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Development of blended learning model with virtual science laboratory for secondary students

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Abstract

This study is conducted in terms of research and development aiming for developing blended learning model using project-based learning via virtual science laboratory in a science classroom for students in secondary schools. The model could lead students to understand sciences lessons easier and enable to do experiments in lesser time, and encourage them to create new further experiments with curiosity. In addition, the model combines face-to-face learning and learning on online network to optimize the advantages of both methods. The research process is divided into 2 phases: 1) the development of blended learning model using project-based learning via virtual science laboratory, and 2) the affirmation of blended learning model using project-based learning via virtual science laboratory. The research samples are five experts selected by purposive sampling. The research instruments are the model of blended learning model using project-based learning via virtual science laboratory, and the evaluation of the model's appropriateness analyzed by means and standardized deviations statistically. The research result shows that: 1. There are five modules in the model which are 1) Student Module 2) Instructor Module 3) Blended Learning Module from Project-Based Learning and Active learning for students to conducting science projects and to check how much they understand what they have learned 4) Virtual Laboratory Module and 5) Assessment Module. 2. The five experts assessed the instruction model, and pointed out that the developed instruction model is highly appropriate. This shows that the developed instruction model can be used for enhancing analytical thinking skills and evaluation of ability in conducting science projects for secondary students.

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Keywords: Blended Learning; Virtual Science Laboratory; Science

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1. Introduction

Most important problems in teaching science in middle school are students lack basic knowledge, schools' laboratories are not well equipped, and subject matters are hard to understand. A survey of teacher opinions also highlighted problems of students not paying attention to the subject, schools lacking standard tools and equipment for teaching, students not understanding science, and schools lacking laboratories (Niparat Witee, 2010). As a result of such problems, a virtual laboratory has been developed to allow students to conduct an experiment several times, to save cost, and to protect students from dangers that could arise when performing a real experiment. According to an article "Physical and Virtual Laboratories in Science and Engineering Education", published in a Science Education issue of Science magazine, it was found that science learning of students of every age group required a scientific investigation part. Applying virtual laboratories in scientific experiments has a number of advantages: they are easy to use, require little time, and allow students to perform several experiments within a limited time and carefully plan their future experiments. Teachers can also use students' experiment data (stored in a computer) to design a group discussion in class, prepare a next lesson, or identify students who need extra tuition. Moreover, they can help students understand things that are not possible to experiment in real life, e.g. a geomagnetic reversal and effects of heart rates (Wijarn Panich, 2013). Accordingly, in order to increase students' participation in learning and facilitate learning at any time and place at their convenience via computer network, I would like to develop a virtual laboratory of the same quality as a real laboratory, where students can test their hypothesis and observe the test result without risk of possible dangers from a real experiment or high cost and prepare themselves for an experiment in a real laboratory, which would result in students experiencing and understanding scientific principles by themselves, thus means better learning and thinking skills of the students (The Virtual Campus, 1998; Tanormporn Loahacharussang, 2002; Boonker Kuanhavech, 2010).

Analytical thinking is an important skill students should keep practicing until it becomes habit in order to enhance their knowledge, experience, and thinking skill thoroughly (Niramon Satawut, 2005). Analytical thinking happens when we try to find a causal explanation of a situation or phenomenon, to assess and make a suitable choice, and to see a big picture of something (Amparat Nualtong, 2011). Science helps humans advance their thinking process, i.e. causal thinking, creative thinking, and analytical thinking; knowledge seeking skills; systematic problem solving; and decision making basing on a variety of information and verifiable empirical evidences. An objective of the Department of Science is to provide students with science education that focuses on connecting knowledge with process, developing students' research skill, knowledge construction skill, and problem solving skill, and encouraging their participation in class with suitable activities for each age group.

In a strategy of blended learning, traditional education will be adopted together with online learning technologies, e.g. learning management system, video broadcasting, desktop video conference, and interactive communication tools to enhance students' participation and exchange of knowledge, while valuable class time will be used for developing thinking skills and necessary attitude toward learning of students. According to the strategy, 30-79% of the course content will be delivered online and the other 21-70% will be delivered face-to-face in class. Integral elements to a successful mix between virtual and traditional classrooms are contexts of classroom, content format, course activities, and evaluation methods (Graham, 2006; Rochester, 2004; Dam, 2003; Thorne, 2003; Carman, 2002; Collis & Moonen, 2001). Even though online learning makes it earlier for students to access to knowledge at any time and place, teacher and student communication in a face-to-face learning is also important. Consequently, the blended learning is an effective strategy that can combine best methods of both real world and virtual world (Siew-Eng, 2010).

Therefore, the researcher had an idea to develop the developing blended learning model using project-based learning via virtual science laboratory in a science classroom for students in secondary schools., which would encourage group learning and help improve analytical and rational thinking, problem solving, and decision making skills of students, both in class and in real life.