The Development of a Hybrid Teaching and Learning Model for Learning the Physics Course of Undergraduate Students

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Abstract: This research aimed to develop of a Hybrid teaching and learning model for learning the Physics course of undergraduate students. The sample consisted of 80 undergraduate students who enrolled in Physics 1 in the 1st semester of the academic year of 2010, obtained using the purposive sampling technique. These students were divided into two groups; an experiment group of 40 students who learned using the Hybrid learning model and a control group of 40 students. The research instruments included lesson plans for Hybrid learning model and traditional learning approach for Physics 1, the achievement test, the test on critical thinking skills and the satisfaction questionnaire on learning via the Hybrid learning model. The statistics used for testing the hypotheses included the paired t-test and the F-test (One-way MANCOVA and one-way ANCOVA) were employed. The study results are as following; the developed Hybrid learning model for Physics 1 course consisted of 12 components namely; specifying learning objectives, analyzing learners, designing the course contents based on the Hybrid learning model, designing activities corresponding to the Hybrid learning model, preparing learning environment, defining teachers' roles, implementing good features of E-learning model, implementing good features of face-to-face learning using information technology to support classroom learning, building students' skills and organizing supporting activities, evaluating classroom learning and taking feedback of classroom learning for improvement. The developed model was at the more appropriate level as assessed by a group of experts. It had the efficiencies (E_1/E_2) at 83.25/80.50 and the effectiveness index of 0.57. The students learned using the developed model and the traditional learning approach did not show Physics learning achievement and critical thinking abilities as a whole and in each subscale differently. However, the first group of the students indicated more learning retention after 2 weeks of learning than the latter group of the students ($p<0.05$). The students learned using the developed model indicated their opinions as a whole at the high level.

Key words: Hybrid teaching, learning model, E-learning, critical thinking, learning retention, undergraduate student

INTRODUCTION

Now-a-days students consider Physics as a difficult subject to learn and understand. Students' understanding of key concepts on electrostatics has been extensively studied, ranging from the simple notions treated in primary school science to the more sophisticated notions addressed in introductory Physics courses at university level. The studies at university level determined that students have many misconceptions and learning difficulties on Physics (Bilal and Erol, 2009), especial in university because university is considered as a source of community learning. Today's technologies are applied in the operation to increase the efficiency of the agency in all areas, especially in the teaching and learning activities. A modified method of teaching at the university level in several ways as the technology becomes important and

necessary part of the university. The forms of electronic learning, ideas for reducing costs of education and solving the problem of insufficient personnel (Jongchaikit, 2003).

E-learning comprises all forms of electronically supported learning and teaching. The information and communication systems whether networked learning or not serve as specific media to implement the learning process (Tavangarian *et al.*, 2004), critical thinking in general refers to higher order thinking that questions assumptions. It is a way of deciding whether a claim is true, false or sometimes true and sometimes false or partly true and partly false. The concept is somewhat contested within the field of education due to the multiple possible meanings (Ennis, 2003). Research on multimedia design have also found that this experiential learning cycle model to be a helpful framework of organizing interactive

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multimedia learning activities to address learning styles (Tsoi and Goh, 2008). The Hybrid teaching and learning model represents learning as a cognitive process (Tsoi, 2007).

Rajabhat Maha Sarakham University is one of higher education institutions in Thailand having an aim to provide and develop quality education to comply with National Education Act of 1999. With its realization with classroom instructional problems, this research was proposed to develop the Hybrid teaching and learning model having student-centered learning process in mind to teach Physics students more effectively.

The research's purposes:
- To development of a Hybrid teaching and learning model for learning the Physics course of undergraduate students
- To study the implementation of a Hybrid teaching and learning model for learning the Physics course of undergraduate students

MATERIALS AND METHODS

This research was an experimental with the two group pre- and post-test design. Population and sample as follows:

- The research population consisted of 4,571 1st-year, bachelor's degree students of Rajabhat Universities who enrolled in Physics 1 in the first semester of the academic year of 2010
- The research sample was two classes of 80 1st-year, bachelor's degree students of Rajabhat Universities who enrolled in Physics 1 in the 2nd semester of the academic year of 2009. They were selected by purposive sampling method and were divided into two groups; experiment group and control group

Research instrument including the following:

- Lesson plans for Physics using the Hybrid teaching and learning model
- Lesson plans for Physics using normal classroom method
- Achievement tests
- Tests on critical thinking skills
- Evaluation forms on the opinions on the Hybrid teaching and learning model

Data collection there was the step as follows:

Step 1: Explain the objectives before the experiment to the subject group and give them the pre-test.

Step 2: The experiment group were assigned to perform the learning activities and were given the post-test.

RESULTS AND DISCUSSION

The research findings were shown as follows:

- According to the experts, the Hybrid teaching and learning model of Physics 1 for Rajabhat Universities students comprised the following features:
  - Time proportion for the Hybrid teaching and learning model and normal classroom method was 60:40
  - The model contained 12 components: Input had five components:
    - Setting instructional objectives
    - Analyzing learners
    - Designing lesson plans using the Hybrid teaching and learning model
    - Designing learning activities using the Hybrid teaching and learning model
    - Preparing learning environments

Learning processes had five components:

- Specifying teachers' roles
- Making use of E-learning method's good points
- Good features of normal classroom teaching method
- Information technology supports
- Strengthening skills and extra curricular activities

Output had one components:

- Evaluation of teaching and learning performance

Feedback had one components:

- Feedback for improvement
- Results of the appropriateness of the components of the Hybrid teaching and learning model

The experts rated the appropriateness of the components of the Hybrid teaching and learning model at a high or very appropriate level and the eight components at the very high or most appropriate level

Table 1: Comparison of learning achievement and critical thinking skills before and after learning with normal classroom teaching method of Rajabhat Universities students

Learning outcomes	Pre-test		Post-test			
	$\bar{X}$	SD	$\bar{X}$	SD	t	p-values
Learning achievement	46.93	6.889	64.10	5.504	-15.490	0.000*
Critical thinking:						
Deductive	7.48	1.754	8.58	1.083	-4.268	0.000*
Acceptance of initial situation	5.45	1.300	6.15	1.051	-3.894	0.000*
Deduction	5.43	1.357	6.03	1.000	-3.509	0.000*
Interpretation	5.58	1.357	5.88	0.911	-1.820	0.000*
Evaluation of controversial issues	5.05	1.280	6.05	0.986	-5.556	0.000*
Total	28.98	3.759	32.98	3.025	-10.222	0.000*

*Significance at 0.01 level

- Results of using the Hybrid teaching and learning model and normal classroom method to teach Physics:
    - After learning, the students who learned Physics with the Hybrid teaching and learning model obtained higher scores in total and every aspect of learning achievement and critical thinking skills than before learning with the statistical significance at 0.01 level (Table 1)
    - After learning, the students who learned with normal classroom method obtained higher scores in total and every aspect of learning achievement and critical thinking skills than before learning with the statistical significance at 0.01 level
    - The scores in learning achievement and critical thinking skills of the students who learned with the Hybrid teaching and learning model and those with normal classroom method in total and each aspect were not different. But the learning retention of the students who learned with the Hybrid teaching and learning model lasted for 2 weeks or 14 days after learning which was longer than those with normal classroom method (p<0.05)
    - The scores in learning achievement in Physics and critical thinking skills of the students who learned with the Hybrid teaching and learning model and those with normal classroom method in total and each aspect were not different
    - In total, the students' opinions were in favor of the Hybrid teaching and learning model at the high level

The research revealed some interesting points worth discussions as follows; the developed Hybrid teaching and learning model to teach Physics in Rajabhat Universities had 12 components, 8 of which were rated most appropriate by the experts including setting objectives, analyzing learners, designing the lessons for the Hybrid teaching and learning model, designing activities, specifying teachers' roles, making use of the good features of the normal classroom method, IT support and feedback for improvement. The other four components were rated the appropriateness at the high level, namely, preparation on learning environment, making use the good features of E-learning, strengthening skills and organizing activities to support learning and learning evaluation.

The Hybrid teaching and learning model was the best blended teaching and learning method of normal classroom method and E-learning method because it incorporated with four good features namely; good features of E-learning, good features of normal classroom method, information technology supports and evaluation. This teaching method got admiration from academics all over the world because the lessons are easily accessed and learned regardless of time. It is a project-based learning; homework is allowed to be sent on line. Students are encouraged to learn curiously and create higher order of thoughts. Learning and discussion can take place either synchronously or asynchronously.

After learning, the students who learned Physics with the Hybrid teaching and learning model obtained higher scores in total and every aspect of learning achievement and critical thinking skills than before learning with the statistical significance at 0.05 level. The scores in learning achievement in Physics and critical thinking skills of the students who learned with the Hybrid teaching and learning model and those with normal classroom method in total and each aspect were not different. Those who learned with the Hybrid teaching and learning model obtained higher scores in learning achievement and critical thinking skills after learning because it blended the good features of E-learning and the ones of the normal classroom method and was student-centered.

On the other hand, the reason why the scores from learning with the Hybrid teaching and learning model and the normal classroom method in learning achievement and critical thinking skills were not different is possibly because students were not able to well adapt themselves to the new teaching method, so they could not direct their learning appropriately. Besides, they tended to rely on friends and teachers as they do in the normal teaching classroom. Nevertheless, the Hybrid teaching and learning model can be an alternative teaching method to train students to be self-directed, responsible and self-disciplined. Also, it is helpful in solving problem on insufficient teachers and reduce teachers' heavy teaching loads. The learning retention of the students who learned with the Hybrid teaching and learning model lasted for

2 weeks or 14 days after learning at the percentage of 98.17 of average score after learning which was higher than those who learned with normal classroom method. The finding is in accordance with the active learning method which states that >90% of learning retention from direct experience and practical learning will last for 2 weeks after learning. Learners can experience the senses of touch, sight and hearing. They can practice and revise lessons by following the law of exercises in doing repeatedly. In addition, they are given regular quizzes after each lesson. The learning steps are set appropriately which helps learning retention last long.

CONCLUSION

The developed Hybrid teaching and learning model for learning the Physics course of undergraduate students was appropriately efficient and effective for increasing the students' outcomes from before learning and more than the students learned using the conventional learning approach. This learning model, therefore should be implemented in teaching and learning a course on Information Technology for Life at other universities.

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