The Development of Blended Learning Model by Applying Information Technology to Develop Higher Order Thinking Skill for Students in The Institute of Physical Education Phetchabun Campus

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Abstract

The objectives of this research were: 1) to develop the efficient blended learning model by applying information technology to develop higher order thinking skill for students in the Institute of Physical Education, and 2) to study the effect of development in students’ higher order thinking skill for students in the Institute of Physical Education. There were 3 phases of this research. Phase 1: included the contextual study and synthesize the conceptual framework in developing the instructional model, and outline the tentative instructional model. Phase 2: included the usage of instructional model by an Action Research for 3 cycles. Phased 3: consisted of validation of instructional model for evaluating the instructional model by using One Group Pretest Posttest Design.

The research findings found that

1. The blended learning model by applying information technology to develop higher order thinking skill for students in the Institute of Physical Education, developed by the researcher, consisted of 4 aspects: 1) the principle of instructional model, 2) the objective of instructional model, 3) the instructional management process, and 4) the measurement and evaluation of instructional model. There were 2 phases of instructional management process as: 1) the step of pre-instructional preparation, 2) the step of developing higher order thinking skill including: 1) the presentation of learning situation, 2) the planning and determination of learning guidelines, 3) the searching and collecting data, and 4) the analysis and investigation of learning performance, 5) the conclusions and presentation of learning performance, and 6) the evaluation and extending of learning performance.

2. The findings of instructional model evaluation, found that the students taught by the blended learning model by applying the information technology to develop higher order thinking skill, developed by the researcher, the posttest average score was higher than the pretest score,
at .05 significant levels. The average score in each skill of higher order thinking skill was in “Good” level.

**Key words:** Blended Learning, Application in Information Technology, Higher Order Thinking Skill

**Introduction**

Both of Science and Technology played an important role in developing the human’s thinking and potentiality in reasoning, systematic, communication, selection in information technology, and determination of problem solving strategy relating to every one’s livelihood. It was also used as an instrument for creating the supplementary skills for studying in other sciences as well. (The Office of Science and Technology Development: OSTD, 2002). It was supported by Jonassen (2003) stated that the technology would be used as an instrument of knowledge construction which would enhance the students’ learning ability for themselves rather than teaching. Therefore, the instructional management should be performed in order to know how to learn as well as the competency in using information technology should be inculcated for new knowledge construction.

To help students in being able to develop knowledge and skill in searching for knowledge and different kinds of thinking process, the instructors needed to apply the technology to be used in instructional activity management (Yuen Pooworawan, 2005). The usage of internet network system in instructional management would improve the learning achievement in many aspects, especially in higher order thinking skill, and higher order communication skill. (Blasi et. Al., 1999; Guphill, 2000; Lim & Tay, 2003) In addition, according to the study of Pea & Roschelle (1999) found that the learning and teaching through World Wide Web (WWW) could improve the learning achievement in 3 things: 1) the students could have different learning technique models which would develop learning, motivation, 2) the convenience since there was no time constraint, and 3) the better higher order thinking skills. Furthermore, if the online instructional activities were combined with the normal classroom instructional activities, it would provide opportunity and facilitate the convenience for students more, including: 1) the opportunity for students to contact and interact with instructors both of in normal classroom and online, 2) the students could be able to study from both of learning media presented in normal classroom, and online, 3) the students would be able to connect and communicate with their classmates both of in normal classroom and online, and 4) the students could work in group both of meeting with each other, and through technology facilitating the virtual classroom to be occurred. (Mossvar-Rahmani & Daugherty, 2007) The activity management in Face-to-Face or normal classroom, combined with e-Learning, was a form of blended learning by congruent integration between the classroom instructions that was enhancing interaction among human beings and e-Learning facilitated in extending the educational opportunity for people, enhancing the learning, and knowledge construction by themselves. It also facilitated the students especially in improving the instructional efficiency, efficiency in accessing information, and increasing the efficiency in management of expenditure to be more efficient (Bonk & Graham, 2006).

The Institute of Physical Education emphasized on instructional management through media as e-Learning in order to develop the learning quality, enhance the students to uti-
lize the information communication and technology in learning from sources, and various learning techniques in order to occur the continuous self-paced learning (Institute of Physical Education, 2008). But, the lack of analysis in environmental condition and organization (SWOT Analysis), the some weaknesses relating to instructional management, were found including the supplementary books, and insufficient teaching media, lack of usage in modern technology for instructional management, as a weak point causing the students graduating had lower quality based on standard as well as low level of learning achievement. (Institute of Physical Education, 2007) In addition, according to the study of Nuanphan Chaiyama (2008) found that most of instructional management, focused on lecturing technique. There were very few of instructional activity management stimulating the students to have analytical, synthetic, and creative thinking, problem solving, and decision making in practice. Most of media using for learning and teaching were printed materials. There was a few number of usage in applying the information communication and technology (ICT) for enhancing and developing the knowledge and skill in information communication and technology. But, according to the studies, found that most of instructors wanted to apply the information technology media in instructional management, especially the instructional management through the internet network system, in “the Highest” level. But, there were no pattern in applying for work with efficiency, convenience, and availability to be used.

According to the above reasons, under paradigm and guidelines for educational management with changes according to global society paying importance to the development of learning skill through the students’ thinking process as well as the usage of information technology supporting the students to learn and knowledge construction by themselves was another major reason for the researcher to be interested in developing the blended learning model by applying the information technology to develop higher order thinking skill for students in the Institute of Physical Education in order to use as guidelines in leading to development of quality instructional management further.

**Research objectives**

1. To develop the efficient blended learning model by applying the information technology to develop higher order thinking skill for students in the Institute of Physical Education.
2. To study the effect of development in higher order thinking skill of students taught by the blended learning model by applying the information technology to develop higher order thinking skill for students in the Institute of Physical Education.

**Conceptual framework**

1. The approach in designing and development of the blended learning model
2. The approach in applying the information technology for using in instructional management.
3. The approach in thinking process and development of higher order thinking skill
4. The approach in designing and instructional management to develop higher order thinking skill
Research methodology

The Developmental Research Type II (Tracey M.W., 2002) was administered to develop the blended learning model by applying information technology to develop higher order thinking skill for students in the Institute of Physical Education, including 3 phases:

**Phase 1: Model development** consisted of 4 steps as:

**Step 1:** Study context of current situation and problem of instructional management, and the needs for instructional management through computer network system. The samples were 36 instructors in the Institute of Physical Education, Phetchabun, and 93 students, by proportion determination and selected by Simple Random Sampling.

**Step 2:** Analyze and synthesize the conceptual framework and related components of blended learning by applying information technology to develop higher order thinking skill for students in the Institute of Physical Education by analyzing documents, textbooks, and related research studies.

**Step 3:** Develop and construct the tentative blended learning model by applying information technology to develop higher order thinking skill for students in the Institute of Physical Education, by developing the research findings from Step 1, and Step 2 as the tentative instructional model.

**Step 4:** Investigate the tentative blended learning model by applying information technology to develop higher order thinking skill for students in the Institute of Physical Education by 9 experts.

**Phase 2: Model use**

Action Research based on Kemmis & Mc Taggart (1992) was administered including 4 steps: 1) Plan, 2) Act, 3) Observe, and 4) Reflect. The samples were 20 Second Year Students, Institute of Physical Education, Phetchabun, who enrolled ED. 031001 Innovation and Educational Technology, studying during the second semester of 2009 academic year.

**Phase 3: Model validation** consisted of 2 steps as:

**Step 1:** Provide training and development for instructors who would try out the instructional model.

**Step 2:** Give the instructional model to the instructors who underwent training from Step 1, to implement in teaching and evaluating the instructional model developed by the researcher. The samples used in One Group Pretest Posttest Design, included 16 first year students in Sports Science, and Sports Communication in the Institute of Physical Education, Phetchabun, who enrolled GE 062004: Law in Daily Life, the second semester, 2010 academic year.

**Data analysis**

1. Analyze data of duration in developing the instructional model by calculating the Frequency, Percentage, Mean, Standard Deviation, document analysis, and content analysis.
2. Analyze data of duration in using the instructional model by calculating the Mean, Standard Deviation, t-test, and content analysis.
3. Analyze data of duration in validation the instructional model by calculating the Mean, t-test, and content analysis.
Research findings

The Blended learning model by applying information technology to develop higher order thinking skill for students in the Institute of Physical Education

The researcher studied context of current situation and problem in instructional management, and the needs for instructional management through computer network system in instructor groups and students in the Institute of Physical Education, Petchabun, and studied the documents, books, textbooks, and related literature of blended learning model by applying the information technology to develop higher order thinking skill for students in the Institute of Physical Education. The tentative instructional model was investigated by experts. Then, it was tried out for developing the efficiency of instructional model. The instructional model was evaluated its effectiveness by research process respectively. The instructional model developed by the researcher including following details:

Components of instructional model

The blended learning model by applying the information technology to develop higher order thinking skill for students in the Institute of Physical Education included 4 components as follows:

1. Principle of instructional model

Blended learning model by applying information technology to develop higher order thinking skill for students in the Institute of Physical Education consisted of principle in instructional management as follows:

1.1 Blended learning

Consisted of the blended learning by integrating the traditional instruction or normal classroom instruction (F2F) by would be organized in the computer laboratory by presentation and practice training, and e-Learning through Learning Management System (LMS) including: 1) Live Event as Synchronous, and 2) Self-Paced Learning as Asynchronous by determining proportion of blending as 30-70. Most of the used media, used the e-Learning technique.

1.2 Instructional activity management to develop higher order thinking

For guidelines in instructional activity management for developing higher order thinking skill, consisted of following principles: 1) the content material or learning situation which was meaningful for learning and related to the students’ real situation, 2) the media and resource origin were organized to be congruent with the learning, 3) the various patterns were presented so that the students would view the problem from many viewpoints, 4) the instruction was organized by focusing on participation in learning process and learning by doing themselves through group process by organizing variety student groups as well as enhancing each student to be responsible with one’s assigned task, 5) the students should be provided opportunity in learning by surveying problem, practicing the thinking process skill and knowledge organization management, 6) the interaction among student-student, student-instructor or counselor, should be enhanced, 7) the students should be provided the reflection in learning from practicing in order to construct knowledge as well as be able to apply the knowledge in other situations, 8) the instructors’ role would be facilitators providing suggestions, and evaluators in learning.
1.3 Students’ role

The students played role in studying the content by self paced learning and live event with group members for theoretical content, and instruction in normal classroom for practice content by implementing the learning based on step, and instructional activity based on conceptual framework of blended instructional management for developing higher order thinking in which the students had to be enthusiastic in learning by studying the content material as specified by instructors in learning management system, presenting the learning technique and problem solving as determined by the instructors, determining guidelines in searching answers and solutions, searching for information and collecting data, analyzing and synthesizing the obtained data, and concluding the findings of data for leading to solving the obtained problem, being self responsible in working with the others, and participating in the group activity intentionally, expressing one’s opinion and accepting the others’ opinion as well as sharing ideas with group members including small group and large group, asking questions and listening to clarification from instructors when there were problems in learning as well as constructing the new body of knowledge by students themselves.

Instructors’ role

The instructors played role in planning for instructional management, preparing for readiness in learning and teaching, determining the learning objective, selecting the content material, arranging the media and learning resource origin, organizing the learning process, discussion activity, work assignment, facilitating, following, monitoring, controlling, and examining the students’ instructional activities to follow the specified steps and activities, advising and suggesting the learning guidelines of learning, providing counseling as well as encouraging the students to participate in instructional activities, expressing one’s opinion, and training each student’s higher order of thinking through group process, developing the students’ motivation in learning and instruction so that the instructional activities would accomplish the determined goal, the instructors had to give an importance to the individual differences of students both of in the regular classroom learning, and the e-Learning, the evaluation of learning performance, and reflection for students during the instructional management, and leaning evaluation after instruction.

1.5 Media/supportive resource of e-Learning

The media/supportive resource of e-Learning for blended learning model by applying information technology to develop the higher order thinking skill for students in the Institute of Physical Education consisted of parts as follows:

1) Computer technology and network system, the network equipment, internet connection, and Learning Management System (LMS), needed to be organized so that the students could access conveniently an quickly, and the staffs to be ready for providing service and solving problem throughout the learning session.

2) Management of learning situation performed by using the course content in managing the learning situation, and determining steps of learning through learning management system so that the students would have learning, and solving problem based on specified guidelines and steps by instructors.

3) Preparation in data source for supporting the students was performed by developing Data based, e-Book, PDF Download, and Web links to the information or related website for students to study and search for data in order to use in solving the learning problems.
4) Supplementary service for communication in both of Synchronous communication including the chat room, and Asynchronous one including the e-mail, Web board, Weblog, and SMS for both of students and instructors to communicate with each other throughout the time of instructional management.

1.6 E-Learning interaction techniques

The interaction technique of e-Learning for blended learning by applying the information technology to develop higher order thinking skill for students in the Institute of Physical Education could be classified into 4 kinds as:

1) Learner-interface in designing the lesson on LMS, the parts for connecting and cooperating with students to be convenient and quick used, beautiful and attractive for students, including the news broadcasting of learning as well as the advice for studying during the students entering the instructional management system. The students could correct the demographic data, and investigate their own learning progress all the time. The presentation of activity needed to be challenged for students to be eager in learning, and determined as learning steps clearly so that the students wouldn’t be confused during their studying.

2) Learner-content, was performed in which the students studied through learning management system in the course. The students studied the learning content as well as implemented according to instructional activities as specified in LMS, by the instructors as the asynchronous interaction.

3) Learner-learner, was performed by using both of synchronous interaction, and the e-Brainstorming with members through Chat room, and the asynchronous interaction in advertising the findings in determining problem issues, setting alternative hypothesis in solving problems, establishing guidelines for and technique of learning, summarizing data from three analysis and investigating data together with group members, and concluding rationale from problem solving in learning situation through Web board as specified in instructional management system, by instructors.

4) Learner-Instructor, both of synchronous interaction, interaction was administered. The students performed e-Brainstorming through the Chat room, including the instructor in each group and instructor aids stimulating for interaction to be occurred, pointing out the guidelines and solving problems in discussion, and the asynchronous interaction in investigating, and providing feedback during each step of instructional management, and sending the assigned work tasks through the Online question.

2. Objective of instructional model

The instructional model developed by the researcher aimed to develop higher order thinking skill for students of Physical Education Institute, consisted of 10 skills as follows: Executing, Implementing, Differentiating, Organizing, Attributing, Checking, Critiquing, Generating, Planning and Producing

3. Process of instructional management

The process of instructional management of blended learning model by applying information technology to develop higher order thinking skill for students in the Institute of Physical Education consisted of steps in learning and teaching as follows:

3.1 Step of pre-instructional preparation, was a step for arranging the students and instructor aids’ readiness such as orientation, informing the instructional
technique, the student grouping, and measurement and evaluation in learning performance, including following details:

1) **Orientation** consisted of 2 parts as:

   (1) **Instructor aids orientation**, the handbook for using the learning management system for instructors, informing the objectives and guidelines of teaching, providing advice and training in using LMS of the course, technique, and step in instructional management, scoring the worksheet, informing the feedback, and measuring and evaluating the learning performance.

   (2) **Students’ orientation management**, the handbook of supplementary documents were distributed for students, the objectives and regulation in studying, the advice for students in technique for using LMS of the course, technique and steps of instructional activities, the submit, the measurement and evaluation in learning performance, and the investigation in learning performance by oneself.

2) **Enrollment in practice**, every students enrolled in LMS of the course for determining the username and password into instructional system, and improving demographic data, practicing the LMS in each course, study in learning content, the submit, Web board, and Chat room in LMS, Web browser, and the search on web.

3) **Students grouping**, 3-4 students were assigned into each group as the size in which everyone could fully participate in learning without spending too much time in discussion. The students could select their own members based on willingness or interest. The conditions were determined that: in each group had to include different competency levels, in order to have various kinds of thought, the high achievers should help the low achievers, give the group name, and determine role, function, and responsibility of group members. The group members collaborated in learning and teaching of general classroom, and e-Learning through online communication instruments.

4) **Measurement of higher order thinking skill**, was the assessment of students’ pretest higher order thinking skill so that they would know their own competency level of higher order thinking skill. As a result, they would be able to determine their own learning objective appropriately that: which skill they would develop their own higher order thinking skill, by suing the higher order thinking skill test developed by the researcher as 3 alternatives, 60 items, 60 minutes session, measuring 10 higher order thinking skills based on approach of Anderson & Krathwohl (2001).

3.2 **Steps of developing the higher order thinking skill**

The blended learning model by applying information technology to develop higher order thinking skill for students in the Institute of Physical Education would be the instructional activity management for both of normal classroom and e-Learning, consisted of 6 steps and learning activities as follows:

**Step 1: Presentation of learning situation**, the students would obtain problems, or be stimulated to have cognitive dissonance by the questionable learning situation which were challenged for them, would be presented which might be the questions, incidence, article, or case study for motivating their interest to search for the answers or solve problems in order to help them to discuss as well as express their opinion, and conclude the best answer. The students determined major problems/ issues from the specified incidence or learning situation, with schedule for submitting their work tasks on the online question or Web page.
Step 2: Planning and determining the learning guidelines, was a step the students had to plan and specify the guidelines or technique in surveying, investigating, or solving different specified problems. The students needed to conjecture the answer or set up hypothesis in learning, and determine the guidelines or technique to be used in solving problem from specified learning situation as well as specify the guidelines in searching and collecting information technology from various sources in order to bring information to support the determined answer or hypothesis. The group members discussed and modified opinion in group through Chat room in each course, and concluded for answer obtaining from sharing opinion, and scheduling the submit of work tasks in Web page of LMS.

Step 3: Searching and collecting data, was a step the students implementing based on specified guidelines or technique to search for answer or solve the problems. The student practiced in searching for and collecting the information technology which was related and useful for problem solving from determined data source of knowledge, and searching from other origins of additional data by using the searching program. Then, the evaluation was performed whether the information technology was appropriate and sufficient in investigating the set up hypothesis or not. Data was posted collected data on the online Web page on Web board.

Step 4: Analysis and investigation of learning performance, the students had obtained sufficient data from survey and investigation, the students in each group analyzed and considered data from the study by classifying the important one and related to solving problem as well as sequenced the order of data and discussed in group in order to adjust opinion, synthesize data whether it was adequate or not. Then, the main idea was concluded leading to presenting the answer by taking note in the LMS on the online question or Web page.

Step 5: Conclusions and presentation of learning performance, was a step the students concluded the details of rationales and opinion obtaining from learning or problem solving. The answers or findings were summarized including the explanations. The group conclusions or information technology were organized for arranging the group presentation by recording into LMS on the online web page.

Step 6: Evaluation and extending the learning, was a step presenting the findings in solving problem and learning performance as well as steps in implementing various activities. The students collaborated in reviewing the work practice in each step whether it was well performed or not and what the problems were. They collaborated in critique, considering, and comparing their own performance with the group performance whether it was satisfied or not. They cooperated in concluding the guidelines in applying with other situations. Then, they recorded it into the LMS of the online web page.

4. Measurement and evaluation

1) Authentic measurement and evaluation, the measurement was performed after finishing the learning activity in each step by evaluating from statistic of participation, activity in studying the content, recording the learning, sharing opinion in discussion, presentation the performance in practicing according to assignment.

2) Measurement in higher order thinking skill, the measurement scale of higher order thinking skill based on approach of Anderson & Krathwohl, (2001) 10 skills, 3 alternatives, 60 items, 60 minutes session, developed by the researcher was administered.
The findings of evaluation in instructional model

According to application of blended learning model by applying information technology to develop higher order thinking skill for students in the Institute of Physical Education, for teaching in GE 062004 Law in Daily Life for the first year students in Sports Science and Sports Communication, found that the samples taught by blended learning model by applying information technology to develop higher order thinking skill, had their posttest scores of thinking skill in higher level than the pretest scores at .05 level, and average score in each skill of higher order thinking skills in “Good” level. Besides, according to qualitative analysis, found that the samples taught by blended learning model by applying information technology to develop higher order thinking skill, were happy and cheerful during participating in instructional activities. They had opportunity in training for systematic thinking more, learning, and being able to knowledge construction by themselves from participation in instructional activities, sharing opinion, and comparing their own ideas with their friends in the same group as well as their classmates. They discussed with their friends regarding to different knowledge issues. As a result, they could develop group working skill as well as were confident in their presentation or discussion on work performance, and recommendations for guidelines in applying knowledge of other situations as well as skill training for working in information technology and instruction through the internet network system or e-Learning.

Conclusions and discussions

1. Recommendations for using the blended learning model by applying the information technology to develop higher order thinking skill

According to this study, the findings of development the blended learning model by applying the information technology to develop higher order thinking skill, and the usage of the instructional model in teaching were shown by writing into 2 courses of lesson plan including: ED 031001 Innovation and Educational Technology for the second year students majoring in Physical Education, and GE 062004 Law in Daily Life for the first year students majoring in Sports Science and Sports Communication, they were appropriate to be used in instructional management of general education courses and other courses which was not only to help the students in learning very well, but also to provide opportunity for students to be trained in higher order thinking skill that would help them to develop various kinds of thinking process such as critical thinking process, problem solving process, analytical thinking process, and creative thinking process. According to the experiment based on instructional model developed by the researcher, was highly successful based on the presented findings. In addition, the researcher provided recommendations in applying the instructional model appropriately as follows:

1.1 Preparation for students and instructors

1) The instructors had to analyze the learning content, and prepare the knowledge to be ready before implementing the learning and teaching. They needed to have comprehension in steps and processes of instructional activity management very well. But, most of problems were the usages of computer network system. Therefore, the instructors should have skill in using the information technology as well as management system of the course learning very well before implementing the instructional activity management.
2) The preparation for students’ readiness was an important thing, before the students would learn through the blended learning model by applying information technology to develop higher order thinking skill, they had to have knowledge in using the information technology and computer network system as foundation as well as the usage in LMS. Consequently, the instructors should search for techniques in organizing the training program for using basic information technology for students before teaching by instructional model developed by the researcher.

1.2 Instructional management and development of higher order thinking skill

1) Step of presentation in learning situation

For presentation in the problem issues or learning situation, the instructors needed to present the problem issues of content in the course they had taught in various forms as much as possible. The characteristics of problem issues or learning situation should be complex, challenging, and stimulating the students to find the answers, especially those who studied in higher education level. The leading questions which could encourage the students to think was very important in stimulating students to train their higher order thinking skill. But, the problem issues should be clear in which the students were able to search for information. Furthermore, various kinds of instructional media should be used by presenting the problem issues by video tape so that the students would feel as if they were in real situation without boring, and should be interesting.

2) Step of planning and determination of guidelines for learning

The activities in this step aimed to the students training in planning or determining the guidelines in investigating or solving problem as determination. The group members would discuss and modify opinion in their group by using their prior knowledge or trustworthy and reasonable basic information in order to be able to set learning hypothesis as well as consider relationship of information for determining the guidelines in solving problems. At the beginning, the students might be confused in technique for sequencing or steps which would be used in problem solving or conjecturing the answer of obtained problems. Therefore, in this step, the instructors should suggest the students in guidelines for determining the boundary and process in problem solving selected by the students, systematic reflection in opinion on problem solving, and the anticipation for answers or selection for hypothesis which would cause the students to be able to specify the guidelines clearly, and lower duration of time in participating activities in this step.

3) Step in searching and collecting data

The activities in this step focused on the students to search for and collect related and useful information for problem solving as well as evaluation that whether the obtained information was appropriate and complete for solving problem or not. The students had to consider and investigate the credibility of knowledge data source, and organize data as well as make decision in selecting the information obtaining from their self-studying. In this step, the sufficient time and freedom should be provided for students in searching and collecting data. At the beginning, the students might be confused and not familiar with the activities. They focused on finding the answers rather than using their higher order thinking skill. They often tried to open the information knowledge document preparing for them in the internet, or ask the instructors for assuring the clearness of obtained information. So, the instructors should encourage students in trying to collect the adequate and useful data for
problem solving, and suggest guidelines in reflecting their thought by searching for additional data source from related and congruent information technology with how to solve the problems.

4) **Step in analysis and investigation of learning performance**

   The activities in this step provided opportunity for students in group for collaborating in classifying data as well as sequencing the importance of information for using to support the hypothesis. The students were provided opportunity in sharing and modifying their opinion and synthesizing the obtained knowledge how much it would be appropriate. In this step, they students should be provided sufficient time, and flexibility in duration. At the beginning, it would be time consuming since the students were not acquainted with the training for systematic thinking as well as activities. But, after being trained for 2-3 lesson plans, they started to be familiar and spent less duration of time in this step. Their questions were less as well. Moreover, the instructors should enhance and encourage the students as well as be interested in every question of students without answering them all. The answers to be given for students should inform information and stimulate them to think by themselves which would develop their own confidence in using their higher order thinking skill better. In addition, the instructors had to investigate the findings of discussion in synthesizing information the students searching from their group discussion.

5) **Step of conclusions and presentation in the learning performance**

   The activities in this step would provide opportunity for students to share their ideas with their friends within group to summarize the issues, rationales, and approaches obtaining from problem solving, explaining the reasons and details, and organizing documents for presenting their group performance. They would be trained how to compare and contrast the similarity and differences in their own thinking process with their friends in group, be good listeners listening to the others’ opinions which were better than theirs. At the beginning, the students hardly expressed their ideas or discussed in small group since they didn’t have self-confidence. Therefore, the instructors should pay attention and participate in suggesting and answering questions from discussed issues so that the students would be courage in expressing their opinion and participate in discussing more as well as open opportunity for them to negotiate with each other sufficiently which needed to spend more time as well. But, when the students were trained for 2-3 lesson plans, the discussed issuers which were important and relevant to content and congruent with content. So the duration spent for participating in performing activities of the last lesson plans, was less.

6) **Step of evaluation and extending the learning performance.**

   The activities in this step, the students in each group would have their representatives to present the findings from problem solving as well as step in implementing the group activities in normal classroom. They would train how to present their work performance by using their own words, asking or negotiating with reasons, critiquing the performance, and collaborating in summarizing the guidelines for applying in other situations which would develop strength of reasons for higher order thinking. Therefore, every student and group needed to prepare their readiness throughout the time in order to present to the whole class. Their friends would give additional ideas. For students in other groups, if they had any doubts or problem issues, they could raise their hands or add their supplementary ideas in appropriate timing. The instructors should provide feedback the presentation and conclude for clarification of content as well as train their higher order
thinking skill which would help the students to know themselves and be able to improve, correct, and know the correct information as well as develop themselves quickly.

2. Recommendations for future research

1. The comparison of findings in “the effect of blended learning model by applying information technology to develop higher order thinking skill, on the learning achievement,” and the study of relationship in development on higher order thinking skill and learning achievement, and competency in information communication and technology,” should be conducted.

2. The study in “The effect of blended learning model by applying information technology to develop higher order thinking skill showing relationship during development of higher order thinking skill, and different thinking processes,” should be conducted.

3. The study in “The effect of usage in blended learning model by applying information technology to develop higher order thinking skill, with the other groups of students,” such as the Secondary School Students or Graduate Students, should be conducted.

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Appendix

Figure 1: The blended learning model by applying the information technology to develop higher order thinking skill

Figure 2: Components of the blended learning model by applying information technology to develop higher order thinking skill
**Figure 3:** The process of instructional management of the blended learning model by applying information technology to develop higher order thinking skill

### Steps of Pre-Instructional Preparation


### Steps of Developing higher order thinking skill