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Development of Mobile Web for the Library

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Abstract

The university library provides information services aimed at fulfilling learning and academic research for students and faculty members. In the age of rapidly growing Internet technology, library websites have become a gateway to knowledge and the entrance for readers to access valuable resources and services. With the advancement of mobile technology in recent years, an increasing number of library readers have started to access library resources and services through their mobile devices. The information provided through a traditional website is too complex to be browsed with a mobile device, and users may also encounter some technical limits. Websites developed for mobile devices might overcome users' difficulties when reading heavily from traditional web pages. Mobile web helps overcome difficulties in searching for needed information and makes information more accessible. For any library, especially university libraries, developing mobile websites is becoming a necessary trend to satisfy users' mobile needs of exploring the world of knowledge. This study provides experiences of developing a mobile web for the academic library. Users' applications and reactions to the system are analyzed and summarized. Technological and implementation issues related to the construction of a library mobile web are discussed. Implications of the study results might provide valuable information for promoting a ubiquitous library service and information access.

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1. Introduction

With the advancement of modern technology, the devices used for communication are becoming smaller and smarter. In recent years, the popularity of mobile devices such as smartphones and tablet PCs have changed the way of using the Internet and computers. Mobile services have become one of the important trends in academic libraries.

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Among library users, college students are the main group of users of technology products, and the emergence of mobile technology is also changing the way students retrieve and obtain information. According to a survey of ACRL (the Association of College & Research Libraries, 2012), about 55% of college students own a mobile device. Among these students, more than 66% use their mobile devices for academic purposes, 59% of them search for information online, and 24% use mobile devices to obtain library resources.

In order to cope with the needs of users in the ever-growing development of the mobile technological world, higher education begins to mobilize their teaching and learning services. Academic libraries are also joining the trend to provide mobile services to fulfill users' mobile needs. In the era of the Internet, library websites are an entrance to library resources and services. However, a website design for PCs is too complicated for users to read through and access the information they need via their phones. Therefore, a growing number of libraries are starting to offer a mobile web to simplify the operation of using their library website.

A mobile web is a mobile-friendly portal which offers a convenient interface for users when browsing a website with smaller screen size mobile devices (Kroski, 2008). When using a traditional PC website, a user might encounter obstacles and challenges, such as adaptation of screen size, computation capability, and bandwidth of Internet transmission. Providing a friendly mobile interface by restructuring the necessary library services and rearranging the content layout may free users from heavily reading and working with a limited screen size, and thus increase the efficiency of accessing information.

2. Relevant research on library websites design

In recent years, mobile technologies have become pervasive. Mobile devices are making rapid gains over notebook and desktop computers (Breeding, 2012). Most service websites now have a specially designed mobile version in order to fulfill the needs of users. The trend for implementing mobile webs by libraries is worth noting. A review of services provided by the mobile websites of several university libraries in Taiwan showed that various common services are provided, including: library introduction, news update, online search, personal circulation status, database link, selective resources, book recommendations, library space reservations, user instructions, and contact information. Woodbury (2010) suggests that libraries should consider feasibility and applicability before mobilizing library services. Several issues should be considered before implementation, including: services currently available, services applicable on a mobile device, the ability to translate services well into the mobile environment, and easy creation of tools.

To examine the design of library websites, research has employed various approaches related to user applications in the implementation of web services. For example, Battleson, Booth and Weintrop (2001) used the think aloud process to study the efficiency and usability of website design. Hsieh and Liu (2009) triangulated various user data for assessing the design of website usability, including usability tests, think aloud, in-depth interviews, and questionnaire survey methods. Iskam and Tsuji (2011), Joo, Lin and Lu (2011), and Iqbal and Warraich (2012) used the questionnaire survey method to assess users' responses to the interface design of library websites. For the use of mobile devices, both Pendell and Bowman (2012) and Yeh and Fontenelle (2012) conducted an experimental study to test the website usability for use with mobile devices (Table 1). From these assessments, the use of usability tests invites users to use the website to accomplish a list of structured tasks, so that researchers may evaluate the usability of the designed interface. In addition to testing usability, the use of survey questionnaires and interviews also invites users to provide both overall and in-depth reactions to the system. Diverse approaches to evaluating the interface designs of mobile devices are needed to obtain guidance for improving the usability and applicability of the design approach.

Table 1. Methods of implementing usability tests

Scholars	Year	Purpose	Methods
Battleson, Booth & Weintrop	2001	Website efficiency and usability	Usability test Think aloud
Hsieh & Liu	2009	Website usability	Usability test

			Think aloud
			In-depth interview
			Questionnaire
Iskam & Tsuji	2011	Website interface design	Questionnaire
Joo, Lin & Lu	2011	Website efficiency, effectiveness and learnability	Questionnaire
Iqbal & Warraich	2012	Website usability test	Questionnaire
Pendell & Bowman	2012	Website usability test when using mobile devices	Experiment
			Usability test
Yeh & Fontenelle	2012	Website resource needs of mobile devices	Usability test

3. Development and implementation of library Mobile web

In order to provide college students with a convenient interface to obtain library resources and information, a Library Mobile Web was developed at Fu Jen Catholic University Library. Figure 1 indicates the structure of the mobile web. On the “Main Page” of the system, icons provide service links to the most frequently used services, including: “online search (of collections)”, “library news”, “personal circulation status”, “book recommendation”, “seats in learning commons”, “college selected”, “feedback”, “open hours and contact information”.

The most important and the core part of the library mobile web service is the online search. The integrated library system used by Fu Jen Catholic University Library is Sierra by Innovative (<http://www.iii.com/products/sierra>). For managing library collections locally, all bibliographical data are only accessible through Sierra’s customized management software. To implement the mobile online search function without reaching the database structure of the Sierra system, PHP Simple HTML DOM Parser (<http://simplehtmldom.sourceforge.net>) was used. The tool can capture the target webpage and analyze the source code of the web content. Since the PC version online catalog provides organized structures of html codes to display the bibliographic information (for instance, the title of a book wrapped with a CSS ID or class), PHP Simple HTML DOM Parser could exclude non-useful information, then filter the information needed to be presented. This tool is used to capture and filter bibliographic information from the Sierra online catalog and arrange appropriate information that is easy to read and use for the library mobile online search function. The rest of the services in the library mobile web, such as library news, book recommendations, and etc., are connected to the library web server to retrieve timely data and synchronize the information in the mobile web.

4. The Study

In this study, a usability test was conducted before the mobile web was formally released by the university library. Fifty students volunteered for the study. They were instructed to use mobile devices for participation in the usability test. A structured task sheet was provided to measure the efficiency of using the library mobile web. Thirty online catalog search tasks were covered in the task sheet: 15 search tasks (time limit: 10 minutes, using a mobile device) for PC web and 15 search tasks (time limit: 10 minutes, using a mobile device) for Mobile web. In order to avoid the familiarity effect caused by the prior search tasks, the sequences of the different versions (PC web and mobile web) were shifted during the testing. Half of the participants (25) used (1) PC web and then (2) mobile web, while the other half used (1) mobile web and then (2) PC web. Follow-up open-ended questions using a Likert’s 5-point scale were also used to obtain users’ reactions to the services in the library mobile web, and overall responses regarding various aspects, including: interface, system function, content organization and reflection on the system.

5. Findings

Of the 50 volunteer participants, their majors were distributed among 11 colleges at Fu Jen Catholic University, and they included 14 males (28%) and 36 females (72%). Compared with the PC web group, the Mobile web group

finished more search tasks ($t = 9.514, p < 0.001$) (Table 2) in less time ($t = -5.634, p < 0.001$) (Table 3). Mobile web is more efficient than PC web in terms of the time used for completing a search task ($t = -11.951, p < 0.001$) (Table 4). The mean of correct answers obtained by the Mobile web group was also greater than that of the PC web group ($t = 5.933, p < 0.001$) (Table 5). The data reveal that the Mobile web users completed more questions, used less time to finish a question, and got more correct answers. In addition to the test results, the students' reactions to the Mobile web were also obtained and summarized from the questionnaire items as shown in Table 6.

Table 2. Numbers of questions finished in 10 minutes

Finished item numbers	<i>M</i>	<i>SD</i>	<i>t</i>	<i>P</i>
Mobile	14.140	1.178	9.514	0.000***
PC	12.420	1.773		

$N = 50, *** p < 0.001$

Table 3. Total time required for finishing search tasks

Total search time (second)	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Mobile	551.252	41.358	-5.634	0.000***
PC	583.407	22.450		

$N = 50, *** p < 0.001$

Table 4. Time for completing a search task

Time/per task (second)	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Mobile	39.355	5.247	-11.951	0.000***
PC	47.995	7.526		

$N = 50, *** p < 0.001$

Table 5. Accuracy of responses

Number of correct items	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Mobile	13.180	1.674	5.933	0.000***
PC	11.700	1.908		

$N = 50, *** p < 0.001$

Table 6. Users' reactions to the use of the various mobile services

Items for responding reactions	Scale (Number of respondents)					<i>M</i>	<i>SD</i>
	1	2	3	4	5		
Satisfaction with "Online Search"	0	0	4	25	21	4.34	0.62
Satisfaction with "Library News"	0	0	7	25	18	4.22	0.67
Satisfaction with "Personal Circulation Status"	1	3	7	21	18	4.04	0.96
Satisfaction with "Book Recommendation"	1	0	5	14	30	4.44	0.83
Satisfaction with "Seats in Learning Commons"	0	2	10	17	21	4.14	0.88
Satisfaction with "College Selected"	0	1	4	17	28	4.44	0.73

Satisfaction with "Open Hours"	0	1	0	18	31	4.58	0.60
Satisfaction with "Contact Information"	0	1	3	15	31	4.52	0.70

N = 50, Likert's 5-point scale

6. Users' Open-ended Reactions toward the Library Mobile Web

The open-ended responses gathered from the questionnaire also provided reflections on and suggestions regarding the use of the library mobile website. The students' reactions are structured according to the various aspects, including system interface, system function, and organization of content. From the aspect of the system interface, the users were positive about the interface design of the mobile website. They considered the mobile interface pleasing and user-friendly. Compared with the PC version which contains too much information and uses a complicated interface, the Mobile Web provides the necessary information in a clear format. Without the zoom-in and zoom-out actions to read the content of the web pages, the screen of the mobile web is suitable and easy to manipulate. It is more convenient to use and focus on tasking information.

"The mobile interface is appropriate for the screen size of the mobile device. I don't need to keep on zooming in and out to read the content." (T3)

"The advantage of the PC version is that it contains plenty of functions. The disadvantage (of PC web) is that too many functions provided in the PC web makes the interface too complicated to use. The interface of mobile web uses icons with colors to differentiate various functions." (T8)

"The Mobile version is much easier to use. I can easily click on the item I want. In the PC version, the interface is so small that I frequently click on the unwanted items accidentally. Frequent zooming in and out is needed to read specific information." (T29)

From the aspect of system function, the users considered it much easier to use the online search function in the Mobile Web, with the needed functions well-organized on the screen. Users felt comfortable selecting and typing in the keyword at the designated areas on the mobile device. In spite of more functions provided in the PC web (e.g., setting search conditions for filtering the search results), users felt that it was too complex to use the mobile device to accomplish search tasks with PC web. However, some students recommended adding additional functions for advanced search purposes. They also suggested the integration of social networking in the Mobile web for sharing information and reflections on books.

"In the PC version, I can set more search limitations in advanced search to find more detailed information." (T6)

"The advantage of the mobile version is that it's easy to use. I don't need to zoom in and out to read the content. But sometimes, it reacts slowly.." (T14)

"All the functions needed are included in mobile version. It's convenient to use." (T17)

"I think a FB share function can be added that allows users to use the camera to recommend books for others." (T34)

From the aspect of content organization, the size of the text for Mobile web was appropriate for reading. However, details about the search results were needed. Users revealed that the information provided in the Mobile Web sometimes excluded needed information for further actions. More details of the search results were suggested by users to avoid switching screens and links for accessing the complete information.

"The search result in the PC version is clearly presented. I can access the information efficiently to see whether the book is available for check-out." (T26)

"The PC version displays more information than the mobile version, I will need to click the link to browse for more information." (T40)

"The text size is too small in the PC version. It's hard to see the structure of information." (T45)

7. Conclusions

In this study, the mobile web of Fu Jen Catholic University Library has been developed and evaluated since the end of 2014. Students' perceptions of and reflections on various aspects of using the library mobile web were gathered through the usability test. Reactions to the system interface, function, and content organization, and open-ended reflections on the system were also obtained. Analysis of the usability test results indicated that the students performed better using the library mobile web, accomplishing the search tasks more efficiently and effectively. Most students thought the mobile website provided a well-designed interface and that the well-organized content allowed them to read easily and clearly, and reduced the inconvenience of zooming in and out to access the content. However, additional functions for adapting different user needs should also be considered in future implementations. The use of a mobile web of the library is aimed to make library information more accessible for mobile device users. It is expected that through the library mobile web, students can benefit from the abundant resources of the library. A ubiquitous learning environment can be provided to students to fulfill their academic and leisure needs for accessing resources from the library. It is also hoped that this study might provide valuable references and indicators for future implementation and evaluation of a library mobile web.

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