environment that is accessible anywhere, anytime	✓	✓	✓	✓	✓
Creating interactions with each other and opportunities to learn together	✓	✓	✓	✓	✓
Building trust and open communication		✓	✓	✓	
Learning by doing	✓	✓	✓	✓	✓
Supporting and helping each other	✓	✓	✓	✓	✓
Recognizing the benefits of learning experiences	✓	✓	✓	✓	✓
Combining a variety of experiences	✓	✓	✓	✓	✓
Combining a variety of experiences; customer experience, staff experience, user experience	✓	✓	✓	✓	✓
Accessing experiences in multi-channel	✓	✓	✓	✓	✓
Creating enjoyable experiences and promoting positive relationships	✓	✓	✓	✓	✓
Creating a superior experience by working together	✓	✓	✓	✓	✓

Table 3 indicates that the total experience consists of integrating materials and technology to create learning experiences, accessing content anytime and anywhere, creating interactions between learners and learners and learners with teacher and learning resources, learning by doing, supporting and helping each other, and recognizing the benefits of learning experiences.

The design of the MVLM-Gt model.

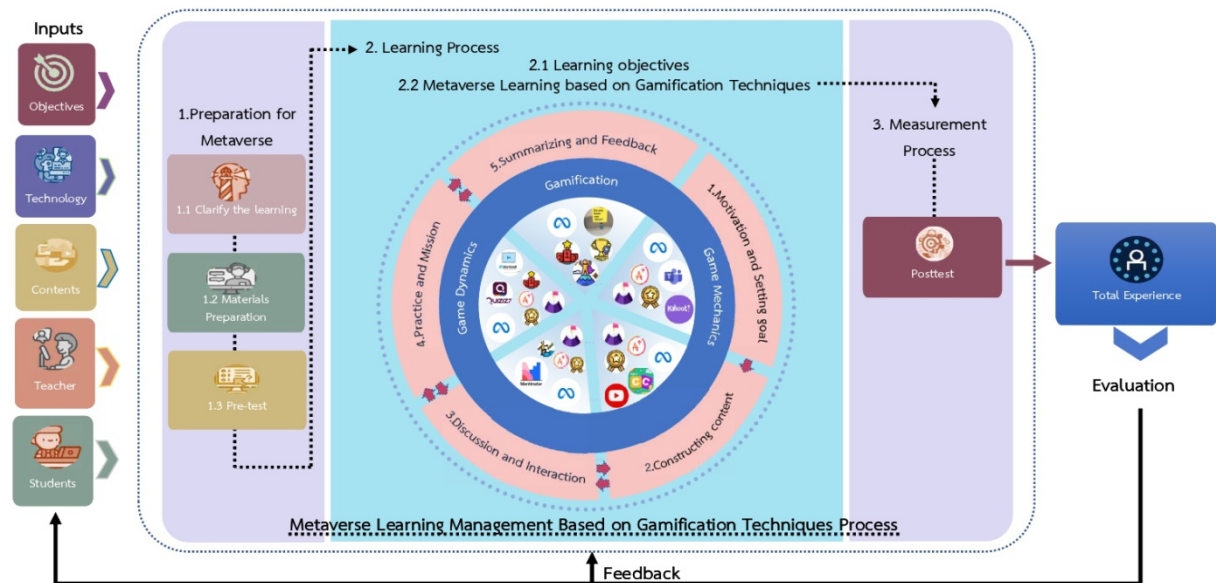


Figure 2. Overview of MVLM-Gt model

Figure 2 shows the components of the MVLM-Gt model which can be divided into four components. The components detailed in the following paragraphs.

1) The inputs consist of five elements.

- a) The objectives are determined from the content and knowledge in each unit and can be evaluated.
- b) Technology is required in the form of computers, laptops, iPads or tablets (with a camera and microphone).
- c) The content relates to the Basic Education Core Curriculum, (Ministry of Education).
- d) Teachers can use the metaverse through the spatial.io application.
- e) Students should be skilled in using computers and the internet for communication.

2) The Metaverse Learning Management Based on Gamification Techniques process consists of three steps.

2.1) Preparation for metaverse learning consists of three sub-steps as follows.

- a) Clarifying the learning. This introduces the learning model, the instruction style, rules, etiquette, how to ask for help, advice, and any of the other necessary information that students need to know through the Microsoft Teams platform.
- b) Materials preparation. This is where the students materials are prepared and where students familiarize themselves with them. The teachers also need to prepare learning resources, testing the links, videos, and all other media.
- c) The pre-test step. This is where students content knowledge is tested and where they self-assess the total experience before learning with the MVLM-Gt model through the Microsoft Teams platform.

2.2) The learning process consists of two sub-steps as follows:

- a) Learning objectives. This is where the learning objectives and learning content, learning activities, and measurement and assessment are identified.
- b) The metaverse learning based on gamification techniques consists of five steps. Each step has two elements – learning management tools and gamification techniques (game mechanics and game dynamics).

Step 1: Motivation and setting goals. This is where the metaverse platform features are explained. Students need to learn from their devices by using Microsoft Teams platform. They create an avatar in the metaverse platform and are introduced to the gamified symbols they will receive when completing missions or conditions. In this step, the Kahoot application will apply to students' motivation.

Step 2: Constructing the content. This is where student knowledge of content and skills is built using various functions of the metaverse platform. Students study the content from the learning resources, the OBEC Content

Center platform, and the YouTube platform in the exhibition room. They are able to study all contents in the exhibition room continuously. In this step, self-study missions are given out and presented to the group. Furthermore, students will receive points or badges when they complete each mission or task.

Step 3: Discussion and interaction. This is where students are given the opportunities to ask questions after they have been through the previous step. They can share their problems or knowledge with a teacher and other students. Small group discussions about research missions will be presented in the auditorium in the metaverse platform. The Mentimeter application will be applied to encourage participation in the discussion. Here students can receive points and badges at the end of the missions they complete. The teacher can present a leaderboard to stimulate further learning challenges.

Step 4: Practice and mission. This is where the tasks are assigned to students to practice the skills they have learned in the previous step. Students can access a meeting room in the metaverse platform where they can complete their worksheets, online quizzes in the Quizizz application, and activities in the Wordwall application. Missions can be controlled to allow students to choose conditions such as single, duo, and group. In this step, the teachers provide points, badges, special prizes, and a summary of the leaderboard.

Step 5: Summarizing and feedback. This is where the learning process is summarized. Students will have the opportunity to reflect on content, skills, procedures, and learning styles in the exhibition room in the metaverse platform. In addition, the Sticky note function will be applied to reflect students' ideas. The teacher can summarize the leaderboard and awards can be given to students based on their individual conditions.

It is here that the teacher can return to the previous steps of constructing content, discussion and interaction, or practice and mission, if students are unclear about what to do or if they do not understand the content. Therefore, the teacher can repeat the explanation or allow students to practice more until they achieve the objectives.

2.3) The measurement process is a post-test step to measure students' content knowledge after learning with the MVLM-Gt model.

3) Evaluation is where the students' total experience using the MVLM-Gt model is evaluated.

4) Feedback has two components: 1) feedback to the inputs, and 2) feedback to the learning process. At this stage, the information and results from the students' questionnaires, expert opinion, and learning process outcomes will be used for further improvement of the system.

Phase 2: The appropriateness evaluation results of the MVLM-Gt model by seven experts in terms of enhancing total experiences is shown in Table 4.

Table 4. The Appropriateness of the MVLM-Gt model in each component

Description	Result		Appropriateness
	Mean	S.D.	
Inputs	4.69	0.47	Excellent
1. Objectives	4.71	0.49	Excellent
2. Technology	4.71	0.49	Excellent
3. Contents	4.71	0.49	Excellent
4. Teacher	4.57	0.53	Excellent
5. Students	4.71	0.49	Excellent
Metaverse Learning Management Based on Gamification Techniques Process	4.86	0.38	Excellent
1. Preparation for metaverse learning	4.71	0.49	Excellent
1.1 Clarify the learning	4.86	0.38	Excellent
1.2 Materials preparation	4.86	0.38	Excellent
1.3 Pre-test	5.00	0.00	Excellent
2. Learning process	4.86	0.38	Excellent
2.1 Learning objectives	5.00	0.00	Excellent
2.2 Metaverse learning based on gamification techniques	4.86	0.38	Excellent
a. Motivation and setting goals	4.86	0.38	Excellent
b. Construct content	4.71	0.49	Excellent
c. Discussion and interaction	4.71	0.49	Excellent
d. Practice and mission	4.71	0.49	Excellent
e. Summarize and feedback	5.00	0.00	Excellent



2.3 Measurement process	5.00	0.00	<i>Excellent</i>
a. Posttest	4.71	0.49	<i>Excellent</i>
Evaluation	4.71	0.49	<i>Excellent</i>
Evaluation of student total experience	4.71	0.49	<i>Excellent</i>
Feedback	5.00	0.00	<i>Excellent</i>
1. Feedback on the inputs	5.00	0.00	<i>Excellent</i>
2. Feedback on the learning process	5.00	0.00	<i>Excellent</i>
<i>Overall</i>	<i>4.82</i>	<i>0.38</i>	<i>Excellent</i>

Table 4 indicates the appropriateness of the MVLM-Gt model to enhance the total experience. The experts commented that the appropriateness overall was excellent (Mean= 4.82, S.D.=0.38). When considering each component, the feedback component had the highest appropriateness value (Mean=.00, S.D.=0.00), followed by the learning process (Mean= 4.86, S.D.= 0.38), and the evaluation component (Mean= 4.71, S.D.=0.49).

## 5. Conclusion and Discussion

The MVLM-Gt model has four core components: the first is inputs, the second is metaverse learning management based on gamification techniques process, the third is an evaluation, and the fourth is feedback. Each component contains details of the sub-elements as follows: the inputs have five components: objectives, technology, content, teacher and students. The metaverse learning management based on gamification techniques process has three components: preparation for metaverse learning, learning process, and measurement process. The preparation for metaverse learning has three components: clarifying the learning, materials preparation, and pre-test. The learning process has three components: learning objectives, metaverse learning based on gamification techniques, and measurement process. The metaverse learning based on gamification techniques has five steps: motivation and setting goals, constructing content, discussion and interaction, practice and mission, and summarizing and feedback. The measurement process has a post-test element. The evaluation has one component – the evaluation of the student total experience. Feedback has two components: feedback to the inputs and feedback to the learning process. After evaluation of the appropriateness of the MVLM-Gt model to enhance total experience, the experts commented that overall, it was excellent (Mean=4.82, S.D.=0.38). After considering each component, the feedback component had the highest appropriateness value (Mean= 5.00, S.D.=0.00), followed by the learning process (Mean=4.86, S.D.=0.38), and the evaluation (Mean=4.71, S.D.=0.49). The results show that this MVLM-Gt model could be used to enhance the total experience of students.

The researcher developed the learning process according to gamification process and active learning theory. It consists of five steps: motivation and setting goal, constructing content, discussion and interaction, practice and mission, and summarizing and feedback. The gamification process and active learning theory focus on the learning process rather than the content. This could help learners to construct their own understanding and knowledge by using the materials or learning activities. It relates to the work of Teemuangjai (2018) who studied a learning model for online gamification of collaborative learning. The findings from the research are that the learning model is excellent. Therefore, it could be adopted as a model for developing a learning tool. The learning process using online gamification techniques could encourage learners to concentrate on their learning activities, whilst having fun and working together. Yuengklang, Phuseerit, and Hoksuan (2019) researched the development of a blended learning system in primary schools that used gamification-based learning to enhance learners' mathematics problem-solving skills and real-life connection skills. The findings showed that the learning system was excellent. Therefore, it could be used to teach primary learners. In addition, the researcher applied the metaverse, a new technology, in a virtual learning process. The experts evaluated the appropriateness of the virtual learning process as excellent.

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