Develop a Mobile Learning Model for Museums

Rong-Jyue Fang [1], Yu-Hung Wang[2], Mei-Chen Chang [3], Cheng-Wei Fan [4]
[1]Department of Information Management, Southern Taiwan University of Technology
[2,3,4]Division of Technology Education, National Science and Technology Museum
720, Chiu-Ju 1st Rd. Kaohsiung City, Taiwan

Abstract: - The continuous advance in mobile technology provides a new learning interface in education. It enhance the development of mobile learning in educational settings. By review of literatures, most of mobile learning occurs not in traditional education settings but in riverside resorts, on the cars, museums, even at home. Contrary to the general perception, studies of mobile learning are mostly conducted in research fields such as schools. Few studies in literature reviewed the relationship between mobile learning and informal learning environment. Thus, through the analysis of cases studies which applied mobile technologies in museums, this study proposed the purposes as the following: (1)Investigate the definition of mobile learning and redefine museum-friendly mobile learning. (2)Develop a visitor-centered interactive mobile learning model for museums.

Key-Words: - mobile learning, informal education, informal mobile learning model

1 Introduction

In recent years, the products of digital technology can be seen everywhere. The prosperous development of wireless internet has expanded the creativity of applications of these products. The continuous advance in mobile technology provides a new learning interface in education, for example: PDA allows us to take courses through wireless internet when we are physically away from the classrooms. In Finland, among its 5-million population, 98% of the students own a cellular phone. Cases of teaching university level courses through cellular phones can also be found. One research project of intern teaches studies the results of imparting knowledge through pictures and instant messages in cellular phones to the intern teachers by university professors. This study also tackles on how to conduct teaching to students in elementary schools [1].

In Taiwan, according to the survey conducted by Institute for Information Industry in 2006, as high as 99.7% of students in junior high and elementary schools have used computers and the penetration rate of mobile or wireless internet access is 15.6% which has increased 10.6%, comparing to last year's rate of 14.1% in 2005 [2]. In Taiwan, cellular phone's companies are starting to provide English learning courses through cellular phones. Hence, browsing on the internet and using online search engine through mobile equipments will be more prevalent in the future. However, according to the studies, most of mobile learning occurs not in traditional education settings but in riverside resorts, on the cars, museums , even at home. Contrary to the general perception, studies of mobile learning are mostly conducted in research fields such as schools. Few studies in literature reviewed the relationship between mobile learning and informal learning environment [3]. The development of digital technology has had profound influence on the design of museum exhibition. However, the application of mobile technology is still open for further development in regards to the audience's learning experience in museums.

2 Purpose of this study

The evolutionary development of digital technology has brought new and creative elements into its application in educational settings. Complementary learning through the use of wireless internet greatly optimizes learning efficiency. Previous studies on mobile learning predominantly focused on the learning in school settings rather than informal learning environments [3]. Current study aims to investigate the application of mobile equipments in museum based learning. The purposes of this study are as the following:

(1) Investigate the definition of mobile learning and redefine museum-friendly mobile learning.

(2) Develop a mobile learning model for museums through the analysis of cases studies which applied mobile technology in museums.

3 The characteristics of museum based learning

As an informal educational institute, the science museum with its unique and specialty provides visitors typical informal learning experience. Serrel asserted that good exhibition should be visitor-centered and he also pointed out three criteria for visitor-centered exhibition, such as visitors are able to orientate themselves quickly and consciously [4]. David Anderson, Keith B. Lucas, and Ian S. Ginn tried to clarify the definition of museum learning, and declared the human constructivism can be the theoretical foundation of museum learning [5]. In spite of the various definition of museum learning, while comparing with formal learning, there are remarkable differences between museum based learning and school based learning [6][7].

Table 1 concluded that the characteristics of museum based learning have four aspects: the learners, learning pace, learning pattern, and learning context [6] [8][9] .

Table 1: Characteristics of museum based learning

Aspects	Museum based learning
Learners	For whole ages without limits For whole citizens
Learning pace	Visitors make choices without time-bound and schedule restriction
Learning pattern	Exploring, self-directed learning, and visitor-centered
Learning context	With designed environment and exhibition, object oriented, activities and hands-on

4 The Definition of Mobile learning

The concept of mobile learning was proposed by Revans from England in 1982 which has been more than 25 years [10]. Revans offers an iterative model, successively alternating experience and preparation/reflection, which is a useful paradigm for mobile leaming [11]. However, scholars perceive mobile learning in different ways. The following section contributes to various explanations of mobile learning by international scholars:

- M-learning is e-learning through mobile computational devices: Palms, Windows CE machines, even your digital cell phone [12].
- Mobile learning is a context-based learning by using mobile technology medium and is learner-centered. The flexibility of mobile learning in a proper location allow learners to interact with other learners and instructors and conduct technology-learning, content learning or context-based learning that is proactive, instant, distant /approximate, individual or group-centered. Moreover, learner will experience meaningful knowledge construction through this process [13].
- Mobile learning is defined as any educational provision where the sole or dominant technologies are handheld or palmtop devices [14].

The following definition of m-learning are proposed based on the aforesaid theories regarding the application of mobile device in museums. In this project we came up with the following definition of m-learning：

The so called mobile learning refers to mobile instant learning which must be a portable, light-weighted mobile device with wireless internet feature. The content of the device must contain multimedia systems to provide sufficient messages and allow visitors to search for information of exhibit items when necessary, transmit related information and experience real-time interaction with museum staff.

5 The cases studies of mobile learning in museums

Learning in museums and galleries has been supported by electronic technologies for over forty years, since the first audio guides were developed firstly reel to reel type, then cassette, and now digital systems [13]. In recent years, the development of technology products and internet technology has made the learning pattern of mobile device in museums more popular [5][15]. The following four cases pertain to museums using mobile technology：

5.1 Tate museum, England

In the past, Tate museum offered a 45-minute electronic audio tour system which has a pre-set route. From 2003, the advent of the revolutionary Multimedia Tour Pilot (MIT) allows the visitors to experience the sound and images of the exhibition through mobile PDA which also has an interactive feature.

The tour system used in art museums has the following functions [16]:

- Interactive survey and response: used as visitors' opinions on the exhibition items.
- Creative games: visitors can design a tangible art work by mixing their own voices.
- Interpretation of the exhibition items: visitors have access to interpretation of the exhibition items in any corner of the exhibition hall.
- Tracking and calling functions: the device will track the visitors' location and thus provide necessary assistance.
- Possess recording function: the system will track the visitors' route and record all of the items that the visitors have viewed.
- Function of sending and receiving emails: the system allows the visitors to send or receive emails through the internet system in the art museum.

Tate museum conducted a survey on 850 visitors who have used the device: 70% percent of the users believe that this system will enhance people's interests and 61% of the users provided their personal email address for the use of MMT system whereas 45 % of the users suggested that the system is too complicated to learn.

5.2 Torre Aquila museum, Italy

Most of the display pictures are static in the traditional tour system. Torre Aquila museum has developed multimedia interactive tour methods which plays video clips related to the exhibition items through PDA. When the PDA is within the range 2 meters to the workpiece on the wall, the screen will immediately displays messages and selective video clips through radiation sensor.

Torre Aquila museum conducted a survey on 30 users who made complaints about not being able to concentrate on the art work while learning to operate the device. However, they attitude changed dramatically after they become familiar with the device. More than 90% of the users believed that this device helped them to learn more about the exhibition work and more than 93% of the users thought that PDA allows the audience to catch the gist of a workpiece. Lastly, about 80% of the users were able to more quickly locate the position of the exhibition through the use of PDA [17].

5.3 Exploratorium museum, USA

Exploratorium museum is a scientific museum that features hands on and interactive exhibitions. The visitors are allow to compete with one another while visiting and operation the exhibitions. However, although the positions of the exhibit items are placed in accordance with its theme, there was no obvious instruction. The visitor will often read the exhibit label only when they have finished or their attempt to figure out the exhibit fails. Hence, in consideration with the feature and environment of the museum, the Electronic Guidebook system was designed. The guidebook delivers static Web pages to users' PDAs when they visit exhibits [18]. Three major functions of the PDA are:

- Informing : information about the exhibit and the underlying phenomena
- Suggesting：suggestions about what to do with the exhibit
- Remembering (after visit) : "personal scrapbook" page, containing links to the selected pages, which can be accessed from anywhere on the web

A survey focused on the 35 visitors who have used the electronic guidebook revealed that most of the audience believed the device enabled them to acquire more information of the exhibit items, especially the function of look back on "remembered" exhibits on the personal scrapbook which they think are highly useful and allowed them to used the learned knowledge on schools. However, some visitors felt that the PDA was too large to carry around and they worry about damaging the device. The PDA might also distract students who concentrate on learning to operation the device rather than appreciating the exhibit items.

5.4 Exploratorium museum, Taiwan

In order to improve the guidance system, in 2004, the newly designed hand-held PDA tour system centers on digital learning content by combing humanity with technology. This system allows the visitors to provide interactive guidance service and allow them to more conveniently explore the profundity of science.

The PDA guidance content mainly focuses on the application of science in daily life with context-based guidance method and the incorporation of interactive concept, providing three tour routes based on the relevance and theme of these seemingly unrelated exhibit items. The method of tour includes narration, direction guide, interactive interface, multi-media and etc which guide the visitors to experience the journey of science by using the personal guide of PDA. The PDA tour system includes the following features:

- Combine the exhibit items and provide audio introduction of the exhibit items.
- Provide exhibition map and recommend a suggested route based on the museum theme.
- Allow visitors to search for the exhibitions and

events through internet.
- Interact with the visitors by Science Q & A.

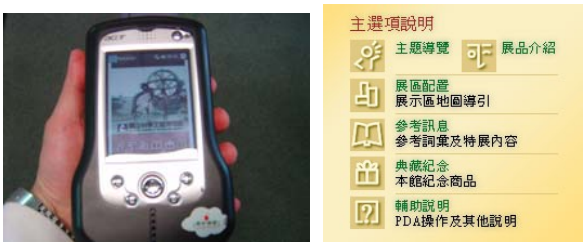

Fig.2 PDA Tour System

This project, although without a satisfaction survey, were largely recommended by people who have used it and were satisfied with its convenience. Jane Bedno pointed out the following suggestion for the project:
- Inconvenient for hearing impaired visitors without subtitles.
- The content is predominantly student or children-centered but does not provide content for different age levels.
- The device lacks the selection of various languages.

5.5 The advantages and restrictions of mobile learning in museums

The above four cases suggest that the museum has begun to use mobile technology in helping the audience to learn which has positive response based on the satisfaction survey. However, empirical evidence is needed to affirm the efficiency of mobile learning. I have concluded the following advantages and restrictions of the development of mobile learning in museums.

Advantages
- Exhibition description: more detailed description of the exhibition content
- Exhibition guidance: rapidly locate the exhibit item
- Provide recommendation of the exhibition
- Feedback: provide feedback and facilitate communication with the museum
- Recall memories: allow the audience to self-reflect
- Tracking: inform the exhibitors of the tour route
- Calling: allow instant communication with the instructor
- Creative game: enhance interests
- Sending E-MAIL: interaction with others.

Restrictions
- It takes time to learn and the operation interface is complicated
- The device is too big to be carried around
- Concerns of possible damages
- Reduce concentration of the exhibit items

6 A mobile learning model for museums

Museums now use digital technology that contain not only sound and picture, but also the interactive device of multi-media, allowing the visitors to have more flexibility and more freely select their desired route and pace while visiting [19]. In the future, mobile learning shall take the following elements into consideration :
- things to know when using mobile learning device
- Quick search and efficient learning efficiency
- the use of operation interface and accessibility
- value-added of the learning context

As the learning device provides service through wireless technology in creating a learning environment that will not be restricted by space, time and any form of mediums, it is essential that a light, easy-to-carry and reader-friendly mobile tool to optimize mobile learning [20].

In formal learning environment, it is clear that the teachers will decide the learning procedures and method for students. However, informal learning environment is usually learner-centered [5]. Hence, the following suggestions are provided based on the above literature and case studies in both Taiwan and other countries for the development of mobile technology in museums. It is suggested that the following six visitor-centered interactive patterns shall be provided:

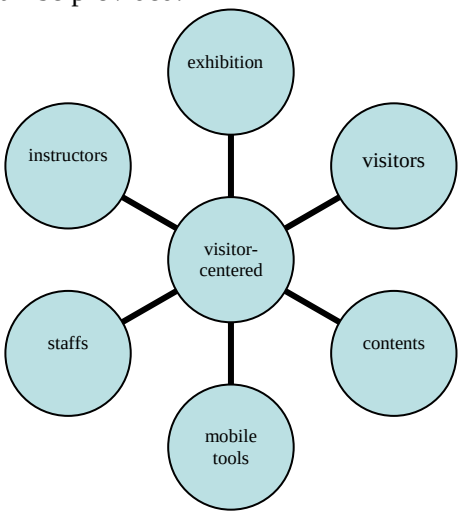

Fig.3 Mobile learning model for museums

6.1 Interaction between visitor and exhibitions

The best way to impart knowledge in museum is

through exhibitions which have limited representations. For example, it is hard for the audience to relate to an object that is historically valuable and meaningful in an exhibition. However, through mobile devices, we can provide the audience with options to acquire the historic background of the item and exhibitions of its related items. Mobile device even provides context-based animation and interactive games. Thus, mobile devices not only provide the basic function of introducing the exhibition items but also strengthen the visitors' learning motivation and interests.

6.2 Interaction between visitor and instructors

Due to limited man power in the museum, it is difficult to provide face-to-face service of interaction between museum interpreters and the visitors. Fortunately, the invention of mobile devices provides an excellent solution which offers detailed and vivid description of the exhibit items. On the other hand, the interpreter can also provide instant response and provide proper solutions where questions of content of the mobile device arise.

6.3 Interaction between visitor and staffs

The exhibition is presented based on the museum staff, however, should the visitors conduct self-motivated learning based on the route designed by the exhibitors? A visitor-centered exhibition must know the audience's preference and mobile device allows the staff to know the audience's travel route or even track the audience's position inside the museum and recall exhibit items they visit which may serve as references for future design, travel route or improvements. At the same time, mobile devices will notify museum staff to provide assistance for the audience immediately.

6.4 Interaction between visitor and contents

The most valuable function of mobile device is to provide the description content of the exhibit items. Mobile device also allows the visitor to record the content they previously viewed and provide the apparatus of self-reflection and recall memories. It is evident that internet search engine and interactive Q&A will allow the visitors to self-examine the learning efficiency in museums.

6.5 Interaction between visitor and visitors

Where museum educational staff is absent, the visitors may interact with other individuals or groups through sending emails and share information of the exhibit items, allowing the learners to conduct instant discussion and thus improving learning efficiency.

6.6 Interaction between visitor and tools

The operation interface of a mobile device is the key to its success. Apart from the basic requirements of light weighted, small keyboard and multi-touch display, it must minimize the learning time and provide easy operation, allowing the visitors to more easily utilize mobile device for learning. It is unquestionably that other functions such as internet, sending emails, instant record, and video taping also allow the uses to record, transmit and share information immediately and greatly enhance the audience's learning interests.

7 Conclusion

In the past, the learning method in museums is to present a real object or a model to the audience. However, the learning stops after visitors leave the museum. The advanced internet technology gives birth to online virtual museums which present the

Table 2: Characteristics of Museum Visitor-centered mobile learning

Aspects	Traditional Museum learning	With mobile learning technology
Visitor vs. Exhibitions	Learning from the interaction with real objects and hands-on devices	Learning through real time and virtual environment with free access and interactive animation to enhance visitors' learning motivation.
Visitor vs. instructors	Limited and should be on schedule	Self-directed and real time response
Visitor vs. Visitors	Only the person company with you	Sharing in anytime and anywhere
Visitor vs. Museum Staffs	Without communication	Tracking provides instant service and real-time communication as well the visitor's tour route and interaction time
Visitor vs. Content	On-site learning only	Record self-learning content allows the audience to conduct retrospection
Visitor vs. Learning tools	Only pictures, sounds or video in galleries	With multimedia and web

exhibit items digitally, distinguishing it from traditional museums which feature exhibitions, education, research and archive. Online museums thus allow learners to browse and learn through computers at home with no time limit but are restrained by the immobility of the bulky computers. Nevertheless, the development of small size mobile device, along with wireless internet technology, the assistance provide by mobile device further extends the functions of museums regardless of the location and significantly enhances learning efficiency.

Hence, museum-based learning will become an instant learning pattern in the future, allowing the visitors to acquire information of exhibit items in any corner of the museum or even transmit the information for continuous learning at home. It is also a self-directed learning pattern which enables the users to design their own learning route and permit the museum to transmit unlimited information and bring the dissemination of education into full play through real time recording and sharing.

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