

The Development of Virtual Classrooms by Using Virtual Image Creation Technique

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Abstract—This research was aimed to develop virtual classrooms using virtual image creation technique. There were 3 classrooms as follow: Classroom 1 for theory which contains video clips by instructors for both lecture and practice. There were also on-line live lectures. Classroom 2 is a library which connects to e-Learning websites concerning radiographic testing. Classroom 3 is a laboratory in order to observe experiment results. All 3 classrooms were designed to be virtual using computer graphic technique. Characters representing learners were also created in order to create interaction between learners and virtual classrooms. Virtual classrooms contain the contents about radiographic testing. The quality of the virtual classrooms evaluated by experts was that the quality was 5.00 on the average. The learning achievement of learners about radiographic testing for the sampling group was that the learners gained 80% higher knowledge than the set criteria and they could save 40% time spent in traditional classroom, higher than the expectation. The learners expressed their opinions that virtual classrooms were suitable for instruction. They highly agreed with the average score of 4.76.

Keywords—virtual classrooms

I. INTRODUCTION

ACCORDING to the importance of information technology and electronic communication which is useful for e-Education, e-Learning, e-Commerce, e-Government and the like, the government set the policy about information technology and communication in Thailand for 2001 – 2010, especially in terms of education. The human resources in Thailand will be ready for the development of the wisdom society where learning has high quality. The strategy is aimed to provide, develop, support and promote the basic structure of information technology and related devices about education and learning. This includes academic contents, knowledge about information technology and instructors who have a role in managing and administering education and training in academics and skills to develop and enhance the quality of knowledge of Thai human resources. This will lead to high quality population which will become power force and labor force full of wisdom and learning to make Thailand's economic and society advance in a fast way to keep up with other developed countries. To achieve the objectives, the inequality and discrimination in learning opportunities must be eliminated no matter Thai people study in any educational institutes. The location and the economic status should not be

the cause of inequality. The information technology must be enhanced so that people can access sources of knowledge. This will increase the wisdom and quality of knowledge of the general Thai people. This will be the treasure for the development of economics, society, politics, and the stability of the country in a sustainable manner.

The main purpose of e-Education development by the government is to reduce the procedure and the duration of learning a lot of contents. ICT plays an important role in promoting a new kind of education, that is to say, to promote the potential of an individual, for example, student-centered learning, or learning at any time and any place, life-long learning, or formal learning. Therefore, e-Education is aimed to make the general public ready for the society of knowledge and learning about policies.

The above-mentioned procedure and rationale is about learning through electronic technology, in other words, digital world in order to satisfy the needs to learn without boundary and limitations in time and space. This kind of learning corresponds to the need of an individual in the educational system.

The way learners learn through electronic technology or digital tools could be considered as an innovation which can be defined as a practice or a device which has never been used before or an adaptation from the previous work so that it is more up-to-date and effective. The innovation must help increase effectiveness and efficiency. It also saves time and labor.

Educational innovations are as follow:

1. e-learning: The definition of e-Learning by Assistant Professor Thanomporn Laohacharatsang is "learning through electronic media and presentation in the format of computer multimedia like electronic texts, still images, graphic arts, video clips, animations, 3-D images and others". Thidathip Chankhana defines e-Learning as "learning through internet network in which learners can learn by themselves based on 2 items of learning principle that are learning according to their abilities and learning to meet the differences in each individual (or the duration spent). Learning can be done on internet network. The instructors present the contents through the service of World Wide Web. There can be interaction (conversation, feedback and message) between instructors and learners as well as learners to learners. The interaction can be made through 1) real-time communication such as conversation in the form of text messaging or voice in chat

room and 2) non real-time communication such as e-mail, webboard, and newsgroup.

2. Virtual classrooms: This innovation is gaining more attention and interest from the educational institutes around the world in the 21st century. This kind of learning depends on electronic communication and computer network called virtual classroom or virtual campus. This can be considered as a distance learning which comes to the door of the learner's house. Many scholars have defined the definition of virtual classroom as a way of presenting the information and concepts to learners in such a way that learners understand and adapt themselves to the society. To achieve the purpose, instructional media such as books, images and sound recordings are used so that learners can visualize and imagine by themselves. Therefore, virtual technology can also increase experiences in learning. Virtual classrooms will make an encyclopedia a museum where tourists can enter and enjoy the pleasure there.

Virtual classrooms are developed using virtual reality. They are normally text-based and graphics-based. The lessons are sent through telecommunication and computer network system. In this way, we can call them virtual education environment or virtual classrooms.

Virtual reality or VR is a technology which creates images so that spectators feel like they are in such situations or encounter the events by themselves. The principle of VR system is that it must make the audience feel as if they were in such events or they participated in the situations. This is not the same as movie on the television in that the audience recognizes themselves as outsiders who just watch others.

Virtual reality or VR is a simulated environment created by computers. The environment in virtual reality is mostly about vision and display on 3-D screen. Some simulations are about information which we can sense such as sounds from speakers or earphones, or touch to observe feedback. Users can interact with the virtual reality by standard input devices such as keyboard and mouse or other things like wire frame gloves, controlling hand, or joystick. The virtual reality can be made to look like the real world. In practice, it is quite difficult to make virtual reality real due to some technical limitations and processing capabilities, image resolution as well as bandwidth or communication difficulties. However, those limitations can be resolved in the future due to technology in transferring image and data and the processing capabilities are highly developed with less cost yet higher effectiveness.

Technology in developing visual aids has progressed rapidly. Devices in creating images have been developed with higher effectiveness, compared to the models in the past years. Black and white televisions with no depth are now replaced by color televisions with details and 3 dimensions along with virtual reality.

3-D images can be created using computer by rendering or giving shade and shadow. The model is usually created from 2 dimension object in the graphical system. The structure of the object information which consists of geometrical data like range, view, texture, and brightness will be calculated and be displayed on 2 dimension screen in digital manner. The

images are calculated to render the color value and brightness at different spots on the model. This is based on angle of incidence from the source. The next process is rasterization which projects the model on the 2 dimension axis before sending the information to the screen. The last process is graphic pipeline which will give the final image or animation.

According to the importance of instruction through digital media, self-learning, student-based learning, advances in information technology and computer technology, the researchers would like to develop virtual classrooms for e-Learning instruction.

II. RESEARCH OBJECTIVES

This research was aimed to develop virtual classrooms using effective virtual image creation technique. They are suitable for digital world at the present time and in the future. The objectives were as follow:

1. To design and develop virtual classrooms using virtual image creation technique.
2. To find out the effectiveness of virtual classrooms so that they can be used both off-line and on-line.
3. To find out the learning achievement of learners who entered virtual classrooms.
4. To find out the satisfaction of learners towards the virtual classrooms.

III. RESEARCH SCOPE

This research was done within the following scope:

1. Only one subject in the undergraduate level was used in virtual classrooms.
2. The sampling group consisted of students from the Department of Industrial Engineering, Faculty of Engineering, King Mongkut's University of Technology Thonburi.
3. All media used in this research were electronic, for both off-line and on-line connectivity.

IV. EXPECTED OUTCOMES

The expected outcomes of this research were as follow:

1. Method which showed how to develop virtual classrooms was known.
2. Process in analyzing, designing and developing the digital media for both off-line and on-line connectivity was known.
3. The results from the research could be used as a way to develop electronic instructional media and to develop human resources in all fields including educational process, business, industrial sectors and training centers.
4. Governmental organizations and private sectors could use this kind of learning to promote learning organization as well.

V. THEORETICAL FRAMEWORK

The research was done in accordance with the following activities:

1. The subject used for the development of virtual classrooms was radiographic testing which was from the Department of Industrial Engineering, Faculty of Engineering, King Mongkut's University of Technology Thonburi.
2. There were 3 virtual classrooms to be developed: Classroom 1 for theory contains video clips by instructors and on-line instruction. Classroom 2 is library which links to e-Learning websites about radiographic testing. Classroom 3 is developed using 3-D graphic model creation technique. This room is intended for practice.
3. The sampling group in this research consisted of fourth year students from the Department of Industrial Engineering, Faculty of Engineering, King Mongkut's University of Technology Thonburi.
4. The quality of the research was evaluated by the experts. The evaluation showed that the quality given by the experts was reliable.
5. The learning achievement of learners evaluated by the sampling group had to increase over 60% and take 30% less time to learn.
6. The satisfaction of learners was evaluated by the learners who entered virtual classrooms, in other words, the sampling group.

VI. HYPOTHESES

In this research, the researchers proposed the following hypotheses:

1. The learning achievement of learners after using virtual classrooms developed through virtual image creation technique would increase for 60% or higher.
2. Learning through virtual classrooms developed through virtual image creation technique would help learners spend at least 40% less time to learn.

VII. DEFINITIONS

Virtual classroom mean a classroom developed using virtual image creation technique with the purpose of instruction for e-Learning. The subject in this research was radiographic testing from the Department of Industrial Engineering, Faculty of Engineering, King Mongkut's University of Technology Thonburi.

Radiographic testing is a subject in the undergraduate level and Master's degree level in the Department of Industrial Engineering, Faculty of Engineering, King Mongkut's University of Technology Thonburi.

The sampling group consisted of fourth year students from the Department of Industrial Engineering, Faculty of Engineering, King Mongkut's University of Technology Thonburi.

VIII. RESEARCH METHODOLOGY

This research was aimed to develop virtual classrooms by using virtual image creation technique in order that they could be used to comply with the objectives of such subject. The experiment was done in order to prove the correctness of the procedure and the designed process. After the desired procedure had been achieved, the virtual classrooms were developed using computer graphic software. They could be used both off-line and on-line to find out the effectiveness and the efficiency of the virtual classrooms. The procedure was as follows:

1. Learning styles and knowledge management were studied, analyzed and designed. The procedure was that new instructional methods were studied for all 3 virtual classrooms. Classroom 1 is a theory classroom which contains lecture video clips by instructors. Learners can learn and review whenever they are free. The classroom could be also be accessed on-line when there was a live lecture performed by an instructor.
2. The subject or the contents were selected to put inside the virtual classrooms developed by using virtual image creation technique in order that it became the frame or the structure of the virtual classrooms in terms of scope, quantity, and the depth of the information. The procedure was that a class with activities dangerous for learners would be selected to be used in developing virtual classrooms. The subject in this research was radiographic testing due to the fact that such subject was mainly about doing radiographic experiments. If learners neither have knowledge nor have enough skills, they might sustain injuries like burnt skin and eye irritations. Such risks are harmful for learners.
3. Virtual classrooms were developed using virtual image creation technique.
 - 3.1 Model for 3 virtual classrooms was developed using theory of 3-D image creation.
 - 3.1.1 Classroom 1 is for theory and contains video clips about the lecture and the practice done by instructors. It could be accessed with on-line connectivity when there was a live lecture.
 - 3.1.2 Classroom 2 is library which connects to e-Learning academic websites about radiographic testing.
 - 3.1.3 Classroom 3 is for practice and contains activities about radiography. The experiment results could be viewed so that students could try the procedure of radiographic testing by themselves.
 - 3.1.4 The characters representing learners were created so that learners have interaction with the virtual classrooms.
 - 3.2 The model for 3-D classrooms was used for the development of virtual classrooms by following the principles of technology and computer graphic theory so that the model was like real object.
4. The quality, the correctness and the completeness of the contents in virtual classrooms were evaluated by the experts.

5. The experiment was done by allowing learners to enter virtual classrooms developed by virtual image creation technique.
6. The data and the information were analyzed to find out the mistakes so that the virtual classrooms could be used with the desired effectiveness.
7. Virtual classrooms developed by using virtual image creation technique were tested with the sampling group of students from the Department of Industrial Engineering, Faculty of Engineering, King Mongkut's University of Technology Thonburi according to their educational level and duration.
8. Results from the test were analyzed and processed to show the level of the test compared to the hypotheses.

Population and the sampling group were defined by the researchers as follow:

Population were all 126 fourth year students from the Department of Industrial Engineering, Faculty of Engineering, King Mongkut's University.

The sampling group was selected out of the population for the proportion of 50% by simple random method. The sampling group consisted of 63 students.

IX. CONCLUSION

The results from the research could be summarized as follow:

1. The quality of the virtual classrooms developed by using virtual image creation technique was at the highest level or 5.00 on the average.
2. The learning achievement of the learners after using the virtual classrooms for radiographic testing was 70%, higher than the hypothesis. It also took 35% less time to learn, higher than the hypothesis.
3. The learners thought that the virtual classroom was suitable for the instruction with the average score of 4.76.

Details could be seen in Tables 1 and 2.

TABLE I SUMMARIZES THE QUALITY EVALUATION RESULTS OF VIRTUAL CLASSROOMS FOR E-LEARNING INSTRUCTION ON THE COURSE 'RADIOGRAPHIC TESTING' BY EXPERTS

Evaluated Items	Mean	Quality Level
1. Virtual classrooms through internet network are more interesting than instruction in classrooms.	4.67	the best quality
2. Virtual classrooms through internet network help learners understand the contents better than in classrooms.	4.67	the best quality
3. Academic contents about radiographic testing in virtual classrooms are presented in an interesting way.	4.53	good quality
4. Learners need not study additional contents from instructors after virtual classrooms.	4.67	good quality

5. Images and texts are in a suitable and neat layout.	4.89	the best quality
6. The lessons have suitable and neat images and texts.	4.80	good quality
7. Colors used in virtual classrooms are suitable.	4.84	good quality
8. The size of texts and images is suitable.	4.68	good quality
9. Virtual classrooms through internet network can link to other appropriate learning resources.	4.87	the best quality
10. Learners can learn in virtual classrooms by themselves.	4.85	the best quality
11. Learners can practice in virtual classrooms by themselves.	4.94	the best quality
12. Learners can learn radiographic testing by themselves.	4.77	good quality
13. Virtual classrooms are interesting; Learners are more enthusiastic because 3 dimension images attract their attention.	4.85	the best quality
14. Virtual classrooms have simulated images, 3 dimensional simulation, and simulated situations.	4.72	the best quality
Average score	5.00	the best quality

TABLE II SUMMARIZES THE OPINIONS OF THE LEARNERS TOWARDS E-LEARNING INSTRUCTION ON THE COURSE 'RADIOGRAPHIC TESTING'

Evaluated Items	Mean	Opinion Level
1. Virtual classrooms through internet network are more interesting than instruction in classrooms.	4.62	Highly agree
2. Virtual classrooms through internet network help learners understand the contents better than in classrooms.	4.83	Highly agree
3. Academic contents about radiographic testing in virtual classrooms are presented in an interesting way.	4.69	Highly agree
4. Learners need not study additional contents from instructors after virtual classrooms.	4.85	Highly agree
5. Images and texts are in a suitable and neat layout.	4.96	Highly agree
6. The lessons have suitable and neat images	4.73	Highly agree

and texts.		
7. Colors used in virtual classrooms are suitable.	4.62	Highly agree
8. The size of texts and images is suitable.	4.83	Highly agree
9. Virtual classrooms through internet network can link to other appropriate learning resources.	4.77	Highly agree
10. Learners can learn in virtual classrooms by themselves.	4.92	Agree the most
11. Learners can practice in virtual classrooms by themselves.	4.87	Highly agree
12. Learners can learn radiographic testing by themselves.	4.63	Agree the most
13. Virtual classrooms are interesting; Learners are more enthusiastic because 3 dimension images attract their attention.	4.76	Highly agree
14. Virtual classrooms have simulated images, 3 dimensional simulation, and simulated situations.	4.65	Agree the most
Average score	4.76	Highly agree

ACKNOWLEDGMENT

The quality of the developed virtual classrooms was at good level. The learning achievement of learners was higher than the criteria. Moreover, the learners showed satisfaction towards virtual classroom at high level. This was because virtual classrooms applied the information technology in managing instruction in the age of electronic media. This innovation or e-Learning and the technique in designing the virtual classrooms based on computer graphics help the virtual classrooms gain quality and effectiveness. The subject which was dangerous if there were experiments and risks could be simulated in virtual classrooms where there was neither dangers nor risks. Moreover, virtual classrooms were easy to learn and they were not boring. Learners could watch video clips or attend online live lecture. To conclude, the development of virtual classrooms in this research met the desired objectives.



Fig. 1 shows menu login virtual classroom



Fig. 2. shows virtual classroom



Fig. 3. show teaching online form virtual classroom

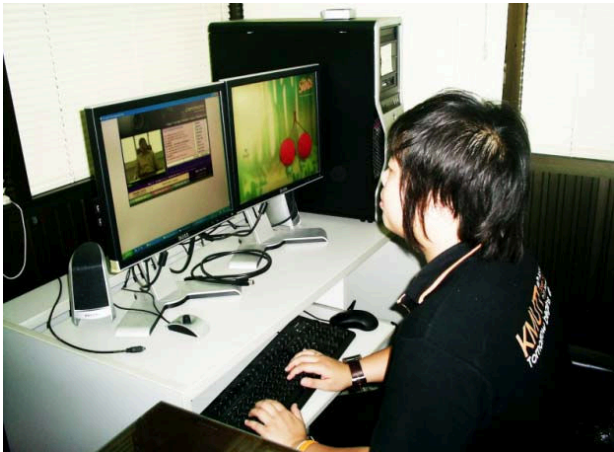


Fig. 4. shows learning online form virtual classroom

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