The development of web-based learning environments model to enhance cognitive skills and critical thinking for undergraduate students

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Abstract

The purposes of this study were to design and develop web-based learning environment model to enhance cognitive skills and critical thinking for undergraduate students. The developmental research phase I: model development was employed. The result is shown that there were 9 elements in the model as follows; (1) Problem base (2) Data bank (3) Related case (4) Scaffolding (5) Enhancing in cognitive skills center (6) Enhancing critical thinking center (7) Chat room and web board foster in collaboration (8) Cognitive tools (9) Coaching. The model illustrated the efficiency in 3 aspects: content, design and media.

Keywords: Web-based learning environment, cognitive skills, critical thinking

1. Introduction

Today’s world and the environment have been changing rapidly in the economy, society, politics and culture and due to the advances in science, technology, and information network link the world as a society of social learning and data transferring. As a result, the international community is a wide contact, connection as well as dependence society which increasing affective and competitive society. In the past, the form of education in Thailand could not develop people to have ability to solve problems effectively. Since the teaching and learning is a traditional style; data entry, remembering, emphasizing in data transfer in a classroom which result in learners are inexperienced, lack of surrounding study which does not stimulate the learners to learn a new thing, lack of a creative thinking, lack of knowledge to think and act, lack of cognitive skills to create cognitive thinking, lack of actual information acquisition and the form of learning is not focus on creative thinking (Sapapong, 1998). Therefore, an educational reform process should focus on practical and continuous learning, thus student centered learning should be acquired. The objective and important principle of the National Education Act (B.E.1999) is to manage the investigate learning and self-study continuously based on the principles that all students have ability to learn and develop themselves. In addition, students shall be considered as the most important; thus, the educational process should support learners to develop themselves naturally and effectively. Students’ activities should be provided to get hands-on experience; practical experience; thinking practice. In addition, an appropriate integrated teaching of
various knowledge; ethics; moral values and desirable characteristics of students should be educated in all courses. To promote and support the teacher providing atmosphere, learning environment and facilities to help students’ learning. The instruction should be provided in everywhere and every time and should be collaborated with people including parents, guardian, and community to improve the students’ potential.

Studying in higher education, learners are expected to gain not only knowledge but also higher-order thinking skills. The skills can help learners coping with problems in daily life, as well as applying and using their knowledge in their professionals effectively. Growing higher-order thinking skills requires critical thinking as a basis of development (Kham Mani et al. 2001). In other word, if learners have inadequate critical thinking, they will have difficulty in developing their higher order thinking skills. Therefore, to develop learners’ higher order thinking skills, the institutes of higher education should train their learners to extend critical thinking skill through their learning and teaching process (Sunsern, 1997).

Goal achievements in study science are to manage learning environment to support and promote the development thinking skills and Science process skills simultaneously to help the students be able to have, problem solving and thinking skills in Science process to get knowledge (Machamni, 2000). In the present, science learning emphasize in process learning with learner center. The teacher helps the learners to construct knowledge and achieve the goal by their own selves (Kham Mani et al, 2001). Especially, in science teaching and learning process the learners should be active inquiry, discovery learning, and solve problem. This can result in developing the thinking process of the learners in learning Science for Quality of Life Course. This may help the learners to enlarge cognitive structure that have been able to analyze carefully and construct the knowledge in meaningful ways.

The above mentioned reason, this study intended to design and develop the learning environments to enhance cognitive skills and critical thinking of students in higher education in Science for Quality of Life. It may result in developing cognitive skills and critical thinking of the learners in the learning process.

**Method and Data Sources**

The purposes of this study were to design and develop web-based learning environment model to enhance cognitive skills and critical thinking for undergraduate students. The target group consisted of 6 experts to evaluate in term of content, media and measurement and evaluation, 4 instructors who taught Science for quality of life subject from General Education Department, 30 students who studied in the Science for Quality of life subject of second semester in 2010 academic year, Udon Thani Rajabhat University. Research design used in this study is Developmental research in Phase 1: Model Development (Richey and Klein, 2007). Several methods used were document analysis and survey research which qualitative collecting data. In particularly, the content used in this study is the part of 4000102 Science for Quality of Life in the topic of food and nutrition. Research variable studied in this work is web-based learning environments model to enhance cognitive skills and critical thinking based on instructional design theory.

The instruments in this study consisted of experimental instruments: web-based learning environment that enhance cognitive skills and critical thinking. The process of the design and development were as follows: (1) to examine the principles and theories, (2) to synthesize designing framework of the web-based learning environment, (3) to design and develop the web-based learning environment based on above mentioned designing framework, and (4) to evaluate the efficiency of the web-based learning environment. The instruments for data collecting including: (1) the opinionaire of instructional context in the course of 400102 Science for Quality of Life is used to survey opinion of the lecturers and students about learning context used open-ended questions. The issue is related to education that promotes knowledge construction, cognitive skills and critical thinking. (2) The record form of document analysis, (3) the participant characteristic survey form includes the features of the following participants: designer, developer, lecturers and students which are based on development process of Richey and Klein (2007), (4) the evaluation form for the experts, (5) the learners’ opinionnaire toward the web-based learning, and (6) The learners’ cognitive skills tests, (7) The learners’ critical thinking tests and (8) the achievement test for students who learn in Science for Quality of Life subject.

Data collected were analysed as: (1) the expert reviews in several domains, such as content, media, instructional design, cognitive skills, critical thinking, constructivist learning environments, and measurement and evaluation experts. The data were collected by the researchers and analysed by analytic description, interpretation and
summarization. (2) The learners’ opinions toward the web-based learning environment. The data were collected by the researchers and analysed by analytic description, interpretation, and summarization. (3) The cognitive skills test, critical thinking test and achievement test. The quantitative data were collected and analysed by descriptive statistics: mean, S.D., and percentage. The qualitative data were collected and analysed by analytic description, interpretation, and summarization.

3. Results.

The results of this study, the developmental research phase I, to design and develop the web-based learning environment model to enhance cognitive skills and critical thinking are as follow:

3.1 Synthesis of a theoretical framework

Research related documents shown that the basic theoretical framework consists of importance five major basis of fundamental (1) the basic psychology of learning, including constructivist theory, cognitive theory (2) Pedagogy focusing on learning environment designed along constructivist theory and cognitive skills and critical thinking theory (3) fundamental in media symbol system (4) based on technology such as web-based learning and (5) based on contextual principle such as graduate desirable features, guidelines for teaching, and the essence of the Science for quality of life courses.

3.2 Context of the study

Results of this study found that the condition of teaching of Science for quality of life subject as follows: the students' learning experience with emphasis on lectures, which the students wrote down the contents. The instructor show slides presentation and students were divided into small groups to present report in front of the class. The students' experience in the computer had to learn with various software programs including Microsoft office and searched on the Internet. Using various social networking applications not at all in learning. However, the students didn't have experience of problem-based learning. Moreover, the students didn't have experience in the constructivist learning environment, with the tasks of learning to provide the students solve the problems. It also found that students didn’t have learning experience with activities that promote cognitive skills and critical thinking.

3.3 Designing framework of web-based learning environment

In order to create designing framework of web-based learning environments model to enhancing the students’ cognitive skills and critical thinking were taken into consideration. The details were as following:

1) The Activation of Cognitive Structure: It is illustrated the relationship between the underlined theories as follows: constructivist theories and cognitive constructivism (Piaget), situated learning (Brown, Collins, & Duguid, 1989), open learning environments: OLEs (Hannafin, 1999) It was designed based on complex problem context (Jonassen, 1999) as the component of Problem base.

2) The Support and Enhancement in Knowledge Construction: It is illustrated the relationship between underlined theories as follows: constructivist theories, CLEs model (Jonassen, 1999) and Mental model (Merrienboer, 1997). It was designed as the component of Related Cases.

3) The Enhancement cognitive structure, cognitive skills and critical thinking: It is illustrated the relationship between underlined theories as follows: social constructivism such as CLEs (Jonassen, 1999). It was designed as the component of Collaborative Learning. OLEs (Hannafin, 1999) it was designed as the component of Cognitive Tool. For enhancement cognitive skills (Fraenkel, 1980) it was designed as the component of Cognitive skills Center. For enhancement critical thinking (Ennis, 2002) it was designed as the component of Critical Thinking Center.

4) The Encouragement and Support Knowledge Construction and learning performance such as cognitive skills and critical thinking. It is illustrated the relationship between underlined theories as follows: OLEs (Hannafin, 1999) it was designed as the component of Scaffolding such as conceptual, procedural, metacognitive and strategic scaffolding, Cognitive apprenticeship (Lave & Wenger, 1991) it was designed as the component of Coaching.

The designing framework are synthesized based on the above mentioned theoretical framework. The relationship between the underlined theories and the components of the constructivist learning environment was produced.
3.4 The performance of the web-based learning environment model to enhance cognitive skills and critical thinking

The evaluate effectiveness of the web-based learning environment model to enhance cognitive skills and critical thinking by product evaluation (Chaijaroen, 2008). To examine the quality of the model through the various experts found that (1) the content is accurate and appropriate to the level of learning among students. In addition, the content looks interesting, up to date and timely today. As well as the contents are subject to extensive study. The contents are to clarify the concept of food and nutrition or students’ construction of knowledge. Language can communicate directly with the concept in learning, compact, hierarchy, and easy to understand. In addition to be suitable for method or principle and theory used in the model design which based on constructivism, such as information in resources, which extensive knowledge to solve problems that relevant to situations. The contents are presented in the interest patterns, such as the letters are highlighted in colour, which in order to enhance the students’ information processing to recognize them easier and contribute to better learning. (2) The media network that is designed navigation help the students find information easily. The designs of navigation structures are similar to easily access information and stability. In addition to the students familiar to use these navigator. (3) The design of learning environment. Exactly consistent with the principles and theories used as fundamental of design. Overall, more appropriate and enhance the students’ cognitive skills and critical thinking.

4. Discussion

The results of the design and development of web-based learning environment to enhance cognitive skills and critical thinking for undergraduate students that consists of 9 elements: (1) Problem base (2) Data bank (3) Related case (4) Scaffolding (5) Enhancing in cognitive skills center (6) Enhancing critical thinking center (7) Chat room and web board foster in collaboration (8) Cognitive tools (9) Coaching. There consistent with Wattanachai et al.(2005), Chaijaroen et al.(2008) Wattanachai et al.(2008), Kanjug (2009) and Samat (2009) The results of this study. Design elements of the learning environment that promotes cognitive skill and critical thinking of the students. That there is a theoretical basis. (1) the basic psychology of learning, including constructivist theory, cognitive theory (2) basic science instruction focusing on learning environment designed along constructivist and cognitive skills and critical thinking theory (3) fundamental of media symbol systems (4) based technology such as learning with web-based learning environment and (5) based on this principle into context such as graduate desirable features, guidelines for teaching and the essence of the analysis and design courses. In addition to found that: this models which designed and developed the quality models, which is evident from the evaluation by the various experts found that the content is accurate, right up to date timely. Design and media can encourage students to construct knowledge and enhance cognitive skills and critical thinking. The result is that, because due to the design has been designed based on a theoretical basis instruction design theory that the principles into practice such principles to construct knowledge based on constructivist theory, which a problem situation to activate students disequilibrium. Encourage students to solve problem lead to equilibrium. It also has adopted the cognitive skills and critical thinking to design integrated into the cognitive skills and critical thinking center that allows students to select knowledge, knowledge deconstruction, adapted knowledge reconstruction. These issues cause the students able to apply to new situations. It was found that the differences observed in this study were the new findings and the learning environments to enhance students’ cognitive skills and critical thinking.

5. Conclusion

The purposes of this study were to design and develop web-based learning environment model to enhance cognitive skills and critical thinking for undergraduate students. The theory foundations for the design of model consisted of psychological and learning theory, instructional design theory, communication and message design theory and design and development research. It was synthesized as theoretical framework and learning context as basis in designing framework associating the design elements of the model.
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