

The Project-based Learning: PjBL via Brainstorming with Metaverse to Promote Multimedia Production Skills

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Abstract

The design of the project-based learning, or PjBL, via brainstorming with metaverse to promote multimedia production skills is based on the integration of the concepts of project-based learning processes via brainstorming with virtual world technologies for use in the instruction management. Thereby, the instruction management in this way is said to develop learners' multimedia production skills as it encourages them to search for knowledge on their own, which shall also enable them to increase knowledge from practices and enhance necessary skills for the 21st century learners. The objectives of this research are (1) to study and synthesize the learning process the PjBL via brainstorming with metaverse, (2) to design the PjBL via brainstorming model with metaverse, and (3) to study the results of the design of the PjBL via brainstorming model with metaverse. The results of this research show that (1) the overall suitability of the design of the PjBL via brainstorming model with metaverse is at highest level (Mean = 4.62, SD. = 0.47), and (2) the overall suitability of the elements of the PjBL via brainstorming model with metaverse is at highest level (Mean = 4.75, SD. = 0.36).

Keywords: project-based learning, brainstorming, metaverse, multimedia production skills

1. Introduction

The time with the outbreak of the COVID-19 is considered such a difficult period that it was affecting people all over the world, and it was seen as great challenges for every sector to cope with so that businesses and operations of all sections could go on (Fakcharoenphol et al., 2020). The COVID-19 pandemic has also greatly affected education systems since there were more than 1.5 billion students, or over 90 percent of all, inflicted by such deadly disease. Owing to the urgent measures launched by many governments to prevent the spread of the virus at that time, i.e., semi-lockdown and social distancing (Vanichanan, 2020), most learners missed the opportunities to learn. For this reason, the use of learning technologies that are consistent with such adverse situation is considered an urgent need so that learners are always well prepared for self-learning.

Vocational certificate program (B.E. 2562) is a post-secondary school curriculum, or equivalent, which was established to provide vocational education at the vocational certificate level, and meanwhile, to elevate the individuals' vocational education to be in line with the National Economic and Social Development Plan, the National Education Plan, the National Qualifications Framework, the national educational standards, the National Vocational Qualifications Framework, and the career standards. Whereby, the emphasis is placed on learning to practice with an aim to increase the competencies of skilled personnel together with morals, ethics, professional ethics, and appropriate work habits, in such a way that these skilled personnel can satisfy the workforce demand in the labor market, communities, societies and be able to do self-employment. At the meantime, learners must be able to choose appropriate learning systems and methods according to their potential, their interests, and opportunities in hand. In addition, it is necessary to promote the cooperation in terms of education management and joint curriculum development among educational institutions, workplaces, agencies, and organizations at community level, local level, and national level (Office of the Vocational Education Commission, 2019; Office of the National Economic and Social Development Council, 2023).

Project-based learning (PjBL) is a learning management process that focuses mainly on learners, encouraging them do all practices ranging from doing the survey, making learning plans, designing their learning, and applying the bodies of knowledge derived therefrom to evaluate their own works (Nilsook, Chatwattana & Seechaliao, 2021; Dole, Bloom & Doss, 2016). The roles of instructors are to facilitate or give advice to help

learners complete their projects. In addition, the project-based learning also emphasizes the learning styles that allow learners to gain life experiences while developing different skills in consistence with the 6 stages of cognitive development of Bloom (2001), i.e., remember, understand, apply, analyze, evaluate, and create, respectively.

The project-based learning management is a policy of instruction management for vocational and technical education in Thailand. The graduates are required to create inventions and innovations in their projects while learning the skills related to communication, critical thinking, creative thinking, and collaboration (Nilsook, Chatwattana & Seechaliao, 2021). Besides, the graduates are expected to know how to make working plans, practice leadership skills, and develop thinking processes, especially those concerning advanced thinking and self-assessment. Meanwhile, the instructors are responsible for stimulating learners to search for knowledge by themselves based on their own interest. This method shall enable learners to increase their knowledge derived from practices, and develop necessary skills for the 21st century learners (Wanglang & Chatwattana, 2023).

Brainstorming is the most important strategy to arouse creativity and problem solving. Brainstorming refers to the use of human's brain to solve problems by looking for the original solutions that have never been known before. The said solutions can be found by connecting and expanding the scopes of knowledge by means of brainstorming from every perspective without judging whether it is right or wrong. This is all to find out the alternatives for making decisions in order to generate new ideas that can be employed in planning as efficiently as possible (Abdullahi, 2015).

Kongpha & Chatwattana (2023) stated that metaverse is a virtual environment in the digital space, which is created to allow people to interact with one another through their 3D avatars. With the aid of some technologies and accessories, people are able to do many activities in metaverse through virtual community (Suzuki et al., 2020). Thus, metaverse is not limited to any one world or universe, but it can be anything generated from the technologies that connect people and allow them to communicate and do activities together.

According to the aforementioned principles and theories, the researchers have had an idea to design the project-based learning via brainstorming with metaverse for use as a guideline to develop the instruction management designated for learners in vocational education in Thailand. It is believed that this kind of instruction management can encourage learners to learn by their own after doing practices in the project-based learning process because they have to do brainstorming in every aspect so as to find out the brand-new ideas that can be further put in the planning.

2. Research Objectives and Hypotheses

- 1) To study and synthesize the learning process the PjBL via brainstorming with metaverse to promote multimedia production skills
- 2) To design the PjBL via brainstorming model with metaverse to promote multimedia production skills
- 3) To study the results of the design PjBL via brainstorming model with metaverse to promote multimedia production skills

According to the results of evaluation on the suitability of the design PjBL via brainstorming model with metaverse to promote multimedia production skills is at high level.

3. Research Methodology

This research is related to the design of the PjBL via brainstorming with metaverse, and the research methodology is as follows.

3.1 Participants

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

3.2 Research Instruments and Statistics Used In Data Analysis

The tools employed in this research consist of (1) the PjBL via brainstorming model with metaverse, and (2) the evaluation form on the suitability of the PjBL via brainstorming model with metaverse to promote multimedia production skills. The statistics used for data analysis are mean and standard deviation.

3.3 Research Methodology

The research methodology designated to design this model is based on the system approach (Khemmani, 2010; Utranan, 1982), and design and development process using SDLC techniques (Robert et al., 2013), which can be divided into 3 stages as shown in Figure 1.

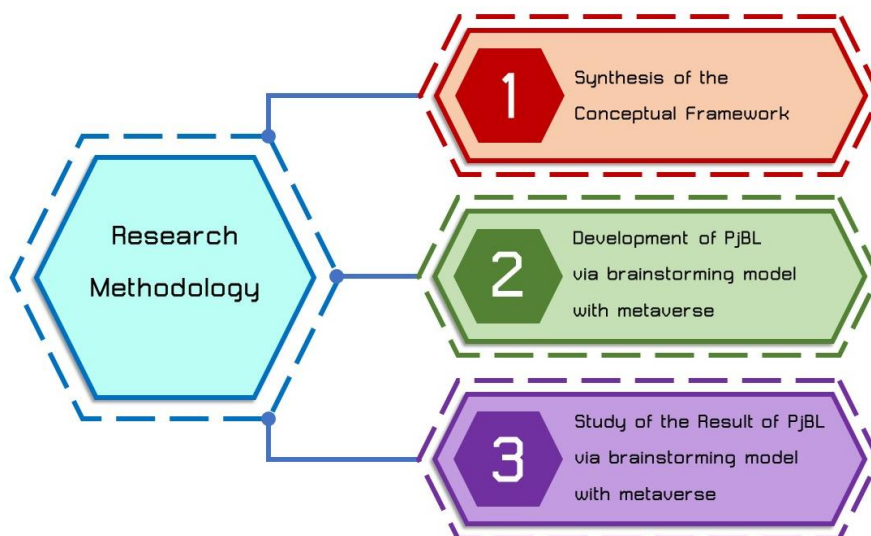


Figure 1. Research methodology

Stage 1: Study, analysis, and synthesis of the documents and the researches relevant to the design the PjBL via brainstorming with 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 vocational certificate program B.E. 2562, project-based leaning, brainstorm, metaverse, and multimedia production skills.

Stage 2: Design of the PjBL via brainstorming model with metaverse. In this stage, the researchers based the design and the development of this architecture on the principles of system approach and design and development process using SDLC techniques.

Stage 3: Study the results of the PjBL via brainstorming model with metaverse. The researchers employed the research tools to find out the results after having the participants use the said architecture. There are 7 participants in this research who were derived by means of purposive sampling. All of them are the experts from different institutions, who are specialized in design and development of instruction models and 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 PjBL via brainstorming model with metaverse to promote multimedia production skills can be summarized as follows:

4.1 Results of the Synthesis of the Learning Process of the PjBL via Brainstorming with Metaverse

After the study, analysis, and synthesis of the documents and the researches relevant to the design the PjBL via brainstorming with metaverse, especially in terms of vocational certificate program B.E. 2562, project-based leaning, brainstorm, metaverse, and multimedia production skills, the researchers obtained the conceptual framework of this research as shown in Figure 2.

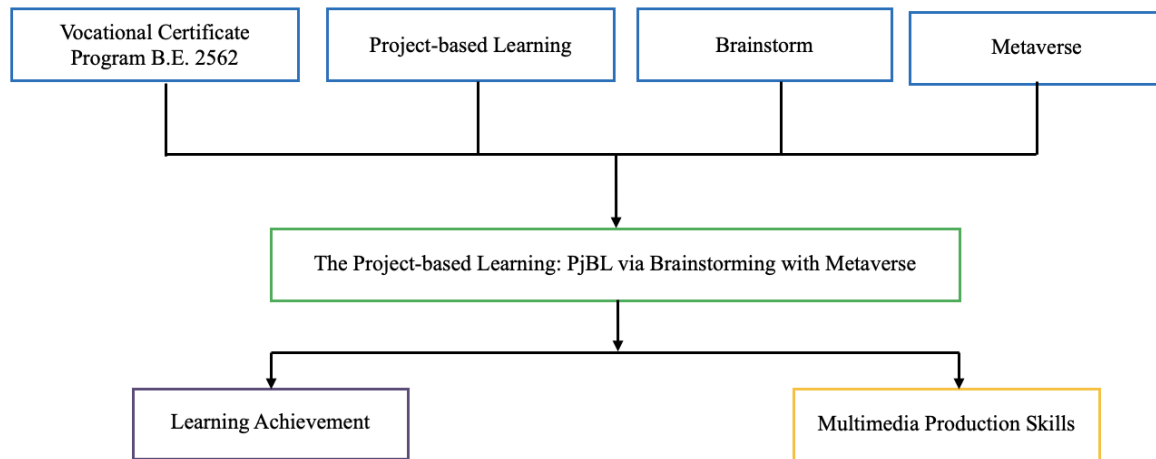


Figure 2. Conceptual framework of the PjBL via brainstorming with metaverse

4.2 Results of the Design of the PjBL via Brainstorming Model with Metaverse

In order to design the PjBL via brainstorming model with metaverse to promote multimedia production skills, the researchers applied the principles of a system approach integrated with the principles of SDLC (Robert et al., 2013). In addition, the 4 steps of project-based learning process and the 5 steps of brainstorming were also applied in combination in the design and the development of this model, as illustrated in Figure 3.

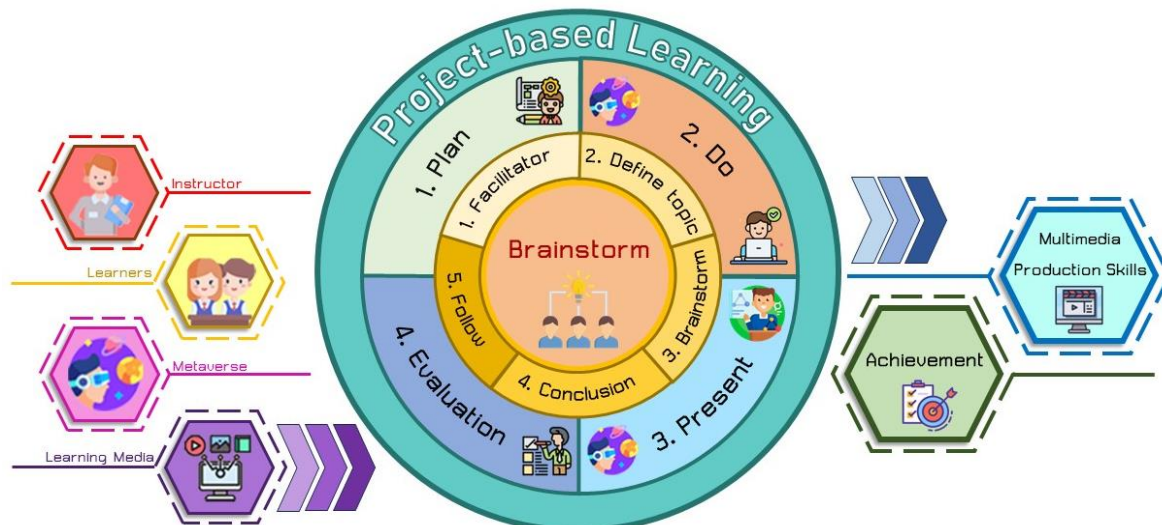


Figure 3. The project-based learning: PjBL via brainstorming model with metaverse

Figure 3 represents the PjBL via brainstorming model with metaverse to promote multimedia production skills, which consists of 4 main elements as follows:

1. Input factor: This element refers to the environment and the sub-elements involved in the design and the development of the PjBL via brainstorming model with metaverse, which include instructor, learners, metaverse, and learning media.

2. Learning process using the PjBL via brainstorming model with metaverse: This is the learning process initiated from the integration of several steps in project-based learning process and collaborative brainstorming with metaverse. It is said that the learning process of this kind can promote learners to enhance their multimedia production skills. The details of the learning process using the PjBL via brainstorming model with metaverse are as below:

- 2.1 Project-based learning is an activity that teaches learners how to do projects, take action to develop their knowledge and skills, and eventually create quality products. The main purpose of the

project-based learning is to encourage learners to observe, ask questions, make assumptions, seek knowledge by themselves in order to find out the answers of the questions they are interested in, summarize and understand the findings. The project-based learning management process consists of 4 steps, i.e., plan, action, present, and evaluate, respectively.

- 2.2 Brainstorm refers to an attempt to collect ideas from every perspective without judging whether it is right or wrong in order to find alternatives in decision making and new ideas that can be put in planning as efficiently as possible. Brainstorming includes 5 steps, which are facilitator, define topic, brainstorm, conclusion, and follow.
- 2.3 Learning via metaverse is the use of a virtual reality system developed through a web-based platform to create a learning space with an intention to promote multimedia production skills. Users can create their personal avatars to represent their identities and access to such virtual world, in which there are a variety of virtual simulation rooms available.

3. Output: This element refers to learning achievement and multimedia production skills, which are the fundamental skills that learners acquired after learning with the PjBL via brainstorming model with metaverse.

4. Feedback: This is the results of evaluation on learning achievement and multimedia production skills.

4.3 Results of the Study on the Suitability of the PjBL via Brainstorming Model with Metaverse

The study results of the design of the PjBL via brainstorming model with metaverse with 7 participants in this research who were derived by means of purposive sampling. All of them are the experts from different institutions, who are specialized in design and development of instruction models and instruction systems are shown in Table 2 and Table 3.

Table 2. Results of evaluation on the suitability of the design of the PjBL via brainstorming model with metaverse (overall elements)

Items for evaluation	Assessment results		Interpretation of results
	Mean	S.D.	
1. The design of the PjBL via brainstorming model with metaverse contains principles and concepts that can be used as the basis for developing the instruction systems.	4.71	0.48	Highest
2. The elements of the PjBL via brainstorming model with metaverse are as comprehensive as the main elements of the instruction systems.	4.71	0.48	Highest
3. The sequence of elements in the design of the PjBL via brainstorming model with metaverse is clear and consistent.	4.85	0.37	Highest
4. The ordering of elements in the design of the PjBL via brainstorming model with metaverse is suitable and easy to understand.	4.42	0.53	High
5. The overall elements of the design of the PjBL via brainstorming model with metaverse is complete and covers the needs.	4.42	0.53	High
Overall average	4.62	0.47	Highest

Referring to Table 2, it is found that the overall suitability of the design of the PjBL via brainstorming model with metaverse is at highest level (Mean = 4.62, SD. = 0.47). Therefore, it can be summarized that the PjBL via brainstorming model with metaverse contains complete elements and it can be used as a guideline to further develop other project-based learning systems via brainstorming with metaverse that can promote multimedia production skills of vocational students. The project-based learning and the brainstorming are said to encourage learners to observe and ask questions in order to find out alternatives for decision making, which can be put in planning as efficiently as possible.

Table 3. Results of evaluation on the suitability of the components of the PjBL via brainstorming model with metaverse

Items for evaluation	Assessment Results		Interpretation of results
	Mean	S.D.	
1. Input factor			
1.1 Instructor	4.71	0.48	Highest
1.2 Learners	4.85	0.37	Highest
1.3 Metaverse	4.28	0.75	High
1.4 Learning Media	4.28	0.48	High
2. Learning process using the PjBL via brainstorming with metaverse			
2.1 Project-based learning steps			
2.1.1 Plan	5.00	0.00	Highest
2.1.2 Action	4.85	0.37	Highest
2.1.3 Present	4.85	0.37	Highest
2.1.4 Evaluate	4.85	0.37	Highest
2.2 Brainstorm steps			
2.2.1 Facilitator	4.71	0.48	Highest
2.2.2 Define topic	5.00	0.00	Highest
2.2.3 Brainstorm	5.00	0.00	Highest
2.2.4 Conclusion	4.85	0.37	Highest
2.2.5 Follow	4.85	0.37	Highest
3. Output			
3.1 Learning achievement	4.71	0.48	Highest
3.2 Multimedia production skills	4.57	0.53	Highest
Overall	4.74	0.36	Highest

According to Table 3, it can be clearly seen that the overall suitability of the elements of the PjBL via brainstorming model with metaverse is at highest level (Mean = 4.74, SD. = 0.36). This can be concluded that the PjBL via brainstorming model with metaverse has all necessary elements and it can be employed to further develop other project-based learning systems via brainstorming with metaverse designated to promote multimedia production skills of vocational students in Thailand. This kind of learning can create new bodies of knowledge arising from brainstorming through the project-based learning process with the aid of metaverse and technologies for instruction management that can support learning in the digital world.

5. Conclusion & Discussion

The design of the the PjBL via brainstorming with metaverse is intended to promote multimedia production skills, which are considered highly essential for the 21st century learners, especially those who study multimedia production courses. In this research, the researchers applied principles, concepts, theories, and innovations related to the new teaching styles of Thailand 4.0, which are corresponding to the current situations and believed to encourage learners to learn and work as a team, enable them to solve immediate problems, and promote their creativity through the project-based learning via brainstorming with metaverse.

The PjBL via brainstorming model with metaverse is composed of 4 main elements, i.e., 1. input factor, which includes of instructor, learners, metaverse, and learning media; 2. learning process using the PjBL via brainstorming with metaverse, which consists of the project-based learning 4 steps, i.e., plan, action, present, and evaluate, that combine with brainstrom process 5 steps, which includes of facilitator, define topic, brainstorm, conclusion, and follow; 3. output, which consists of learning achievement, and multimedia production skills; and 4. feedback, which includes results of evaluation on learning achievement, and results of evaluation on multimedia production skills.

In reference to the evaluation results, the overall suitability of the design of the PjBL via brainstorming model with metaverse is at highest level (Mean = 4.62, SD. = 0.47), and the overall suitability of the elements of the PjBL via brainstorming model with metaverse is at highest level (Mean = 4.74, SD. = 0.36) as well. These results are in line with the research of Chatwattana (2021), who said that the utilization of current technologies in the management of learning environment can create a learning society in digital universities. The findings are also consistent with the research of Phunaploy, Chatwattana & Piriyaawong (2021), who mentioned that the use of different information technologies corresponding to the world's current situations in educational management

that facilitates learners to learn anywhere and anytime while enabling them to connect bodies of knowledge can encourage learners to take on challenges and develop the 21st century skills, e.g., collaborative skill, creative skill, communication skill, etc., which are all needed for learning in such a dynamic world as today.

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Authors contributions

Mr. Phanuwat Kongkhen 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.

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Obtained.

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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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