

EDUCATIONAL MATERIALS FOR MOBILE LEARNING

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ABSTRACT

This paper introduces several educational materials developed by ICER (Innovation Center for Educational Resource) of Kyushu University Library and considers about what are better designs for mobile educational materials through their development experiences and their investigations about its learning effectiveness. The introduced materials are various types and have several ICT (Information and Communication Technology), e.g. serious games for medical fields, web application-based educational materials using HTML5-based technologies, online educational courses such as OCW (Open Course Ware) and MOOC (Massive Open Online Course), etc.

KEYWORDS

Educational Materials, Mobile Learning, Serious Game, Open Course Ware, Massive Open Online Course.

1. INTRODUCTION

With the rapid advancements of ICT (Information and Communication Technology), our education environments also have rapidly changed. Many researches using mobile educational materials in their education program have introduced year after year (e.g. Hwang et al.; Yordanova et al.). These mobile technologies and Internet technologies enable us to easily access online educational resources anytime and anywhere. Therefore, we can learn using them without any spatial and temporal restrictions. The World Wide Web supports an effective study environment to learn various knowledge by following its links and jumping from a web page to a web page. On-demand courses using online environments such as OCW (Open Course Ware) and MOOC (Massive Open Online Course) receive massive learners from all over the world and spread their knowledge in their class and compensate learners' understanding by online discussion. 3DCG (3D Computer Graphics) technology shows stereoscopic structures of things and we can watch it from various angles by taking interactive operations. These technologies allow us to develop effective educational materials which are difficult to achieve with *Paper* educational materials and also support *Active Learner* who can make their goal for their learning stage and proactively learn by themselves. As Kyushu University Library supports these educational environments with novel ICT and cultivates *Active Learner* by utilizing them, ICER (Innovation Center for Educational Resource) was established in 2011 (Online Reference: ICER) for supporting the development of such educational materials using ICT and investigating its learning effectiveness. This paper introduces several educational materials developed by ICER's projects.

The remainder of this paper is organized as follows. First of all, we focus on designs of game-based educational materials through several development experiences of serious games and investigation of their learning effectiveness. In section 3, as another educational design, we consider about availabilities of web-based application as educational materials. Section 4 introduces on-demand education courses such as OCW and MOOC, and consider about availabilities of the educational designs. Finally, we conclude and discuss about better designs for mobile educational materials.

2. GAME-BASED EDUCATIONAL MATERIALS

Game-based educational materials such as serious game have a possibility to engage learner's motivation to provide an effective method for amusingly learning. The motivation is necessary not only to make a learner interested in at his/her first study stage but also to maintain his/her willingness for the study.

The left side images in Figure 1 are screenshots of a serious game for learning utilizations of library services, e.g. book lending period, internet search service and so on. The target learner is university freshmen. In this serious game, 12 questions about library services are shown to a learner. The question styles are quiz, crossword puzzle and QR (Quick Response) code matching, etc. A learner has to move around library to answer these questions. By answering questions with moving around library, they can understand not only knowledge about questions but also gradually learn places of book shelves and several service counters. Some university freshmen are boring to a seminar style lecture and the knowledge learning in such kind of situation becomes forgettable. On the other hand, game-based educational materials like this educational material have a possibility to engage learner's motivation. The serious game which runs on iOS and Android OS as one of the mobile applications can communicate to a data analysis server logging learner's activity data such as answer data and tracking data. Librarians check these log data and use those for the improvements of their library services.

The center images in Figure 1 are screenshots of a serious game for Bacteriology (Sugimura et al.). The target learner is university students in the school of medicine. The genre is an adventure game. This game has its story that a bacterial accident occurred and several bacteria are spread all over the university hospital. As the result, almost people in the hospital are infected by the bacteria. In this game, a Bacteriology learner must help people to pinpoint bacteria causing their bad symptom by hearing their health condition e.g. having fever and stomach ache, and to administer most effective medicine to the person. In the administration phase, the game transitions to a command-based battle scene in which a learner can select several medicine and throw it to bacteria. Incorrect medicines give a little damage to the bacteria but the correct medicines give a big damage to them. By playing this serious game, a learner can understand knowledge to pinpoint bacteria causing the symptom and to administer most effective medicine against the bacteria. This serious game runs on Android OS.



Figure 1. Screenshots of serious games developed by ICER; left are the serious game for library services, center are the serious game for Bacteriology, and right is the serious game for Anatomy.

The right side image in Figure 1 is a screenshot of the serious game for Anatomy. The target learner is university students in the school of medicine. The genre is a board game similar to *MONOPOLY* in which several player battle simultaneously with occupying their regions. In this game, at first, a learner throw dice and move on the field according to a number of the dice. The field has several types of grids: quiz grids, item grids, organ grids which are occupation possible location. If a learner stay on a quiz grid, the game shows a quiz about Anatomy. These quizzes are various styles: true-false quiz, four selection quiz, text input style quiz and sorting type quiz. If a learner select a correct answer, they get money for purchasing locations. One of the advantage points of this serious game is to learn about Anatomy with face-to-face communication. In this game, as several learners study simultaneously, they can see a playstyle of another learner. Therefore, learners enjoy to study with their friends together than they are alone. The platform of this serious game is Android OS.

In our investigation for leaning effectiveness about these serious games, we could not find significant differences of learners' test scores between the two study styles: learning with serious game and without it. But we found that there is a difference about their study period between them. The game-based studies have the result that learners study for longer time than non-game-based study. This result shows that a game-based study can continuously maintain learners' motivation for their study.

3. WEB-BASED EDUCATIONAL MATERIALS

As one of the available tools for supporting mobile educational environments, ICER focus on educational materials as web applications. Web applications have an advantage to execute without minding about OS platforms and devices because we can run them on a web browser. HTML5 supports multimedia contents: videos, 3D graphics, sounds and so on. Therefore, it is very useful to develop educational materials containing these contents as web applications. The following introduces web-based educational materials run on a mobile device.

The left side images in Figure 2 are screenshots of the educational material for learning multiple languages. In this material, a learner can hear conversations of several languages and read text of the conversations comparing other languages. The material supports seven languages: Japanese, German, French, Spanish, Esperanto, Chinese and Korea. In the hearing phase, an image appears to compensate its conversation situation.

The right side images in Figure 2 shows screenshots of the educational material for leaning Osteology. In this material, a learner can study names of bones with interactive operations to watch them from various angles. The target of the material is university students in the school of medicine. They must remember over than 200 bone's names. This material helps their hard study with 2D and 3D graphics images.



Figure 2. Web-based educational materials developed by ICER; left are educational materials for learning multiple languages and right are ones for learning Osteology.

A web-based educational material has advantage to execute it without worrying about OS on their computer and mobile devices. One of disadvantages is that the performance of its execution speed is not so good especially using very heavily 3DCG on a mobile device. Another disadvantage of the web-based educational materials is that a learner can't watch it without the Internet.

4. ON-DEMAND EDUCATIONAL COURSES

On-demand educational courses using the Internet such as online e-learning service provides helpful educational environments in which a learner can take a course they want to learn without minding about learning pace and physical spaces. Another advantage of the course is that a lecturer can teach to massive people from all over the world.

ICER organizes OCW in Kyushu University (Online Reference: OCW). One of the screenshots of OCW pages appears on the left side in Figure3. In this course, a learner can experience a lecture of our university by watching the lecture videos and reading its educational materials. The courses are open on the Web so that a learner can study anytime and anywhere. Additionally, a learner does not need to worry about their platform, OS and devices because they can watch the online contents by their web browser. We also broadcast lecture videos through YouTube and iTunes U. Several courses are provided as iTunes U Course which is OCW platform in iTunes U. The center image of Fig. 3 is a screenshot of educational materials about historical resources in Kyushu University on iTunes U Course.

ICER has a film studio for taking a lecture movie. The studio is used for making MOOC contents. MOOC has become a hot topic in recent online e-learning fields. ICER developed MOOC contents for Archaeology titled "Global Social Archaeology" broadcasted from JMOOC platform (Online Reference: MOOC). The right side image of Figure 3 is a screenshot of the MOOC. 799 people from 53 countries attended the course and got 27.8% completion rate which is the current best rate in JMOOC.

On-demand educational services are very useful to teach their knowledge to massive people. The disadvantage, which is the same problem as web-based educational materials mentioned above, is that a learner cannot take the course in offline environments.



Figure 3. On-demand educational courses developed by ICER. The left image is a screenshot of OCW in Kyushu University. The center image is a screenshot of the educational material on iTunes U course. The right image is a screenshot of MOOC on JMOOC platform.

5. CONCLUSION

In this paper, we introduced mobile educational materials developed by ICER and considered their designs from several viewpoints of their styles. Each design has its advantage and disadvantage points. Therefore, we have to consider about what kind of situation we provide our educational materials to and select the best choice for a learner to study. ICER continues to develop various mobile educational materials and investigate its leaning effectiveness.

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