The Edutainment of Online Thai Traditional Musical 3D Virtual Reality Museum

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Abstract
The edutainment of online Thai traditional musical 3D virtual reality museum was developed under the Virtual Reality Media project, School of Information Technology, Sripatum University, Chonburi Campus. The edutainment was defined not only as an innovative, exciting, and promising field, but also provides professional cite benefits to learners. The combination of 3D Virtual Reality (VR) composting of virtual music instrument (VMI), education and entertainment of the online edutainment becomes popular under the concepts of lifelong learning. It could be shown that edutainment improves learning achievement by increasing users’ enthusiasms. The 3D virtual reality system was an education system based on the virtual reality technology that models conventional real-world education by integrating a set of virtual museums, virtual library and virtual music instrument (a physical modeling approach is presented, along with a classification scheme of real Thai Music Instrument). Therefore, the purpose of this research was to develop and evaluate the edutainment of online Thai traditional musical 3D virtual reality museum. The proposed sampling method was applied which comprised of 40 students from elementary school, Chonburi Thailand and 5 experts to find technology solutions for solving several problems in classroom such as insufficient time in classroom instruction and inadequate proper practice. Therefore, it is important to create a variety ways to deliver and provide electronic resources for learners. In this system, whenever students logs in the VR and enter their own learning space, they could see their 3-dimensional (3D) virtual environments. They could control their contents by using fingers with multi touch and virtual joystick. The results at the moment revealed that: for the panel of experts’ satisfaction, the mean was at 4.38 with the standard deviation of 0.50. In part of learners’ satisfaction, the mean was at 4.52 with the standard deviation of 0.54. This can be summarized that 3D virtual reality museum was available for the learners to learn via Internet. Students who participated in 3D virtual reality museum showed an increase of learners’ interest and enthusiasm in learning. Moreover, learners had more time to practice outside classroom which could reduce the differences in the learning of students between urban and rural areas.

Keywords: 3D Virtual Reality, Thai Traditional Music and Instruments, Virtual Music Instrument, Edutainment

1. Introduction
Currently, it is obvious to say that education is significant for daily life. Education is the knowledge of putting one's potentials to maximum use. There are two main reasons why education is significant. For the first reason, the training of a human mind has not been flawless without education yet. Education makes people think what the right thing is. Education will shape people to know how to think and to make decision wisely. Turning to the second reason, people are enabled to gain knowledge from the global because of education. Thus, they can acquaint themselves with the past experiences and receive all knowledge regarding to the present.
Therefore, daily quality education in the school and university level is an important part of a student’s extensive and well-rounded education program which positively affects on life-long and well-being. The best possible education program will encourage knowledge commitment to activity as part of one’s life [1]. Moreover, the education in 21st century is not only focuses on student-centered instruction but also attempts to engender active learning by using methods such as cooperative learning, open ended assignments, critical-thinking exercises, simulation, and problem-solving activities. Student’s responsibility and independence help us to develop characteristics of lifelong learners- motivation, self-evaluation, time management and skills to access information.

Edutainment which combines education and entertainment are becoming popular in concepts for lifelong learning [2], [3] have shown that edutainment improves learning achievement by increasing users’ enthusiasms. Most of the edutainment systems are based on virtual environment implants, however, the interaction with these systems are still not simple because the interface does not familiar with students. To decrease the gap between the virtual environment and the real world, the edutainment system presents a user-friendly interaction to discover innovative edutainment and technology solutions, and create a variety ways to provide electronic resources for users. In recent years, edutainment, virtual environment interfaces, human computer interaction, Virtual Reality (VR), Virtual Music Instrument (VMI), and learning content have been adopted by many researchers [4] [5]. Furthermore, the development of edutainment has been successfully used in learning innovation, entertainment, training and other application. A virtual reality and virtual musical instrument, or virtual environment for music and sound, represents sound processes and their parameters as entities of a virtual reality. Thereby, users can perceive not only through auditory feedback but also via visually in and possibly through tactile as well as haptic feedback, using interface consisting of interaction techniques such as navigation, selection and manipulation [6]. Virtual environment for music builds the trend in electronic musical instruments to develop new ways to control sound and perform music. The virtual environment for music provides individuals the opportunity to learn to play an instrument regardless of their mobility or ability. It also has the potential to address goals in the physical, cognitive, communication, sensory, and social domains. It gives users access to a leisure activity, encourages exploration and offers a channel for emotional expression.

Moreover, if VR technology has to be applied to facilitate the presentation, the lesson may be interesting due to it is interactive. This is because virtual reality systems have the potential to allow learners to discover and experience objects and phenomena in ways that they cannot do in real life [7]. However, the purpose of this paper was to develop and combine VR and VMI to create learning innovation for learners. In this paper we will clarify about research framework, prototype of VR and VMI, and provide cues for possible future work.

2. Literature Review

2.1. Virtual Reality (VR) and Education

The virtual reality systems is an education system based on the Virtual Reality technology that models conventional real-world education by integrating a set of equivalent virtual concepts for virtual homework, virtual classes, virtual tests, virtual classrooms, virtual museums, virtual library and other external academic resources [8]. Immersion in VR is achieved with the disappearance of an artificial interface, replaced by natural every day’s actions present in the real world. This is one of the key aspects of VR that brings many researchers together to support it. Some other advantages of immersion are not so obvious, but they are very important for justifying the use of VR in education. For example,
VR enables first person experiences, which are natural, unreflect and personal, generating direct, subjective and personal knowledge. VR provides a less symbolic interaction with the environment. Any description of an experience or action is usually transmitted through of symbols, conventions and formalisms, meaning that traditional learning of a concept require previous knowledge. VR has the potential to allow learners to discover and experience objects and phenomena in ways that they cannot do in real life [9] [10].

2.2. Edutainment

Edutainment is a neologism (new term coining), similar to infotainment, that expresses the combination of education and entertainment in a work or presentation such as a television program or a Web site. The most educationally effective children's programs on television are “Sesame Street”, “The Electric Company” and “Mr. Rogers”, could all be classified as Edutainment. Outstanding web sites of edutainment include; Learn2.com and HowStuffWorks.com [11]. Edutainment (also educational entertainment or entertainment-education) is a form of entertainment designed to educate as well as to amuse. Edutainment typically seeks to instruct or socialize its audience by embedding lessons in some familiar form of entertainment: television programs, computer and video games, films, music, websites, multimedia software, etc. Morey (2003) showed that edutainment activity influences learners to think, revise knowledge and increase analyzable acknowledgement [12]. This supports the concept of the edutainment design by the activity and feeling of free time because in this is the period of learning the learner must feel relaxed (White, 2004). In its outstanding style, edutainment influences learning in many universities focusing on the special use of educational technology equipment which is not only a channel of communication to contact with the targets directly but also its objective.

Support experts, students, or geniuses, who have demonstrated superior performance abilities, can also help support intelligence, and can be helpful in teaching techniques in solving problems logically. At the present time, the process of warrantee quality education is used with self-assessment report, to warrant that the graduates can be to fit in labor market. The objective must be continuously developed, yet is struck by the students who are absent, tardy or inattentive during the classroom lectures and lessons. Consequently, both students and teachers are simple bored in the classroom environment. Considering the problem of learning management and trend in designing learning environment from many universities, the concept must be taken to bring entertainment media to support learning materials such as; movies, music, television programs and online games following the concept of entertainment as a motivation which is more effective than a normal lesson plan [13].

2.3. Edutainment in Thailand

The territory of edutainment has been widely explored in Thailand; however, it has not been done extensively in the field. Both the methodological and the empirical aspects of adopting games for educational purposes require further in-depth investigation. The current popular issues in the field and the relevant research questions are both necessary to be concerned. In Thailand, there are encapsulating in a nutshell the efforts of the edutainment supported education users, a working group on Game-Enhanced Learning active in the framework of many levels of learning. For example; (i) the development of tour 3D edutainment game wheel which aims to provide young people turn to play the Thailand Cultural depictions and tourist attractions of each region [14]. (ii) A development of English language learning game name ‘Vocabulary Time’ for primary school students which expect to solve the main weakness that causes directed towards learning English and also causes many continuous problems subsequently. The Vocabulary Time proves that it can encourage and support the students to learn and understand more vocabulary than their regular lesson [15]. (iii) The game project called
‘Guardian of the Tree’ develops 3D edutainment game for student to learn how important of the nature and environment is and the way how to protect them [16]. (iv) A development of Mathematics learning game for primary school students named ‘Shopping Funny’ enables students to grasp benefits of mathematics and numeracy training [17]. As a result of mentioned researches, they presented the improvement of learning capacity in any level of research groups. It supports the concept that edutainment develops individuals’ mental and physical capacities, has its own rules, continues for limited time and space, forms voluntary groups through voluntary participation, holds the attention of participants all the time and puts the individuals in a race with themselves and other individuals in order to achieve certain objectives. Moreover, edutainment is an entertaining activity performed in an environment different from real life, based on coincidence and skill and it is mostly played for spending time without any financial gain. Moreover, the various groups that showed a good respond to those mentioned research also proved that the use of game-based learning not only played by children as young as five years but also played even up to adulthood. Integration and implementation of games into the classroom is also seen to help students learn with more fun and effective. To sum up, edutainment showed itself as an effective tool that can be used as the application of teaching and student learning in Thailand.

3. The Approach

This study presented that the edutainment of online Thai traditional musical 3D virtual reality museum was developed based on the PIDP model. The Participatory Integrated Design Process (PIDP) is used as a framework for web-based development [18]. As shown in Figure 1, the process consists of four phases of design. Each of them has its own protocol. The researchers used the PIDP framework to encompass the entire process of development starting from an early needs analysis phase and continuing through to the evaluation phase. PIDP consist of four phase 1) needs analysis, 2) conceptual design, 3) development, and 4) evaluation.

Figure 1. Participatory Integrated Design Process (PIDP)
1) Needs analysis: this phase was concerned with gathering information about situations, problems and needs, and analyzing and summarizing information that was necessary to build the prototype. It consisted of three design processes, viz., requirements specification, features and components identification, and the setting of design goals.

2) Conceptual design: this phase focused on an explicit construction of concepts involved with 1) what the components are, 2) what they can do, and 3) how they are intended to be used. It consisted of four design processes. These were design scenarios development, information design, structure design, and page design.

3) Development: In this phase consisted of three design processes namely; the low-fidelity prototype, design walk-through, and the high-fidelity prototype. The low-fidelity prototype process described the methodology to build a rough interface system by integrating design ideas. The design walk-through step was concerned with soliciting initial feedback from users. The high-fidelity prototype described the complete development of full functionality.

4) Evaluation process: the evaluation phase was primarily focused on the identification of current weaknesses in the entire system prototype that could be revised by using a systematic design evaluation approach. Evaluation consisted of an expert review and field experiment.

4. The Edutainment of Online Thai Traditional Musical 3D Virtual Reality Museum

The edutainment of online Thai traditional musical 3D virtual reality museum developed following a physical VR approach and VMI. This system was designed as edutainment and usability study progresses. The researcher continues to study ways of making the technology accepted and utilized as a conventional instrument. In order to the system, it can be accessed or downloaded at http://it.east.spu.ac.th/informatics/exportweb/ WebPlayer/WebPlayer.html. Accordingly, this research will consider the possibilities and limitations of visual feedback as a promising channel of VR and VML for edutainment. The basic aim of this system was to support online platform (see Fig 1).
The interactive between students and VR through Internet was used as a learning approach. The mainly module of edutainment of online Thai traditional musical 3D virtual reality museum displayed typical 3D model, VR content, VMI and multimedia, then students can learn by following the VR content and interactive content. The proposed of this system can evaluate the learners’ skill and learning achievement. The edutainment of online Thai traditional musical 3D virtual reality museum showed each learner’s participation graphically. It does not only measure the frequency of participation and intention, but also evaluate whether the opinions given by the learners are useful. According to the initial experiment, the students are interested in the new approach significantly. The students could spend their free time and interact with VR over Internet anytime and anywhere.

Figure 2. The Edutainment of Online Thai Traditional Musical 3D Virtual Reality Museum
In addition, the instructor could randomly visit and look for students’ activities. The students also know that the instructor could see and observe their behaviors all the time. Therefore, this approach could be considered as effective tool in control the students’ activities. The application of VR technology in learning is an innovative and gains a lot of attention of students. For example, students could virtually pick up an object in 3 dimensions which can be controlled by using multi-touch and virtual joystick and making more effective for learning achievement. Finally, this system can confirm that edutainment of online Thai traditional musical 3D virtual reality museum is a novel software program which provides chances of reaching toward professionals cite and benefits to user.

5. Experimental Results

The purposes of this study were to develop the edutainment of online Thai traditional musical 3D virtual reality museum and 2) to evaluate satisfaction of the edutainment of online Thai traditional musical 3D virtual reality museum. An initial study was conducted at Sripatum University Chonburi Campus, Thailand. The sample groups of this study consisted of 40 students from elementary school and 5 experts for summative evaluation to improve the system environment prototype. As described in approach, two phases of evaluation were used in this study which are the experts testing phase and satisfaction’ student phase.
5.1. Experts testing phase

Five experts with a high level of expertise in the research field reviewed the prototype version of system to identify any deficiencies or problems and provided recommendations for its improvement. The evaluation criteria determined the overall quality of the software testing, its clarity and impacts, by following ISO 9241-110 (2006) [19]. The criteria consisted of eight standards, namely suitability for the concepts, suitability for the task, suitability for learning, suitability for individualization, conformity with user expectations, self-descriptiveness, controllability, and error tolerance. The surveys used a 5-point Likert-type scale (1 = strongly disagree, 5 = strongly agree). The experts’ estimation provided a recommended design for the modification of the system.

<table>
<thead>
<tr>
<th>Category</th>
<th>$\bar{X}$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concepts</td>
<td>4.80</td>
<td>0.45</td>
</tr>
<tr>
<td>Suitability for the task</td>
<td>4.20</td>
<td>0.45</td>
</tr>
<tr>
<td>Suitability for learning</td>
<td>4.60</td>
<td>0.55</td>
</tr>
<tr>
<td>Suitability for individualization</td>
<td>4.00</td>
<td>0.71</td>
</tr>
<tr>
<td>Conformity with user expectations</td>
<td>3.80</td>
<td>0.45</td>
</tr>
<tr>
<td>Self-descriptiveness</td>
<td>4.80</td>
<td>0.45</td>
</tr>
<tr>
<td>Controllability</td>
<td>4.20</td>
<td>0.45</td>
</tr>
<tr>
<td>Error tolerance</td>
<td>4.60</td>
<td>0.55</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4.38</strong></td>
<td><strong>0.50</strong></td>
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Form Table 1, the overall quality of the system design was good and the degree of clarity of the system was rated higher than the target levels. The suitability of the concepts, the suitability for the task, suitability for learning, suitability for individualization, conformity with user expectations, self-descriptiveness, controllability, and error tolerance were shown to have means of 4.80 ($SD = 0.45$), 4.20 ($SD = 0.45$), 4.60 ($SD = 0.55$), 4.00 ($SD = 0.71$), 3.80 ($SD = 0.45$), 4.80 ($SD = 0.45$), 4.20 ($SD = 0.45$), and 4.60 ($SD = 0.55$) respectively (Table 1). According to the experts’ suggestions, several designs were changed including a redesign of graphic figures and more options for editing content.

5.2. Satisfaction’ student phase

An initial study was conducted at elementary school, Chonburi, Thailand. The sample groups of this study consisted of 40 students. The result of students’ satisfaction was collected by using questionnaires about the satisfaction of learning environment. Research methods were applied to collect quantitative data by using questionnaires. The data were analyzed by using basic statistical tools, frequency, mean ($\bar{X}$), and standard deviation ($SD$). The levels of student’ satisfaction was determined
as 4.51 – 5.00 means definitely agree, 3.51 – 4.50 means strongly agree, 2.51 – 3.50 means quite agree, 1.51 – 2.50 means quite disagree and 1.00 – 1.50 means strongly disagree.

**Table 2. The result of student’s satisfaction**

<table>
<thead>
<tr>
<th>Category</th>
<th>$\bar{X}$</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction of Course content</td>
<td>4.53</td>
<td>0.51</td>
</tr>
<tr>
<td>Satisfaction of Layout</td>
<td>4.41</td>
<td>0.50</td>
</tr>
<tr>
<td>Satisfaction of Text and structure</td>
<td>4.50</td>
<td>0.51</td>
</tr>
<tr>
<td>Satisfaction of VR and Multimedia</td>
<td>4.53</td>
<td>0.51</td>
</tr>
<tr>
<td>Satisfaction of Sound and synchronize</td>
<td>4.44</td>
<td>0.50</td>
</tr>
<tr>
<td>Satisfaction of Presentation</td>
<td>4.47</td>
<td>0.57</td>
</tr>
<tr>
<td>Satisfaction of Opportunity for studying independently</td>
<td>4.69</td>
<td>0.59</td>
</tr>
<tr>
<td>Satisfaction of System Control</td>
<td>4.41</td>
<td>0.67</td>
</tr>
<tr>
<td>Satisfaction of the Connecting prior knowledge with New knowledge.</td>
<td>4.53</td>
<td>0.57</td>
</tr>
<tr>
<td>Satisfaction of Participatory</td>
<td>4.56</td>
<td>0.56</td>
</tr>
<tr>
<td>Satisfaction of Interactive</td>
<td>4.59</td>
<td>0.50</td>
</tr>
<tr>
<td>Satisfaction of Encourage to respond to the lessons.</td>
<td>4.53</td>
<td>0.51</td>
</tr>
<tr>
<td>Satisfaction of Motivation</td>
<td>4.41</td>
<td>0.67</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4.52</strong></td>
<td><strong>0.54</strong></td>
</tr>
</tbody>
</table>

Form Table 2, the overall satisfaction of the edutainment of online Thai traditional musical 3D virtual reality museum was also conducted to identify a way how to evaluate the quality of students. The overall quality of the edutainment of online Thai traditional musical 3D virtual reality museum was estimated as very good, and the clarity degree of system was rated higher than target levels. This can be concluded that developed system be successful, various aspects of the edutainment of online Thai traditional musical 3D virtual reality museum should be considered such as application domain knowledge, conceptual theory, user interface design, and evaluation about the overall quality of the design environment.
6. Conclusion and Future Work

The edutainment of online Thai traditional musical 3D virtual reality museum has been widely adopted for students’ learning. Pedagogically highly valued products are on the market and have a proven success in the improvement of learning as well as in students’ acceptance. Recently, the edutainment of online Thai traditional musical 3D virtual reality museum is becoming a new form of interactive content, worthy of exploration for learning purposes. Educators are also looking for a new positioning in the changing setting of lifelong learning. Educators need to develop innovative forms of learning in order to provide concepts for lifelong learning to their primary students. The edutainment of online Thai traditional musical 3D virtual reality museum interacts with learners via 3D virtual reality learning environments and also supported by mainly platform such as Internet and PC. Moreover, the system can make students feel more interested and eager on learning. Thus, the researcher can conclude that the edutainment of online Thai traditional musical 3D virtual reality museum presents an excellent environment for learning, which can be produce knowledge to students.

For the further, we plan to tryout the proposed system with more 100 students of primary school at Chonburi Province, Thailand to find the efficiency of this system. In addition, the researcher plan to continue the research by looking for different technique for VR training and M-learning technology such as collaboration among users "avatars" in shared synthetic environments which may support a wider range of pedagogical strategies (e.g. teaching, tutoring, training). Furthermore, it may make Virtual Reality learning environments (VLEs) more intriguing to students who are most motivated to learn when intellectual content is contextualized in a social setting. We also plan to investigate the effectiveness of learning technology in which three roles among 1) using the head mounted display (HMD) and data gloves, 2) extending to support all platform such as Window, OSX, UNIX, Linux, Windows Phone, new Google Android and new iOS and 3) serving as external guide support and participating as a reflective observer.

7. Acknowledgment

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8. References


