The Knowledge-based Mobile Learning System Applied in Printing Network Instructive Course for Science Museum

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Abstract: - Providing a knowledge-based mobile learning interface and content is a good way to expand the user participation in a science museum with a web-based system, especially as the internet and computing fields grow more and more diversely. There are many ways for providing museum to collect information, however some yield better knowledge and interesting content than others. This paper presents a prototype of the National Science and Technology Museum (NSTM) showing how to design the museum's educational content for an interface as well as a brief evaluation of those approaches. It then concludes with the design of a mobile learning center that expectably will help produce real-time digital content of archive for museum's education.

Key-Words: Knowledge-based, mobile learning, museum collection, museum's education

1 Introduction

Education can be always improved by new technologies, especially with the emerging of computer related information technology [1]. The digital collection resource is an important asset to any museum. Besides conservation and maintenance, how to use these wealthy and knowledge-valued digital resources from creative design and development will be the challenge of any museum in the future. Especially, when facing coming competitive environment, it would be the museum's developing direction to add knowledge value and create competitive superiority. The plan is to apply the concept of knowledge-based mobile learning system to process the creation and management of knowledge. By means of constructing printing network instructive course and education platform, it would be useful to help museum integrating many exhibition and education resources into network instructive courses, which are also utilized in the mobile learning and education activity repeatedly. To museum, it seemed that one of the most telling criticisms of many earlier science center exhibits was the little time visitors engaged with them, the relatively low percentage of completion, and the low percentage of exhibits actually engaged with during a typical visit. Clearly, something wasn't working. Part of the solution seemed to lie in redefining what sort of activity should be happening in the first place. Thus instead of looking for learning in terms of observable cognitive gains - a series of facts learned - we had to look for sustained engagement with the activity [2]. So, the knowledge-based mobile learning will be a good opportunity for the science museum to establish and expand the learning environment. At the same time, the museum teaching materials can be also promoted in school for national nine-year serial education policy in Taiwan. It can also help museum's educators to develop and edit the e-learning course with this knowledge-based network platform. If the plan could be established, it would change the exhibition and education style of museum and become an important feature of NSTM in Taiwan.

In order to find the position of mobile learning applied in education area, the scholars Vavoula & Sharples [3] have tried to discuss the learning activity impact which the mobile learning make from the relative learning theory. They think that the adult learning and informal, lifelong learning will be the theory basis of mobile learning. Moreover, approaches to analyze discourse have developed simultaneously in different fields, such as linguistics, analytical philosophy, anthropology, etc. and have also inspired educational research, e.g., the concept of "grounding" in different media [4] has been transferred to computer-supported collaborative learning [5] [6]. These approaches need to be well connected to questions and theories of educational research [7]. The fit between theoretical and

methodological approach is vital with regard to decisions on how to sample, segment, and categorize the discourse materials. Counting the frequency of specific speech acts, for instance, may be more valuable to linguistic than educational research, because speech acts may not well represent relevant cognitive processes of learning. Furthermore, there are a number of different theoretical approaches to collaborative learning, which stress different process dimensions as indicators of knowledge building. Coding the discourse corpora with regard to one process dimension of collaborative learning may have blind spots regarding effects and side effects of other process dimensions on knowledge building. By analyzing whole samples of discourse corpora on multiple process dimensions we aim to better understand how specific processes of collaborative learning contribute to and improve individual acquisition of knowledge [8].

The study will process these valuable materials by implementing these knowledge materials from printing industrial technology which is digitalized and constructed by NSTM, and applying with the technology of Learning Management System (LMS) platform which is coming from SUN NET Technology Cooperates. The value-added processes can be divided into five steps. The first is to collect and analyze materials. The second is to work out the teaching plan. The third is to edit the matters. The fourth is to record the course. The last is to establish and manage the learning platform. The purpose of this study is to design and develop serial e-learning courses for printing industrial technology. It starts from NSTM technology education activity. By inviting the teacher and student to participate in the course designing on network learning platform, we can combine the resource of museum in collection, exhibition and education with value-added matters and promote through the internet.

Revans think the characteristics of action learning includes six elements: An emphasis on learning by doing, Conducted in teams, Addressing company/organizational issues, With participants placed into problem-solving roles, Where team decisions are required, and Formalized into presentations. The core of action learning is relatively simple and can be expressed by the equation L = P + Q, where learning (L) occurs through programmed knowledge (P) and insightful questioning (Q) [9]. According to the concept, we start to design the mobile learning courseware and reinforcing the effect of exhibition and education in museum by the cooperation with other company.

2 Research Purpose

The purpose of this research is to develop a serial of e-learning courses for the printing technology education through LMS platform. The resource is coming from the digital collection of the NSTM in Taiwan. The digital collection of museum needs to process its past (Objects Digitalization), nowadays (Cultural Heritage Annotated) and future (Knowledge Value-added and Managed) so that we need to regard it as a new vision. It is worthy for us to pay more attention to its importance, the conservation, and the reuse of digital resources of museum. When we review the development of museum, the modern culture indication changed rapidly from analog to digital media, from atom to bit. The museum also changed the way of paying attention to objects collections. The information communication skill will become more and more important for creating, sharing and preserving the resources of museum via the copy and represent of exhibited objects. The research starts from the basic concept of digital collection, through the distinctions of the concept of knowledge value-added, and expects to provide mobile learning system through the digital collection with a clear development direction.

Starting from the museum technology education activity, we invite teachers and students to attend the design course. As for the computers, they are more than simple information machines, despite the common use of the phrase “information technology” or “IT.” Of course, computers are wonderful for transmitting and accessing information, but they are, more broadly, a new medium through which people can create and express. If we use computers simply to deliver information to students, we are missing the revolutionary potential of the new technology for transforming learning and education. The declining cost of computation will make digital technologies accessible to nearly everyone in all parts of the world. These new technologies have the potential to fundamentally transform how and what people learn throughout their lives. Just as advances in biotechnologies made possible the “green revolution” in agriculture, new digital technologies make possible a “learning revolution” in education.

3 Method

According to the metadata of digital database in NSTM, the materials can be sorted by text, graphic, AV, animator component and virtual 3D component. We need to understand these materials and plan the

course outline. We are considering about three points at this stage regarding how to present the course content. The first is the context of teaching material: thinking about how to design the interactive function between the user and the instructor. The second is user-interface design: according to the need of museum's customer and habit of operation, we try to design some user-interface prototype. The prototype unit includes subject of learning, object of learning, suggestion of learning, course index, resource of learning, feedback & question and so on. At the same time, we also think about the location and effect of interactive component on the template. The third is the course content: The research develops an idea to build interaction between the instructor and the teaching material, and presents the proposal. After finishing the plan of teaching material, we will have to carry on the teaching material editing stage. This stage for designing teaching material consists of the following three level's structures:

3.1 Template Form Design: According to the cooperation manufacturer's experience, all the interface forms of teaching material will be unified, and shall be easy for use. The caption and position for the symbol, the caption of subject, and the caption of unit must be noted.

3.2 Template Function Design**:** To confirm the position for push button and function button on the screen before designing.

3.3 Curriculum Content Produce：When you start to produce the curriculum content, you must consider the interaction relations between the teaching material and the instructor or learner. Next step is to record the curriculum and add the instructor's video and printed lecture to making the content more attractive. During the process of recording, you need to note the time duration of the curriculum because the e-learning environment is very different from the school learning one. The e-learning curriculum should be shorter than the real teaching. By the way, the attraction and staying time on the curriculum is also very important factor for design. Here we try to integrate the technique of cooperate company with the view of educator and printing researcher in the museum and have a better result for the project. The last is to establish the e-learning platform in the museum. The technique of building the e-learning platform is coming from the SUN NET Technology cooperates and we utilize the platform to build the printing network courses. The LMS includes these functions of learner condition analysis and record, curriculum uploading and test which provide a convenient mechanism for the learner, manager and teacher.

The Activity Design for Curriculum: This curriculum for coordinating with the museum's demonstration activity, we design four units which include learn by doing course, printing e-learning course, demonstration course and Q&A brain storming course for learning. Basically, the museum has developed many printing education activities to innovate the audience's learning interesting of printing, in particular for the elementary and junior high school students. By learning booklet and onsite demonstration, the student can learn the printing technology and know how to print a book with engraving printing. By the way, we also set up a printing theater in the museum which the audience can attend the learn-by-doing course for the printing activities on site and supplemental online printing e-learning course through wireless connecting in the theater where we provide the tablet PC and LCD equipments. The point of printing e-learning course is focusing on the introduction of Taiwan ancient engraving printing history. The content of e-learning course includes the original history of Taiwan Song-Yun-Xuan ancient engraving printing, the development of technology, and the AV demonstration of engraving printing. When focusing on the education object of technology, we will introduce the method of engraving printing technology, the application of ancient printing technology on the woodblock printing and Japan's Ukiyo-e **(**pictures of the floating world**)** and the influence on the social culture. When focusing on the education object of emotion, we try to teach the learner for hands-on science attitude. The goal of curriculum has three aspects. The first is to set up the historical concept of printing technology. The second is to expert the basic process and technology of natural and living science. The third is to understand the relationship between the printing technology and social development. Through the curriculum, the audience can do self-learning and reach the goal of learning. On the phase, we also utilize the countryside record film of museum to explain in segment. We record the process of demonstration of engraving printing expert to show how to make a printing. We also record the dialogue between the expert and the researcher of museum for showing the detail knowledge of printing technology. With this process, the audience can understand the content of printing technology how they connect with our life and social culture. In the mean time, we also design the Q&A brain storming learning

unit on the platform which provides the interactive material and chance for the family learners.

4 Architecture Design of Knowledge-based Mobile Learning System

4.1 From Data, Knowledge to Wisdom

Data is worthless to most of us with the row material. It is the product of research or creation, but it is an important product for communicating. To have informational value, the data must be organized, transformed, and presented in a way which can offer some meaning. An e-learning environment encompasses critical issues relevant to the following eight dimensions. We have organized all e-learning resources around these eight dimensions [10]:

(1).Institutional: Including administrative, academic and student services issues.

(2).Pedagogical: Including goals / objectives, contents, design approaches, organizations, methods and strategies, and medium issues.

(3).Technological: Including infrastructure planning, hardware and software issues.

(4).Interface Design: Including page and site designs, content designs, navigations, and usability testing issues.

(5).Evaluation: Including assessment of learners and evaluation of the teaching material and learning environment issues.

(6).Management: Including maintenance of learning environment and distribution of information issues.

(7).Resource Support: Including online support and resources required for e-learning.

(8).Ethical: Including social and cultural diversity, bias, geographical diversity, learner diversity, information accessibility, etiquette, and the legal issues.

When people think about education and learning, they often think about information. They ask questions like: What is the most important information for people to know? What are the best ways to transmit that information from one person (a teacher) to another (a learner)? What are the best ways to represent and display information so that it is both understandable and learnable? The study tries to transform information of digital museum into knowledge and manage that knowledge. There are so many kinds of information and activities in the museum. For examples, there are visitor record, museum tour guide, museum visitors information, museum education activity information, museum exhibition information, museum learning list, museum demonstration information, museum digital collection, and so on. We try to analysis the structure of the Knowledge-based mobile learning system for the museum.

We hope to integrate the information into a mobile learning system which can help the museum to develop the real-time education activity. When deciding to produce multimedia curriculum, according to the curriculum characteristics, the first we need to decide what to kind of the source material type. The multimedia material type basically may divide into the text files, the static graphic files, the dynamic graphic files, the audio and video, the animation component, and the virtual three dimensional component and so on [10]. Then we define an annotation type for those digitalized information which has been set up in the website of the digital collection of Taiwanese technological artifacts and industrial technology (the website is http://digital.nstm.gov.tw) and transfer those information into the mobile learning system. On one hand, we invite related scholars to involve with the research and establishment of digitalizing artifacts and metadata information, on the other hand we design the friendly user interface and search function for the teachers by constructing the database and searching engine system. This system can provide teachers to utilize instructive material resource easily and help them to transform information of digital museum into knowledge, and manage that knowledge. The museum staff can also use the system to collect and study the information to support the museum collection research, exhibition, marketing and education activities. The chart of the system structure can be shown as follows:

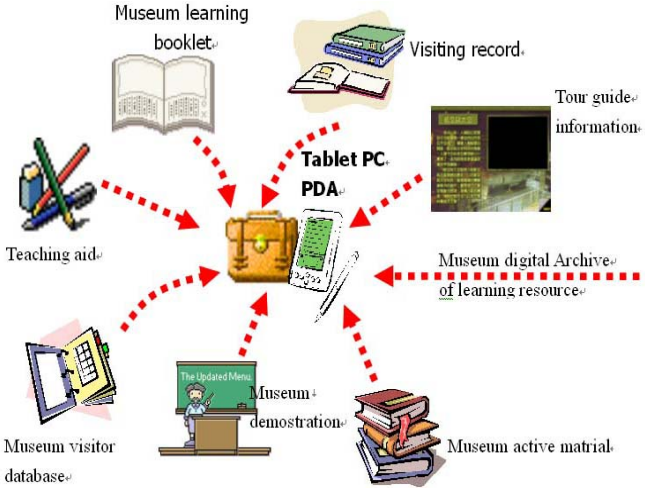

Fig. 1 The Architecture of Mobile Learning System in the Museum

4.2 The Knowledge Value-added of Digital Collection

In order to provide an effective platform which instructors can carry on the on-line course on the

museum mobile learning system, we study to establish the LMS for the knowledge value-added of digital collection. The technique of LMS is coming from the SUN NET Technology Cooperates and we utilize the platform to develop the printing e-learning course. The function of LMS includes student management, course management, work management, test management; score management, questionnaire & polling management, curriculum files management, and learning schedule management and so on. The mobile learning style is very different from the school learning one because the former is active, and the later is passive. To analysis the user need of mobile learning, we found that some requirements are necessary for mobile learning environment. These requirements include the urgency of learning need, active of knowledge granting, mobility of learning environment, situate of teaching activity, and integration of teaching content. The required conditions are familiar with the characteristic of cognitive apprenticeship learning environment. In order to establish the characteristics of the cognitive apprenticeship learning environment in the museum, we try to combine the museum hands-on activity with the printing network instructive course to have an experiment on site. We find the result which can motivate the learning interesting of audiences in the museum and is more effective for printing education. For the activity of engraving printing and rubbing, both of them are different but similar kind of copy technology. During the demonstration on site, we emphasize on how to find out the difference between them. We can find the effective of works for engraving printing and rubbing are so different. The copy method of engraving printing is using the rake to brush smoothly on the back of paper. The copy method of rubbing is using the fabric bundle which packaged with wood to hammer on the paper orderly and the effectiveness is similar with the high contrast copy. Although we can learn the technique how to make a copy with engraving printing and rubbing, the deeply knowledge of history of engraving printing and rubbing is hard to represent during the hands-on activity. So we utilize the Knowledge-based mobile learning system to assist us in providing the further learning content for the visitors of museum. The design and development flow chart for the printing network instructive course includes five steps. The first one is integration and analysis of digital resources. The second is planning the different level of instructive course. The third is to think about three factors for editing instructive course. The forth is to record the instructive course. The last one is constructing and setting up the course on LMS platform. The detail caption explain as in Figure 2.

The structure of the printing network instructive course includes five parts. The first is to outline the

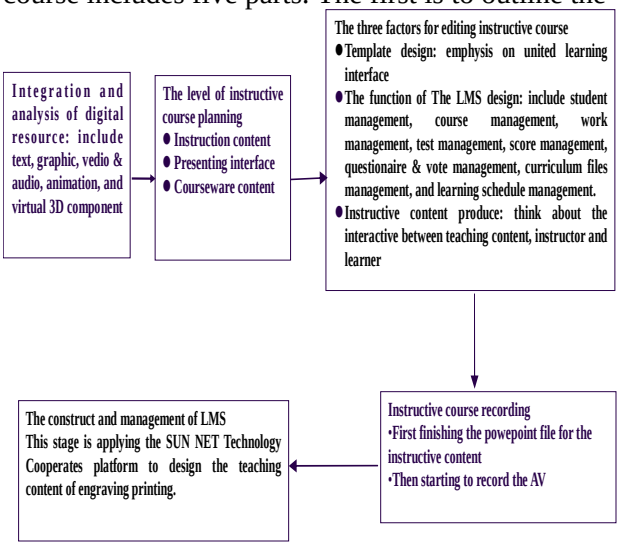

Fig. 2 The Design and Development Flow Chart for the Printing Network Instructive Course

course. The second is to combine the speech of instructor with the instructive material. The third is to include the supplemental instructive material for the history of engraving printing in Taiwan. The fourth is to edit the video of demonstration. The fifth is the Q&A unit which we design the flash animation questions for discussion on site. This courseware of Knowledge-based mobile learning system is more capable for subject teaching in museum. During the learning process of school, the teacher can also utilize those resources of museum to develop other subject teaching activity. For example, the teacher can set up the rubbing subject teaching activity for students and encourage them to do some field investigation at their home. They can learn the rubbing technique on museum mobile learning system website and apply it to the field investigation activity. When the students have the chance to involve with the printing technology into their learning activity and learn by doing. We think it would be more interesting for learning.

4.3 Establishing the Developing Standard of Distance Exhibition and Technology Education Curriculum and Booklet of Demonstrating Caption.

The study has tried to establish the developing standard of distance exhibition and technology education curriculum and booklet of demonstrating caption. The following table can be a reference: When we try to design the network instructive course. The standard includes the classification of curriculum presenting style, the classification of technique

requirement, the format of standard course structure, the template and icon design of standard course, the process of standard course and the standard document of script. The table of the developing standard of distance exhibition and technology education curriculum and booklet of demonstrating caption as follow:

Table 1 The Developing Standard of Distance Exhibition and Technology Education Curriculum and Booklet

Content title	Content Decription
the classification of curriculum presenting style	**To classify the curriculum presenting style that is useful for the teacher to design a new curriculum and script in the future. The curriculum presenting style can be classified into three ways: A. Situation type presenting style B. Goal-oriented presenting style C. Story line presenting style**
the classification of technique requirement	**According the presenting technique requirement of curriculum, the teacher and web designer can communicate more easily.**
the format of standard course structure	**Here refers to the finishing teaching material should be formatted and filed with standard process which is convenient for re-use and re-construct in the future.**
the template and icon design of standard course	**The standard of template and icon design can be helpful for learner to operate the e-learning course more easily and friendly.**
the process of standard course	**For controlling the schedule of project effectively, the standard course process manuscript should be established.**
the standard document of script	**For the project working effectively, the standard document (script, scenario, and so on) should be established.**

5 Conclusion

This research mainly is focusing on how to promote and apply the digital archive of Taiwan science and technology cultural relic by the concept of Knowledge-based mobile learning system. Basically, we have established the content of digital archive of National Science and Technology Museum systematically and provided the effective search engine function for the digital archive database. At the same time, we also have set up a LMS for the knowledge value-added of digital collection. By using the mobile learning platform, the technology education activities of museum can be recorded and edited to be the network instructive courses. Besides, it also can be applied to museum's exhibition and education activity to help the instructor mastering information technology for designing a creative exhibition and education activity. Still now, the study result is under experimental and need to be evaluated and modified further. During the experimental period, we find that the narrow and unstable wireless band in our museum is a major problem when the learners use the tablet device and try to connect the film in the internet. This would strongly influence the teaching result and need to be improved in the future.

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