

Development of a Collaborative Learning with Creative Problem-Solving Process Model in Ubiquitous Learning Environment

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Abstract—The purposes of this research study were 1) to development a U-CCPS Model 2) to evaluate a U-CCPS Model. The research procedures were divided into two phases. The first phase was to develop a U-CCPS Model, and the second phase was to evaluate a U-CCPS Model. The sample group in this study consisted of 5 experts in instructional design, information technology, u-Learning, creative thinking and collaboration skills using purposive sampling. Data were analyzed by arithmetic mean and standard deviation. The research findings were as follows: 1. The U-CCPS Model consisted of four components as followed: 1) principles, 2) objectives, 3) instructional process and 4) evaluation. The objective of the model is to develop a creative thinking and collaboration skills. The instructional process consisted of two stages. The first stage is the preparing stage and the second stage is learning stage. The evaluation of learning is to measure a creative thinking, collaboration skills and authentic assessment. 2. The experts agree that a U-CCPS Model was appropriateness in a high level.

Index Terms—Collaborative learning, creative problem solving process, u-learning, creative thinking.

I. INTRODUCTION

Partnership for 21st Century Skills has developed some visions for the success of learners in economic systems of the new world, and for the practitioners to integrate skills with the teaching of academic contents. Accordingly, the 21st Century Student Outcomes and Support Systems were established by the combination of knowledge, specialized skills, expertise, and omniscience, all of which contribute to the success in both career and life [1].

According to the Partnership for 21st Century Skills, it is found that creative thinking of the learners is very necessary because the world in the 21st century is dynamic and changeable. Those who are able to live practically in the new society should practice their creative and innovative thinking. Actually, these skills already exist in everybody but good learning and training will make him or her more intelligent, more active and more patient. Those who have more creative thinking skills will have better jobs, more progress and more contribution to the world. In addition to creative thinking, the important skill for the 21st century learners is collaboration skill, i.e. the ability to work efficiently in group with flexible roles and willingness to help others so as to achieve mutual

goal. Thereby, the learners must be responsible for the teamwork and appreciate the outcomes of each member.

Creative thinking is such an indispensable skill for the learners that there have been a number of studies to find out methods and ways of learning management, which can develop the said skill to the learners. One of the most interesting and popular techniques is Creative problem-solving process [2].

Collaborative Learning is a method in which the learners dedicate themselves to working in group. In this way, they can study anything of the same interest by setting a project and then presenting the knowledge derived from their cooperation. The learners in each group study and create knowledge together by linking their existing expertise, and synthesizing it to generate the new brand knowledge [3-4]. Therefore, Collaborative Learning is a means that encourages the learners to have collaboration skills.

Ubiquitous Learning refers to a learning model in which information technology and media are used in the management of study. Since it is based on Ubiquitous technology, the learning will be created in different situations and different contexts of the learners [5], and the said u-Learning can be applied in the theory of Constructivism [6].

It is therefore necessary to develop a teaching model with the application of information technology in order that the learners could have both creative thinking skill and collaboration skill. Thus, the researcher is interested in the study of collaborative learning via electronic media based on Creative problem-solving process in Ubiquitous learning environment so that the learners could develop creative thinking skill and collaboration skill.

II. PURPOSE OF THE RESEARCH

- 1) to design a Collaborative Learning with Creative Problem-Solving Process Model in Ubiquitous Learning Environment
- 2) to evaluate a Collaborative Learning with Creative Problem-Solving Process Model in Ubiquitous Learning Environment

III. SCOPE OF THE RESEARCH

A. Population

Population of study is experts instructional design, information technology, u-Learning, creative thinking and collaboration skills.

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B. Sample Groups

Sample Groups of study is 5 experts through instructional design, information technology, u-Learning, creative thinking and collaboration skills.

C. Variables of the Research

Independent variable is Collaborative Learning with Creative Problem-Solving Process Learning Model in Ubiquitous Learning Environment and dependent variable is evaluation of proposed model.

IV. METHODOLOGY

A. The First Phase

The first phase was to develop Collaborative Learning with Creative Problem-Solving Process Learning Model in Ubiquitous Learning Environment (U-CCPS Model).

- 1) Study, analyze and synthesize documents and former researches relevant to the elements of U-learning, Collaborative learning and Creative Problem-Solving Process. Then, the results thereof are used to set up a conceptual framework in order to develop a model of Collaborative learning..
- 2) Study information about learning management by interviewing the instructors in order to synthesize the data of learning model; and by interviewing the students about their ability to use information technology and communication for learning, their learning style, and their cognitive style.
- 3) The development of model of U-CCPS Model
- 4) Present the U-CCPS Model to the advisors for consideration and revision.
- 5) Present the U-CCPS Model to the experts for consideration by means of in-depth interview.
- 6) Create the tools for evaluating the suitability of the U-CCPS Model.

B. The Second Phase

The second phase was to evaluation of U-CCPS Model.

- 1) Present the developed model to the 5 experts from the fields of instructional design, information technology, u-Learning, creative thinking and collaboration skills, for suitability evaluation.
- 2) Improve the U-CCPS Model as to the suggestions of the experts.
- 3) Presenting the U-CCPS Model in the form of diagram with report.
- 4) Analyze the results of evaluation of the model by mean (\bar{x}) and standard deviation (S.D.).

V. RESULT

A. Collaborative Learning with Creative Problem Solving Process Model in Ubiquitous Learning Environment to Develop Creative Thinking Skills and Collaboration Skills (U-CCPS Model)

The U-CCPS Model consisted of three components as followed: 1) principles, 2) objectives, 3) instructional process and 4) evaluation.

a) Principles of the learning model

- 1) Collaborative Learning is a learning method in which the learners dedicate themselves to working in group so that they can study anything of the same interest by setting a project or a job and then presenting the new knowledge derived from their cooperation. The learners in each group study and create knowledge together.
- 2) Creative Problem-Solving Process is a method to combine creative thinking with experiences and information research in order to find out the solutions. There are 4 main steps in solving the problems:
 - Understanding the problem - In creative problem-solving process, once we completely understand the problem or really know its context, it is easy to find out the solution thereof.
 - Generating ideas - To generate any ideas to find out the solution or answer to the questions of the previous step, the extraordinarily new and different ideas are needed.
 - Planning for action - In this step, there are solution finding and acceptance finding. The first one is about analysis, definition, and adaptation of the ideas to be more concrete based on elaborate consideration and examination. The other is about the finding of support and objection in order to bring about the solution.
 - Appraising tasks - Creative problem solving process is effective and flexible, and it can be adjusted to suit any individuals, problems or situations.
- 3) Ubiquitous Learning is a kind of learning in a form of digital media, in which the learners can study anything anytime and anywhere without a computer. As a result, there is flexibility in learning and fast access to the information; whereby the learning will be in accordance with different environments and contexts of the learners. The characteristics of u-Learning include:
 - Permanency - The information will exist until the learners delete it. All works derived from learning process are recorded all the time.
 - Accessibility - The learners will receive the desired information immediately, and they can access the information whenever they need.
 - Immediacy - When the learners retrieve any information, they will get it at once so that they could solve the problems during the learning process.
 - Interactivity - The learners can interact with each other, with instructors or experts, and with teaching media.
 - Context awareness - Learning environment and learning activity must comply with the context of learners.
- 4) Ubiquitous Learning is a kind of learning in a form of digital media, in which the learners can study anything anytime and anywhere without a computer. As a result, there are flexibility in learning and fast access to the information; whereby the learning will be in accordance with different environments and contexts of the learners. The characteristics of u-Learning include:
 - Computer tablets with processing unit and memory are equipped with a system that can check the status of learners before sending them the contents through the said tablets.

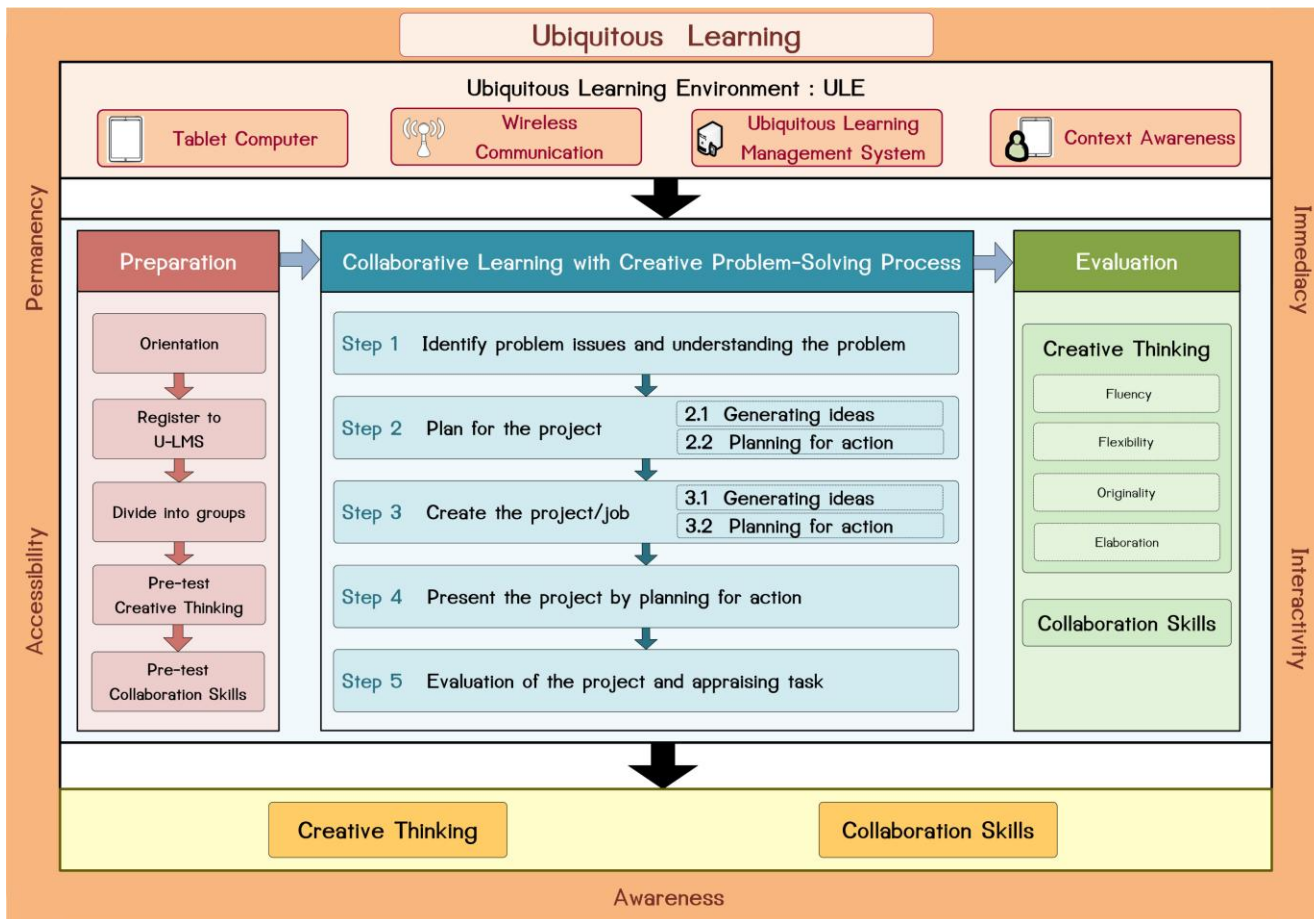


Fig. 1. Collaborative learning with creative problem-solving process learning model in Ubiquitous learning environment (U-CCPS Model).

- Wireless Communication, e.g. Bluetooth or Wifi, is suitable for the fast data transfer. This research employs Wifi network, in which the learners can study anything wherever there is Wifi available.
 - Ubiquitous Learning Management System (U-LMS) has a host computer for the management of learning, and storage of education resources, media, and education units. The host computer can also provide the learners with understanding and assistance by analyzing and answering the learners' questions through their tablets.
 - Context Awareness will detect the movement and environment according to the learners' context so as to recognize their status.
- 5) Creative Thinking refers to advanced cognitive process based on different thinking processes to create new things or solve the existing problems. Creative thinking consists of fluency, flexibility, originality and elaboration.
 - 6) Collaboration skills consists of:
 - Demonstrate ability to work effectively and respectfully with diverse teams.
 - Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal.
 - Assume shared responsibility for collaborative work, and value the individual contributions made by each team member.
- b) The objectives of the model are*
- 1) To develop creative thinking according to the 3 principles of creative thinking evaluation by Torrance: 1) Evaluation of fluency 2) Evaluation of flexibility, and 3) Evaluation of originality.
 - 2) To develop collaboration skills.
- c) Instructional process includes 2 stages as below*
- 1) Preparation before learning
 - Orientation - This activity was held to provide knowledge and understanding of learning activities, evaluation, tests, and collaborative learning by means of creative problem-solving process.
 - Register through Ubiquitous Learning Management System - All learners had to register in U-LMS to participate in learning activity of the system.
 - Groups of learners - The learners were divided into groups based on their interests, and they could use any tools to communicate, to work together, and to analyze any problems.
 - Test of creative thinking and collaboration skills to measurement of the scores before taking part in the developed learning model.
 - 2) Collaborative learning with creative problem solving Process - In this research, the researcher inserted creative problem-solving process in the stage of collaborative learning; and the steps of learning management through Ubiquitous Learning Management System are as follow:
 - Create a topic and study the problems - The learners set up a topic of research in order to create a project/task together. The learners had to understand the task/problem issues, realize the problem limits, and search for the problem conditions in order to raise a

group problem issue. Thereby, the U-LMS would automatically present a case study to the learners, and provide suggestions on the posting of questions and answers on the web board and in chat room. Once the members posted any comments, the other members of the group were notified automatically. Then, the learners had to prioritize the significance of each problem and identify them so that they could pick up the most important one.

- Set up collaborative working plans and find out solutions - There was a brainstorming to lay out a project, for instance, by setting the scope of contents, planning to present what to be studied, and assigning the tasks to members. All of the learners had to present, discuss and share their ideas so that they could establish the most interesting topic. This would generate ideas and find out solutions or answer the questions from the previous stage. Whereby, the learners might discuss the issues to review their action, and consider both supporting factors and obstacles in the plans. After that, the plans were adjusted before taking any action until they were appropriate in certain extent. In this step, U-LMS was employed for the group members to discuss, brainstorm, and use their knowledge to present new brand solutions, which were various and possible.
- Create tasks - The members should help each other to create a project/task so that they could have interaction in the group as much as possible. Each of the members was responsible for the assigned learning and tasks; thereby the group itself would control the learning. During this process, the learners would generate more ideas and plan for more action in addition to those figured out in the earlier working plans. Besides, while creating the tasks, the learners shared their ideas and reported the progress via the system.
- Present the job - The project was presented to other groups so that the others could criticize it and share their opinions. In this step, the members of each group prepared the contents and presented what they had learnt as to the established action plans. The learners would employ the planning for actions to design their presentation and make it more interesting and more outstanding. Then, the presentation could be done clearly via the chat room and the web board. Once the members posted any comments, the other members of the group were notified automatically.
- Evaluation - The project was evaluated by the group itself, by other groups, and by the experts. All the learners would evaluate how the project was, whether the thinking process could solve the problems, and whether it was suitable to the situations. After evaluating the projects of the other groups, the learners would generate their own ideas for the next projects.

d) *Measurement and evaluation*

Measurement and Evaluation in each unit were conducted at authentic assessment. After the end of collaborative learning activities based on creative problem-solving process in Ubiquitous environment, the measurement of learning results was conducted in terms of creative thinking as to Torrance, and collaboration skills of the learners.

B. *The evaluation results of the U-CCPS Model*

The evaluation is carried out by submitting the developed model to the five experts for a certification on the suitability of its components, instructional process, and for a test. The evaluation result by the expert has shows that the components have high suitability ($\bar{x} = 4.45$, S.D. = 0.71), the instructional process have the highest suitability ($\bar{x} = 4.60$, S.D. = 0.52), and the overall appropriateness for a test have the high suitability ($\bar{x} = 4.40$, S.D. =0.50).

TABLE I: THE EVALUATION RESULTS OF U-CCPS COMPONENTS

Evaluation Lists	Results		Level of suitability
	\bar{x}	S.D.	
1. principles	4.60	0.55	Highest
2. objectives	4.60	0.89	Highest
3. instructional process	4.20	0.84	High
4. evaluation	4.40	0.55	High
Summary	4.45	0.71	High

The Table I shows that the experts agree that a U-CCPS components was high suitability. ($\bar{x} = 4.45$, S.D. = 0.71)

TABLE II: THE EVALUATION RESULTS OF U-CCPS PROCESS

Evaluation Lists	Results		Level of suitability
	\bar{x}	S.D.	
1. preparation	4.80	0.45	Highest
2. collaborative learning with creative problem solving process	4.40	0.55	High
3. evaluation	4.60	0.55	High
Summary	4.60	0.52	Highest

The Table II shows that the experts agree that a U-CCPS Process was highest suitability. ($\bar{x} = 4.60$, S.D. = 0.52)

TABLE III: THE EVALUATION RESULTS OF U-CCPS MODEL FOR A TEST

Evaluation Lists	Results		Level of suitability
	\bar{x}	S.D.	
1. U-CCPS Model is appropriate to develop creative thinking	4.60	0.55	Highest
2. U-CCPS Model is appropriate to develop collaboration skills	4.20	0.84	High
3. U-CCPS Model is possible for test	4.20	0.84	High
Summary	4.34	0.74	High

The Table III shows that the experts agree that a U-CCPS Model was appropriateness for test in the highest ($\bar{x} = 4.40$, S.D. = 0.50).

VI. CONCLUSION

The findings from this study appear to provide strong support for the premise that a collaborative learning and teaching approach delivered using ubiquitous learning environment could provide strong supports for develop undergraduate students' creative thinking and collaboration skills because student can share knowledge and interactive with their friend. The U-CCPS Model is appropriate for using and can help undergraduate student to develop knowledge and skills in information and communication technology.

VII. DISCUSSION

According to the evaluation by experts, it is found that the elements, the stages, and the activities of the model have suitability in high level. This is in compliance with the research of Treffinger, Isaksen and Dorval [7], who found that the management of learning based on creative problem-solving process must have 4 steps provided in the said process. For u-Learning, Moushir [8] presented the collaborative learning in order to support the learning in u-Learning environment. The learners are able to share their knowledge, interact, collaborate in learning, and exchange their experiences.

As to the evaluation by experts, it is found that the learning model is suitable for the development of creative thinking and collaboration skills in high level. This is in accordance to the research of Maraviglia and Kvashny [9], who applied the teaching model based on creative problem-solving process. They found that the creative problem-solving process had the highest effect on creative thinking. Moreover, the research of Ogata and Yano [10] found that collaborative learning is the process that provides the learners with collaboration skills.

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