The Efficiency of Simulation Animation on a Science Lesson: A Case study of a Lesson on Digestive System

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Abstract—**New Media Technology is involving to support teaching and learning programs. The developing countries in the world need to adopt ne methodology to make the students understand the classroom lesson in real life situations. Animation is one area that can add value to the lessons and enable the student to learn quickly and easily. Simulation of an experiment using animation will enhance learning abilities among the students. Thailand and other Southeast Asian countries are trying to improve the quality of people using new methods by bring theory and experiment in science teaching using simulation models. This paper is result of an experiment conducted on students to make them learn using simulation animation on science lesson "Digestive System". The paper elaborates the pre and post design of simulation animation of the lesson on digestive system. The paper deals with the steps of operations that the specialists and students have to go though the learning abilities measured to find the results.**

Index Terms—**Simulation, animation, computer-based instruction, interactive multimedia.**

I. INTRODUCTION AND MOTIVATION

Thailand and many countries in South East Asia are developing countries both economic and humanity which is including of social and education. At the same time, in modern world, there is rapid growth in science and technology. Therefore, the Government of Thailand has set to implement the National Economic and Social Development Plan No.11 (2012-2016). The priority of this plan is to improve the quality of people. There are both, who gain the benefit of the development and who has driven the development at the same time [1]. The result of the evaluation of international education quality in Mathematics and Science of the PISA 2006 and TISMM 2007 found that Thailand has the lowest average score when compared with neighboring countries which participated the project, except for Indonesia. The main reason of course is the way of learning and teaching that does not work [2].

Typically, the teaching and learning of science should include the theory and experiment together. This will help the students see and understand the process, know the cause and effect of the experiment and finally, the student can apply knowledge to solve problems. In Thailand many schools are teaching science using the documents for learning provided by the Ministry of Education only. There is insufficient media to support course to enable students to visualize

scientific processes. As a result, learning is difficult to understand. Learning programs as a medium of instruction with the potential of computer technology will enhance learning objectives [3]. In addition, it is also possible to create a simulation to make skill of learner and learning as close to real conditions. This will, reduce risks and costs for the trial [4].

In view of the above, the researchers are interested in developing the learning materials for scientific simulation by using computer animation. The result expected will be high efficiency of Digestive System animation simulation learning media.
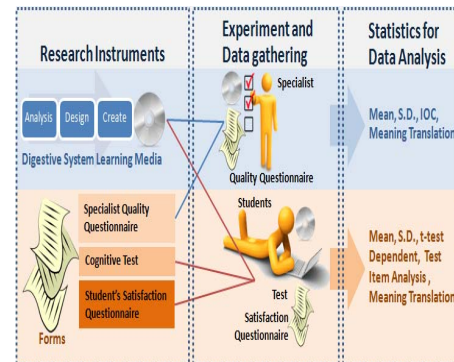

Fig. 1. The steps of studying.

II. LITERATURE REVIEW

The computers come to play a major role in the economic and social development. Likewise in the education area, computer technologies are applied in teaching and learning procedure. By applying them to create a lesson with a modern media will result into computer-based learning media. It has a different name which depend on the characteristics and applications. For example Courseware, Computer Aided Education, Computer Assisted Learning (CAL.), Computer Aided Teaching, Computer Aided Instruction (CAI), Computer Based Instruction (CBI.), Computer Assisted Teaching and Learning and also multimedia that is used in teaching and developing the human resources. However, despite the different names by style and function, the meaning of these words is a lesson media is made up of content to be learned. It must be classified as a subset and ordered by the difficulty of the content. And they also had to taking meditated the differences in learners. Lessons created to be interactive and interact with students. Upon completion, students can get results immediately [5]–[7]. Situation learning media (Simulation) is one of several types of courseware [5]. This is focusing on the creation simulation of real events, for example, continuous events, content that is difficult to understand, invisible, content with imagination of

the students to build understanding, and activities detrimental to learning. Simulations have been created by digital media and providing role play to learners [8]–[10].

During the past five years, in Thailand, a lot of research about computer-based instruction and simulation learning media is going on. The results of several studies confirmed the benefits of them that is being used for teaching both the secondary and higher education. We found that media can stimulates the interest of the learners [9], increase their cognitive knowledge [11]–[14], makes the content easier to understand [9], [15], and learners can remember the knowledge more long time [11], [15]. In addition, an animation used in simulation learning media has more influence on audiences [14], [16].

III. RESEARCH METHODOLOGY

This research is quasi-experiment research. We have research objects, scope and data gathering, the detail s are as follows.

A. Research Objectives

• To develop the efficiency of science lesson using learning media "Digestive System" that is the model of simulation animation.

• To experiment the developed learning media on students and study survey the result.

B. The Scopes

• The population is grade 8 students (in Thailand calls 2nd Mathayomsuka). There are 9 classrooms, total number of student is 336 students. The subjects of this study were 36 students of Suranaree II School, Nakhon Ratchasima Province, Thailand, during the second semester of 2011 academic year. The students were randomly selected by using the cluster random sampling.

• The scope of contents included in the learning media is the lesson of science for grade 8 which improved by Ministry of Education. The topics is human digestive system, we selected only 3 topics to make the story in the media. There are (1) the structure and elements of digestive system, (2) digestive system procedure and (3) the relevant organs. We present learning media with interactive multimedia which work with computers.

• The variables of the study consist; independent variable is multimedia named "Digestive System Learning Media" and dependent variables are efficiency of learning media, students learning achievement and student's satisfaction toward using media.
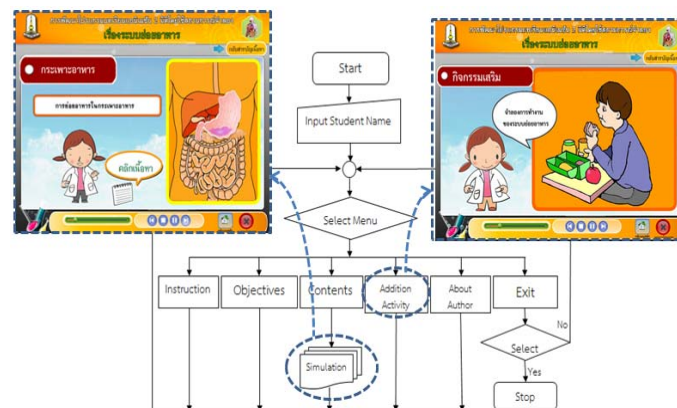

Fig. 2. Flow design and samples of page in the media.

Fig. 3. Experiments and testing.

A. The Steps of Studying

To find the answer to the objectives of the study, we designed the process of the experiment according steps in Fig. 1.

1) Creating the learning media

The process started with creating the research instruments which include two main instruments; a learning media and collection data forms. For the process of creating the "Digestive System" learning media apply software development life cycle (SDLC), the process of development of instruction and online courseware [5] and ADDIE model [6]. The objective for each topics of learning media was the

result of the analysis content that can sum up as follows; (1) importance of digestive system, structure and relevant organs, (2) classification of the type of digestive and (3) describing digestive process in each segment. Thereafter, we took result of analysis to design and develop as shown in Fig.2.

2) Creating the questions

This research, we try to find out the result of using simulation animation learning media to the students by experimenting the media with students in the classroom and surveying with many types of question. Details are as follows.

a) For the specialists: There are two forms of question for the specialists who answered the question of quality of

"Digestion System" learning media. The first is the Item Objective Congruence (IOC.) for evaluating the validation of designed content and each item of the test. The result of IOC evaluation found that each question of the achievement test has IOC value between 0.67 – 1.00 that means questions based on content. And the second is quality of media questionnaire which is the five-level scale; least, low, moderate, high and highest of quality.

b) For the students: There are two forms of question for the students who used the developed media while studying this subject that was taught by the teacher. One of them is the tests for evaluation of the students learning achievement after they studied with the created media. These tests are designed with four choices and have only one choice is most correct. The first time of designing the tests, there are 35 questions. After we done try-out the question with students, we retain 20 questions that have the value of difficulty index (p) is between 0.30 – 0.80 and the value of discrimination index (r) is between 0.20 – 0.70. And the reliability of the test calculated by Cronbach Coefficient α equal 0.85 with level of significance at 0.05. The other question is student's satisfaction questionnaire which is the five-level scale.

3) Data collection and analysis

As in the Fig. 1, after we finished both the learning media and all of the test and questionnaire. Next step is testing of the developed media toward the students who is our samples. The learning media has three topics as shown above, let student learn with media about 1 hour to topic. The test that student must done is question in addition activity, pre-test and post-test. After the last topic finish, students answer the satisfaction questionnaire.

IV. THE RESULTS

The main objective of this research is finding the efficiency of the science lesson learning media that developed by simulation animation to describe complexity process. We defined the meaning of efficiency that is (1) EFF1: specialist's attitude on quality of the learning media, (2) EFF2: learning media capability which was evaluated by empirical approach E1/E2 model for developmental testing of media and multimedia instructional packages [17], (3) EEF3: student's opinion on satisfaction of the learning media and (4) EFF4: comparison of mean of testing score by t-test independent. Details are as Table I to IV respectively.

V. CONCLUSION AND DISCUSSIONS

The result of this research is interactive learning media with simulations to teach the lessons of science which are very high quality ($\bar{x}$ =4.66, S.D.=0.22) and satisfaction of students is very high ($\bar{x}$ =4.60 , S.D.=0.09). After testing the developed media with samples, we found that the ability of media make students get percentage of score between learn and end of learning equal to 82.77/80.13 that more than standard value that is 80/80. That means a developed media able to make student's knowledge as well. In addition, the results of comparison testing scores exposed that post-test score is higher than pre-test score with significant at 0.05 and

0.01.

TABLE I: THE DETAILS OF EFF1

Questionnaire Items	Statistics and Level of quality		
	$\bar{x}$	S.D.	Level
1. The contents in learning media	**4.60**	**0.16**	**Highest**
1.1 The content is consistent with the objectives	4.80	0.07	Highest
1.2 There is a difficulty right to the students	4.60	0.08	Highest
1.3 The use of language to convey meaning clearly	4.60	0.08	Highest
1.4 The content of the lesson appropriates to using of simulation animation	4.40	0.08	High
2. Learning media presentation and designing	**4.68**	**0.30**	**Highest**
2.1 The screen design is attractive and appropriate	4.80	0.07	Highest
2.2 The screen design is easy to understand, meaningful, and visible	5.00	0.00	Highest
2.3 The format, size and color of the texts are easy to read	4.80	0.07	Highest
2.4 The meaning of simulation-based animation is clear	4.60	0.08	Highest
2.5 Figure, sound effect and narration are clearly appropriate	4.20	0.13	High
3. The interaction and feedback	**4.70**	**0.12**	**Highest**
3.1 Provide opportunities for students to properly interact with media	4.60	0.08	Highest
3.2 The navigation of lesson is simple and not confusing	4.60	0.08	Highest
3.3 To provide feedback and reinforced by an appropriate combination of feedback and interaction	4.80	0.07	Highest
3.4 To provide opportunities for learners to control their own learning	4.80	0.07	Highest
Totally	**4.66**	**0.20**	**Highest**

TABLE II: THE DETAILS OF EFF2

List	E1- score of capability of learning process in each topic				E2-score of post-test (20 points)
	Topic1 (5 marks)	Topic2 (5 marks)	Topic3 (10 marks)	Total (20 marks)	
Sum of score (36 students)	156	144	296	596	577
$\bar{x}$	4.33	4.00	8.22	16.55	16.03
Percentage (%)	86.60	80.00	82.20	**82.77***	**80.13***

The causes of learning achievement of the students are of high score and are very different between the two tests. Moreover, the attitude of specialists and students found that they are in the same direction both attitude on designing and developing and attitude on using the media. Their attitude is positive. We are confident that one is developing process of learning media in combination of many methodologies such as the way to develop media as in [5], SDLC used for multimedia programming and ADDIE used for educational design. However, animation is used as a medium for communicating with students, it is able to make excitement

and attract attention as well [14], [16]. That means results of previous researches and including this research are confirmation that the kids like cartoon animation which can make imagination of knowledge and understanding of a lesson of science.

TABLE III: THE DETAILS OF EFF3

Questionnaire Items	Statistics and Level of satisfaction		
	$\bar{x}$	S.D.	Level
1. Students are more interested in content	4.63	0.49	Most
2. Simulation Learning media support students are more knowledgeable about the subject	4.53	0.62	Most
3. Students like simulation learning media because of interesting and provocative presentation	4.69	0.47	Most
4. Students like simulation learning media because of playful	4.50	0.57	More
5. Students like interface design because of beautiful environment	4.63	0.55	Most
6. Students like the presentation of simulation animation to simulate the situation	4.69	0.47	Most
7. Students have fun when they are learning with simulation animation lesson	4.59	0.65	Most
8. Students understand how to learn a simulation animation lesson	4.69	0.47	Most
9. Students like simulation learning media because of content freely	4.69	0.47	Most
10. Students like simulation learning media because they can learn and review at any time	4.41	0.56	More
Totally	**4.60**	**0.09**	**Most**

TABLE IV: THE DETAILS OF EFF4

Test	N	Score		t	Sig. (2-tailed)
		$\bar{x}$	S.D.		
Pre-test	36	11.50	2.78	-8.12	0.00*
Post-test	36	16.03	1.58		

*. Significant at both $\alpha = 0.05$ and $\alpha = 0.01$

In the future, human organism has a lot of part that is complexity function. To description and presentation to all level of learners should be well-designed and well-tested. Nowadays, there are many types of digital media or new media relevant to event simulation such as 3 dimensions animation, virtual reality and augmented reality; these can apply to creating the event situation as well. However, the learning media which have main objective to developing the human resource must be considered to focus on the audience first. That means developer should emphasis on the user-centered design and designing for all.

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