

# Development of Flipped Classroom using Cloud-Based Learning and Board Games Model to Enhance Critical Thinking Skills

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**Abstract** – This research aims to develop and assess flipped classroom by using cloud-based learning and board games to enhance critical thinking skills. Research results indicate that the model consists of 3 concepts which are flipped classroom activities, cloud-based learning, and board game usage. Regarding the evaluation results of the appropriateness of the model, the specialists comment that overall has the highest appropriateness. The aspect of principle, concept, and theory relating the components of appropriateness index are rated as highest, then followed by flipped classroom process, flipped classroom environment, and learning assessment, respectively.

**Keywords** – Flipped Classroom, Cloud-based Learning, Board Games, Critical Thinking Skills.

## 1. Introduction

Technology is a very significant part in teaching and learning, especially in the current critical time. Subsequently, the usage of information and communications technology plays an important role in the lives of people all over the world.

Education technology including blending various digital media into learning to adjust learning process focuses on promoting learning process by using information and communications technology to access information quickly and leading to interaction with the learners among themselves and with the instructor conveniently. This is also congruent with the development of information technology for education according to the national policy to prepare to be Information Technology Society. Therefore, learning environment arrangement, knowledge, and various learning media are necessary, as a result; new learning methods are used: e-learning and blended learning which is blending traditional and electronics learning together.

Flipped classroom is one type of blended learning. It is a learning process which changes from traditional learning in classroom and doing homework at home to be in the opposite ways. Learners have to study contents before attending class and during class instructors will instruct them to do homework or practice skills [1]. Presently, during the period of studying content before class instructor can use information technology to help learners access resources for learning conveniently such as uploading content and learning document on the cloud [2], [3]. The research is relating to the impact of flipped classroom such as the experiment of [4] which already makes impact comparison indicates that flipped classroom helps learners to be efficient in learning more than traditional and electronics method. This is congruent with another research which shows the similar conclusions and suggests that digital equipment should be applied as supplement or integration, but is not applied to replace all traditional learning. [5]

However, the problems of online learning that are always mentioned are emotion management of learners and stimulating the motivation to learners [6], [7] which is congruent with survey result of Fraillon [8] indicating that the use of information technology and communications (ICT) distracts learners or not. According to perspectives of

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instructors from several countries, only 24% of instructors mention that the use of ICT in learning will distract learners. However, the result from the same research indicates that in Thailand 46% of instructors mention that the use of ICT in learning will distract learners, which is the highest percentage when comparing to other countries. This shows that regarding the perspectives of instructors in Thailand, they feel that the use of digital equipment and online learning may not be perfect enough. The cloud learning or use of cloud as a part in learning may help alleviate this because it can help learners more convenient and develop learner process [9]. Learners can manage study time and quantity as the want.

Critical thinking is one of the important skills that help drive the future of Thailand in the period of education 4.0 because it is the skill that help promote the capability in handling problems, think systematically, increase the capability in making decision, raise questions that should ask, and forecast the answer accurately or make conclusions reasonably [10]. The use of board game blends with flipped classroom may be the solution in the critical time. Application of board games in the classroom causes several direct and indirect benefits. Board games can help learners learn more, stimulate the desire to study on that topic or subject, and also increase flow state [11], [12]. Most of the research relating flipped classroom indicate that flipped classroom generates positive results, it helps learn faster, and most importantly helps enhance critical thinking skills.

## 2. Objectives of the Research

- 2.1. Design and develop flipped classroom by using cloud-based learning and board games model to enhance critical thinking skills.
- 2.2. Assess the appropriateness of flipped classroom by using cloud-based learning and board games model to enhance critical thinking skills.

## 3. Research Methodology

### 3.1. Model Development

In respect of designing and developing flipped classroom by using cloud-based learning and board games to enhance critical thinking skills of vocational level students, researcher collects information from several sources by studying related theories and principles, needs as following:

- 1) Gather information from several sources. Researcher studies, analyzes concepts, theories in relevant document and research to acquire conceptual framework by studying meaning, principles, components, factors in the following aspects:
  - a. Flipped Classroom
  - b. Cloud-based Learning
  - c. Board Games in Education
  - d. Critical Thinking
- 2) Use information from studying document and gathering information for designing draft of flipped classroom using cloud-based learning and board games model to enhance critical thinking skills of vocational level students.

### 3.2. Model Assessment

Model assessment of flipped classroom uses cloud-based learning and board games model to enhance critical thinking skills of vocational level students.

- 1) Sampling group used in survey about flipped classroom uses cloud-based learning and board games model to enhance critical thinking skills is specialists selected from purposive sampling. They are 7 specialists in education technology, cloud-based learning, critical thinking, and use of games in education.
- 2) Research instruments used for collecting information are:
  - (1) Flipped classroom using cloud-based learning and board games model to enhance critical thinking skills is derived from studying related document and research as following: Flipped Classroom, Board Games, Cloud-based Learning, and Critical Thinking.
  - (2) Evaluation form of the appropriateness of Flipped classroom using cloud-based learning and board games model to enhance critical thinking skills is 5-level rating scale consists of components of the model, activities of the model, and learning assessment.

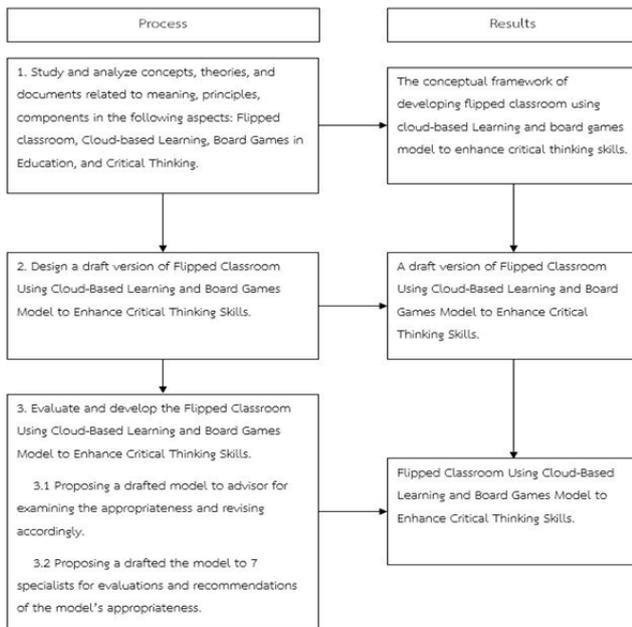


Figure 1. Process of developing flipped classroom using cloud-based Learning and board games model to enhance critical thinking skills

Figure 1 shows the process of developing flipped classroom using cloud-based learning and board games model to enhance critical thinking skills represent process flow as follows:

1. Study and analyze concepts, theories, and documents related to meaning, principles, components in the following aspects: Flipped classroom, Cloud-based Learning, Board Games in Education, and Critical Thinking.
2. Design a draft version of Flipped Classroom using Cloud-Based Learning and Board Games Model to Enhance Critical Thinking Skills.
3. Evaluate and develop the Flipped Classroom Using Cloud-Based Learning and Board Games Model to Enhance Critical Thinking Skills.
  - 3.1. Proposing a drafted model to advisor for examining the appropriateness and revising accordingly.
  - 3.2. Proposing a drafted the model to 7 specialists for evaluations and recommendations of the model's appropriateness.

#### 4. Conceptual Framework

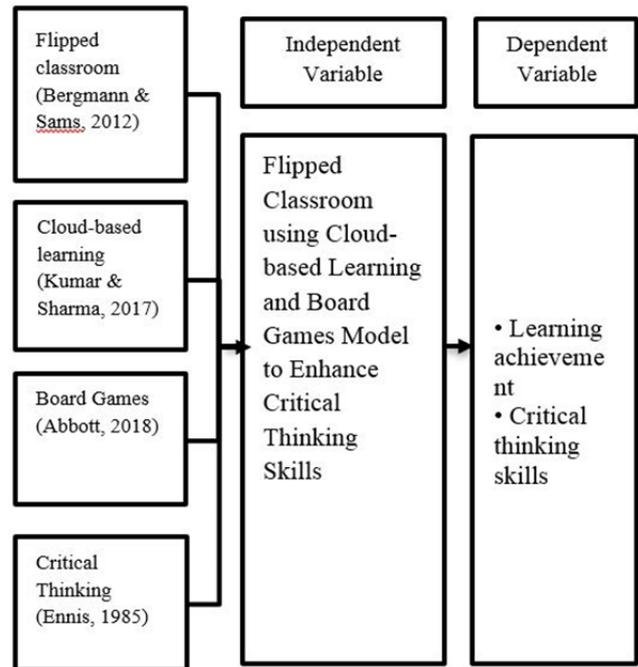


Figure 2. Research conceptual framework of developing flipped classroom using cloud-based Learning and board games model to enhance critical thinking skills

The conceptual framework of Flipped classroom (shown in Figure 2) uses cloud-based learning and board games model to enhance critical thinking skills. The model consists of 4 factors: Flipped classroom, Cloud-based learning, Board Games, and Critical Thinking Theory. This model will be applied to undergraduate students with the goal of developing learners' learning achievements and critical thinking skills.

#### 5. Literature Review

##### 5.1. Flipped Classroom

Before flipped classroom was known, there was similar concept which was called Inverted Classroom by [13]. Inverted Classroom is defined as bringing activities that are done in the classroom to do outside classroom and bringing activities that are done

outside classroom to do in classroom. This concept is similar to the basic concept of Flipped Classroom which is defined as bringing content or knowledge outside classroom, may be home or anywhere at any time. This will be convenient and also give a chance for learners to control their study time whereas classroom will be a place for doing homework or solving problem in order to allow learners to do them at the same time in the classroom. Regarding obvious benefits of Flipped Classroom, when doing homework or activities in classroom, this enables learners to access and helps learners when they face problems easier. These benefits affects learners positively. [4], [14]. In addition, Flipped Classroom stimulates learning motivation and leads to better learning process [15], [16]. However, the learning achievement of Flipped Classroom depends on other factors such as preparation before attending class. [3], [17].

### **5.2. Board Games**

Board Games and tabletop games have lived with human for many years. Presently, there are several researches that adapt the use of Board Games to help learning [18]. The result from the use of game in learning is mostly found that board games affect learners in the positive way. They help increase motivation and flow state for learners. [11], [19]. Furthermore, if board game is applied suitably, they can help promote creativity [20], [21]. Several survey researches study opinions and feelings of learners after they learn by using board games. Research results are shown in the same ways. Most learners comment in the good ways and give feedbacks in the positive ways [22].

### **5.3. Cloud-based Learning**

Cloud is a virtual service technology, which supports resources such as network, software, hardware, data storage, fundamental structure or other necessary service, to enable users access and use it conveniently and quickly [23] which leads to several direct and indirect benefits. The obvious benefit is providing convenience to learners because of no limit of place which helps learners who study through Cloud-based Learning access information and content anytime anywhere [23], [24], increase flexibility in learning [9], access and understand content easier [25], [26], and upgrade knowledge, as well as develop potential and critical thinking skills.

The necessary concern if we apply cloud in learning is that we should have unit or team overseeing and supporting special techniques. [26], [27] Tool that is often mentioned about or used in conjunction with learning through cloud is Learning Management Systems. (LMS) which is the system that helps provide convenience for learners and instructors. In addition, it is often used in online learning and blended learning, especially in higher education level.

### **5.4. Critical Thinking**

Critical Thinking is defined as one form of thinking which have thinking process in analytical way and relying on considering systematically. Facts or logic is used to support them for clarity or deep understanding. In addition, raising questions that should ask and categorizing to help in decision are used [10], [28]. Critical Thinking skill may be derived from combining various types of skills such as data analysis, logical thinking and reasoning, which are essential fundamentals of critical thinking. [10], [29] Ennis (1985) describes concept of critical thinking as following:

Skills of Definition such as identifying the important point of problem, summary, raising suitable questions in each situation, indicating basic conditions and agreement.

Skills of Data Decision such as deciding the reliability of data resources, relevance of problems, and considering the congruence of problems.

Skills of generalizability in solving problem and making reasonable conclusions such as inductive reference and summary, deductive, and reliable prediction of what will happen.

Determining assumption which is defined as the capability to determine guidelines or forecast answers by relying on primary information and agreement, and also select suitable assumption by considering reasonability of problems and results. Regarding the educational perspective in digital era, skills that is often mentioned as a counterpart or can be a by-product of critical thinking is problem-solving skills, which is mentioned in several researches relating mathematics learning and learner-involved learning. [30], [31]. According to the guidelines in promoting critical thinking, a tool that is often mentioned recently is the use of game as a learning tool, contributing to learner involvement and critical thinking skills. [32]

6. Research Result

6.1. Model

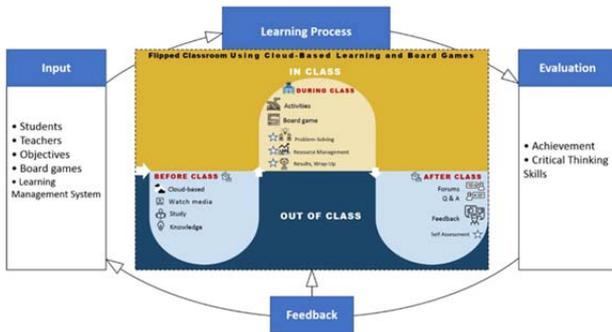


Figure 3. Flipped Classroom Using Cloud-Based Learning and Board Games Model to Enhance Critical Thinking Skills

Study of relating research such as flipped classroom, board games in education, cloud learning leads to Flipped Classroom using Cloud-Based Learning and Board Games Model to Enhance Critical Thinking Skills. The structure of model is shown in Figure 3 and detailed as following:

6.1.1. Input consists of learner, instructor, learning objectives, board games which are games are played on boards and tabletop games that are selected suitably with learner group and learning content, and Cloud-based Learning Management System. This system is processing technology which can be designed to share learning resources on the Internet system and process or provide services ranging from system structure to applications such as Google application.

6.1.2. Learning process during the first learning week, learners and instructor will meet in the classroom. Next time flipped classroom will be used. Each week will be divided into 3 phases. This process will enable learners to learn in flipped classroom that designs learning activities consisting of submitting learning and activity content that instructors made learning content from video on cloud. This will provide learners an opportunity to study how to play board games from cloud media. Concerning the practice of using ideas and absorbing knowledge with activities, learners are divided into groups to play board games to practice advanced thinking and do other activities related to the learning content. In terms of knowledge enhancement (Q&A), this is a period for learners to exchange knowledge with friends in the chat room, ask the instructor for issues that need clarity, and assess learning results by themselves.

Table 1. Learning Process of Flipped Classroom Using Cloud-based Learning and Board Games Model to Enhance Critical Thinking Skills

| Phase | Activities   | Learner Role  | Instructor Role   | Assessment / Result   |
|-------|--|---|---|---|
| 1     | Submitting learning and activity content               | 1.1 Learn learning content from cloud media<br>1.2 Study methods of playing board games from cloud media  |   | <b>Assessment Tests Result</b><br>Test results of 60%   |
| 2     | Practicing thinking and absorb knowledge by activities | - Group board game players to practice thinking, analyze and solve problems<br>- Do other activities related to learning content                  | - Observe learner behaviors<br>- Provide necessary suggestions<br>- Answer questions, suggest learning additional resources, summarize activities and lesson contents | <b>Assessment</b><br>- Behavior observation form and scoring according to the rubric assessment criteria<br>- Exercises at the end of lesson<br><b>Result</b><br>- Learning behaviors is rated as very good<br>- Results of tests at the end of lesson of more than 70% |
| 3     | Enhancing knowledge (Q&A)                              | - Exchange knowledge with friend in the chat room<br>- Talk to instructor for issues that need clarity, and assess learning results by themselves | 3.1. Provide necessary suggestions<br>3.2. Answer the questions - suggest additional learning resources for learners  | <b>Assessment</b><br>- Exercises at the end of lesson (Online)<br><b>Result</b><br>- Results of score at the end of lesson are more than 70%  |

Table 1 Shows the learning process of the model. There are 3 phases of activity with details as follows.

1) Phase 1- Before attending class there is the phase of submitting knowledge. Learners can study activity and learning content in advance such as short video clips which learners can download learning materials of cloud-based learning system. Learners can search information by themselves from other resources in the internet or they can also read from textbooks and are assessed by doing tests.

2) Phase 2- In the classroom there is the phase of absorbing knowledge from activities. In the first duration instructors will suggest activities followed by doing activities which is playing board games consisting of competition, cooperation, resource management, strategic management, negotiations, problem analysis and solving. After doing activities, there will be Q&A period and finally summary by instructor. Instructor will summarize activities first, then summarize learning contents.

3) Phase 3- After classroom is the phase of knowledge enhancement which derived from talking among learners or consulting with instructor. In this phase, learner can meet and consult instructor directly or request for suggestions through system. In addition, learners can exchange knowledge among learners in the forums.

6.1.3 Evaluation consists of the measurement of learning achievement and critical thinking skills by using learning achievement test according to subject content, that is congruent with flipped classroom using cloud-based learning and board games model to enhance critical thinking skills, and critical thinking skill test which researcher creates according to suitable principles and theories to target learners.

6.1.4 Feedback reflects results from process using to improve flipped classroom using cloud-based learning and board games model to enhance critical thinking skills.

## 6.2. Evaluation Results

Table 2. Overall appropriateness evaluation of Flipped Classroom Model using Cloud-based learning and board games model to enhance critical thinking skills

| Components   | $\bar{x}$   | SD          | Appropriateness |
|--|-------------|-------------|-----------------|
| 1. Principles, concepts and theories relating to overall components of model | 4.67        | 0.42        | Highest         |
| 2. Overall environment management of flipped classroom                       | 4.43        | 0.70        | Highest         |
| 3. Learning process of flipped classroom                                     | 4.59        | 0.54        | Highest         |
| 4. Overall learning evaluation   | 4.42        | 0.75        | Highest         |
| Overall Flipped Classroom Model  | <b>4.53</b> | <b>0.60</b> | <b>Highest</b>  |

According to Table 2, this indicates the appropriateness of overall flipped classroom using cloud-based learning and board games model to enhance critical thinking skills. The specialists comment that overall has the highest appropriateness

value ( $\bar{x} = 4.53$ ,  $SD = 0.60$ ). When considering in each component, principles, concepts, and theories relating to overall components of model has highest appropriateness value ( $\bar{x} = 4.67$ ,  $SD = 0.42$ ), followed by learning process of flipped classroom ( $\bar{x} = 4.59$ ,  $SD = 0.54$ ), overall environment management of flipped classroom ( $\bar{x} = 4.43$ ,  $SD = 0.70$ ), learning evaluation ( $\bar{x} = 4.42$ ,  $SD = 0.75$ ), respectively. The details of each component can be considered as following:

Table 3. Appropriateness evaluation regarding principles, concepts, and theories of flipped classroom using cloud-based learning and board games model to enhance critical thinking skills

| Principle, Concept, and Theory                              | $\bar{x}$   | SD          | Appropriateness |
|---|-------------|-------------|-----------------|
| 1.1 Activities of Flipped Classroom (Bergmann & Sams, 2012) | 4.83        | 0.37        | Highest         |
| 1.2 Cloud Learning (Kumar & Sharma, 2017)                   | 4.83        | 0.37        | Highest         |
| 1.3 Board Games (Abbott, 2018)                              | 4.67        | 0.47        | Highest         |
| 1.4 Learning evaluation according to real condition         | 4.33        | 0.47        | Highest         |
| Principle, Concept, and Theory                              | <b>4.67</b> | <b>0.42</b> | <b>Highest</b>  |

Table 3 shows the appropriateness regarding principles, concepts, and theories of flipped classroom using cloud-based learning and board games model to enhance critical thinking skills. The specialists comment that overall has the highest appropriateness value ( $\bar{x} = 4.67$ ,  $SD = 0.42$ ). When considering in each concept, activities of flipped classroom [1] and cloud learning [9] have the highest appropriateness with the equal value  $\bar{x} = 4.83$ ,  $SD = 0.37$ ), followed by board games [18] ( $\bar{x} = 4.67$ ,  $SD = 0.47$ ) and learning evaluation according to real condition ( $\bar{x} = 4.33$ ,  $SD = 0.47$ ), respectively.

Table 4. Appropriateness evaluation regarding environment arrangement

| Environment of Flipped Classroom                 | $\bar{x}$ | SD   | Appropriateness |
|--|-----------|------|-----------------|
| 2.1 Learning resources supporting cloud learning | 4.50      | 0.76 | Highest         |
| 2.2 Online media on the internet                 | 4.50      | 0.76 | Highest         |
| 2.3 Learning activities of flipped classroom     | 4.50      | 0.76 | Highest         |
| 2.4 Activities of board game learning            | 4.33      | 0.75 | Highest         |

| Environment of Flipped Classroom |   | $\bar{x}$   | SD          | Appropriateness |
|----------------------------------|---|-------------|-------------|-----------------|
| 2.5                              | Learning evaluation according to real condition and self-evaluation | 4.33        | 0.47        | Highest         |
|                                  | <b>Overall Environment</b>  | <b>4.43</b> | <b>0.70</b> | <b>Highest</b>  |

As shown in Table 4, the appropriateness regarding environment arrangement of flipped classroom uses cloud-based learning and board games model to enhance critical thinking skills. The specialists comment that overall has the highest appropriateness value ( $\bar{x} = 4.43$ ,  $SD = 0.70$ ). When considering in each arrangement, learning resources support cloud learning, online video media on the Internet, and learning activities of flipped classroom have the highest appropriateness with the equal value ( $\bar{x} = 4.50$ ,  $SD = 0.76$ ), followed by board game learning and learning evaluation according to real condition and self-evaluation ( $\bar{x} = 4.33$ ,  $SD = 0.47$ ), respectively.

Table 5. Appropriateness evaluation regarding learning process of flipped classroom

| 3. Learning Process of Flipped Classroom |  | $\bar{x}$ | SD   | Result  |
|--|--|-----------|------|---------|
| 3.1                                      | <b>Phase1:</b> Submitting learning and activity content<br>Learner Role                    |           |      |         |
|  | - Learn learning content from cloud media  | 4.67      | 0.47 | Highest |
|  | - Study how to play game board from cloud media  | 4.83      | 0.37 | Highest |
|  | Overall learning activities Phase1   | 4.75      | 0.42 | Highest |
| 3.2                                      | <b>Phase2:</b> Practicing ideas and absorbing knowledge through activities<br>Learner Role |           |      |         |
|  | - Group board game players to practice thinking, analyzing and solving problems.           | 4.50      | 0.50 | Highest |
|  | - Do other activities related to learning content  | 4.33      | 0.75 | Highest |
|  | Overall learner role in phase2   | 4.42      | 0.62 | Highest |
|  | Instructor role  |           |      |         |
|  | - Observe learner behaviors  | 4.83      | 0.37 | Highest |
|  | - Provide suggestions as necessary   | 4.83      | 0.37 | Highest |
|  | - Answer questions, recommend additional learning resources for learners                   | 4.83      | 0.37 | Highest |
|  | - Summarize activities and subject content   | 4.67      | 0.75 | Highest |

Table 5. (continue)

| 3. Learning Process of Flipped Classroom |  | $\bar{x}$   | SD          | Result         |
|--|--|-------------|-------------|----------------|
|  | Overall instructor role in phase2                                      | 4.79        | 0.47        | Highest        |
|  | <u>Learning Results</u>  |             |             |                |
|  | - Learning behaviors are rated as very good                            | 4.00        | 0.82        | High           |
|  | - The result of the tests at the end of lesson at least 70%            | 4.17        | 0.90        | High           |
|  | Overall results of phase2  | 4.08        | 0.86        | High           |
|  | Overall learning activities phase2                                     | 4.43        | 0.65        | Highest        |
|  | <b>3.3 Phase3:</b> Enhancing knowledge and Q&A<br>Learner role         |             |             |                |
|  | - Exchange knowledge with friends in the chat room                     | 4.67        | 0.47        | Highest        |
|  | - Ask questions for the issues that need clarity from instructor       | 4.83        | 0.37        | Highest        |
|  | - Evaluate learning results by themselves                              | 4.67        | 0.47        | Highest        |
|  | Overall learner role in phase3   | 4.72        | 0.44        | Highest        |
|  | Instructor Role  |             |             |                |
|  | - Provide necessary suggestions  | 4.67        | 0.47        | Highest        |
|  | - Answer questions, suggest additional learning resources for learners | 4.83        | 0.37        | Highest        |
|  | Overall instructor role in phase3                                      | 4.75        | 0.42        | Highest        |
|  | <u>Results</u>   |             |             |                |
|  | - The result of the tests at the end of lesson at least 70%            | 4.33        | 0.75        | Highest        |
|  | Overall learning activities phase3                                     | 4.60        | 0.54        | Highest        |
|  | Overall Learning Process of Flipped Classroom                          | <b>4.59</b> | <b>0.54</b> | <b>Highest</b> |

Table 5 indicates that learning process of flipped classroom uses cloud-based learning and board games model to enhance critical thinking skills. It divides activities into 3 phases. The specialists comment that overall has the highest appropriateness value ( $\bar{x} = 4.59$ ,  $SD = 0.54$ ). When considering in each activity phase, learning activity phase1: Submitting learning and activity content

has the highest appropriateness ( $\bar{x} = 4.75$ ,  $SD = 0.42$ ), followed by learning activity phase3: Enhancing knowledge and Q&A ( $\bar{x} = 4.60$ ,  $SD = 0.54$ ), and learning activity phase 2: Practicing ideas and absorbing knowledge through activities ( $\bar{x} = 4.33$ ,  $SD = 0.65$ ). The details of mean level of appropriateness in each activity phase are shown as following.

Learning activity phase 1: Submitting learning and activity content is the phase that learner study by themselves before attending classroom which has the

highest appropriateness ( $\bar{x} = 4.75$ ,  $SD = 0.42$ .) Both learning activities of Study how to play game board from cloud media and learn learning content from cloud media have the highest appropriateness value ( $\bar{x} = 4.83$ ,  $SD = 0.37$ ) ( $\bar{x} = 4.67$ ,  $SD = 0.47$ ), respectively.

Learning activity phase 2: Practicing ideas and absorbing knowledge through activities has the highest appropriateness value ( $\bar{x} = 4.43$ ,  $SD = 0.65$ ). Instructor role has the highest appropriateness value ( $\bar{x} = 4.79$ ,  $SD = 0.47$ ), followed by Learner role ( $\bar{x} = 4.42$ ,  $SD = 0.62$ ) whereas learning results has high appropriateness value ( $\bar{x} = 4.08$ ,  $SD = 0.86$ ). When considering in details, this indicates that instructor role has the highest appropriateness value. Observing learner behaviors provide suggestions as necessary, answer questions and recommend additional learning resources for learners have the highest appropriateness with equal value ( $\bar{x} = 4.83$ ,  $SD = 0.37$ ), followed by the role of Summarize activities and subject content ( $\bar{x} = 4.67$ ,  $SD = 0.75$ ) and learner role ( $\bar{x} = 4.42$ ,  $SD = 0.62$ ) which also have the highest appropriateness. Both group board game players to practice thinking, analyzing and solving problems and do other activities related to learning content have the highest appropriateness ( $\bar{x} = 4.50$ ,  $SD = 0.50$ ), ( $\bar{x} = 4.33$ ,  $SD = 0.65$ ), respectively. The results of learning phase 2: Practicing ideas and absorbing knowledge through activities has high appropriateness value ( $\bar{x} = 4.08$ ,  $SD = 0.86$ ) whereas both Result of the tests at the end of lesson at least 70% and learning behaviors has the highest appropriateness value ( $\bar{x} = 4.17$ ,  $SD = 0.90$ ) and ( $\bar{x} = 4.00$ ,  $SD = 0.82$ ), respectively.

Learning activity phase 3: Enhancing knowledge and Q&A has the highest appropriateness value ( $\bar{x} = 4.60$ ,  $SD = 0.54$ ). Instructor role has the highest appropriateness value ( $\bar{x} = 4.75$ ,  $SD = 0.42$ ), followed by learner role ( $\bar{x} = 4.72$ ,  $SD = 0.44$ ), and learning results ( $\bar{x} = 4.33$ ,  $SD = 0.75$ ), respectively. When considering in detail, this indicates that instructor role have the highest appropriateness value. Answering questions, suggest additional learning resources for learners and provide necessary suggestions have the highest appropriateness value ( $\bar{x} = 4.83$ ,  $SD = 0.37$ ) and ( $\bar{x} = 4.67$ ,  $SD = 0.47$ ), respectively. Learner role has the highest appropriateness value ( $\bar{x} = 4.72$ ,  $SD = 0.44$ ). When considering in detail, ask questions for the issues that need clarity from instructor has the highest appropriateness value ( $\bar{x} = 4.83$ ,  $SD = 0.37$ ), followed by exchange knowledge with friends in the chat room and evaluate learning results by themselves have equal appropriateness value. ( $\bar{x} = 4.67$ ,  $SD = 0.47$ ) Result of learning activity phase 3: Enhancing knowledge and Q&A has the highest

appropriateness value ( $\bar{x} = 4.33$ ,  $SD = 0.75$ ) is considered is result of the tests at the end of lesson at least 70%.

Table 6. Results of appropriateness evaluation regarding learning evaluation

|     | <b>Learning Evaluation</b>  | $\bar{x}$ | <i>SD</i> | <b>Results</b> |
|-----|---|-----------|-----------|----------------|
| 4.1 | Learning achievement can be attained according to expected result of 70-80% | 4.33      | 0.75      | Highest        |
|     |   |           |           |                |
| 4.2 | Critical thinking skills are rated as very good                             | 4.50      | 0.76      | Highest        |
|     | Overall Learning Evaluation   |           |           |                |

Table 6 indicates learning evaluation of flipped classroom using cloud-based learning and board games model to enhance critical thinking skills. Specialists comment that overall has the highest appropriateness value ( $\bar{x} = 4.42$ ,  $SD = 0.75$ ). When considering in details, determining learning goals of enabling learners to develop critical thinking skills at a very good level, specialists comment that this evaluation has the highest appropriateness ( $\bar{x} = 4.50$ ,  $SD = 0.76$ ), followed by learning achievement and can be attained according to expected criteria of 70-80% ( $\bar{x} = 4.33$ ,  $SD = 0.75$ ), respectively.

## 7. Conclusion

Regarding the evaluation results of appropriateness of flipped classroom using cloud-based learning and board games model to enhance critical thinking skills, specialists comment that overall have the highest appropriateness. When considering in each component, principle, concepts, and theories relating to overall components of model has the highest appropriateness level, followed by learning process of flipped classroom model, environment management of flipped classroom model, and learning evaluation, respectively. The details are explained as following. According to the appropriateness of flipped classroom using cloud-based learning and board games model to enhance critical thinking skills, specialists comment that overall have the highest appropriateness. When considering in each concept, Activities of Flipped Classroom [1] and Cloud Learning [9] have the highest appropriateness. This is because flipped classroom brings content or knowledge outside classroom, may be home or anytime anywhere. This provides a chance for learners to control their own study time. On the contrary, classroom will be a place for doing homework or solving problems that learners can do together in the classroom [1], [33]. The obvious benefit of flipped classroom is that

when doing homework or activities in classroom, instructor can access and assist students when they are facing problems easily. This contributes positive result to learners [4], [14]. Cloud-based learning enables learners to access information and content anytime anywhere [23], [24], increase learning flexibility [9], also access and understand content easier [25], [26]. In respect of using board games [18], it affect learners positively such as increasing motivation and flow state of learners [11], [19]. Learning process corresponding to flipped classroom using cloud-based learning and board games model to enhance critical thinking skills divides activities into 3 phases. Specialists comment that overall have the highest appropriateness. When considering in detail, phase of practicing ideas and absorbing knowledge through activities has the mean of appropriateness of learning results at high level for result of the tests at the end of lesson at least 70% and learning behaviors are rated as very good. This indicates that specialists are not confident whether learning results will meet criteria. According to these evaluation results, research of the results from flipped classroom using cloud-based learning and board games model to enhance critical thinking skills should be done. This is the real educational challenge of further designing and developing flipped classroom using cloud-based learning and board games model to enhance critical thinking skills.

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