Post Library Faculty Publications

Library

Winter 2017

Research Plus™ Mobile App: Information Literacy "On the Go"

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Recommended Citation

Title: Research Plus™ Mobile App: Information Literacy "On the Go"

Purpose

This paper describes a case study illustrating the systematic approach librarians used to develop of an information literacy application (app) prototype that aids students in performing research tasks "on the go".

Design/methodology/approach

The initial findings from a student survey on technology use indicated the value of an information literacy mobile application. The ADDIE approach was used to develop the app. Alpha and small-scale usability testing was performed to evaluate the prototype's readiness for deployment.

Findings

The survey analysis indicated that students were not using mobile devices as expected for library related tasks. Student suggestions for improving their library experiences included mobile access to the libraries' digital collection and an application that assisted them in effectively using these resources. Usability studies indicated a positive response to the app and its readiness for beta testing among the inclusive student population.

Originality/value

To the author's knowledge, this is the first native information literacy mobile application whose aim is to help students with research on the go. The step-by-step approach used for each phase of development, as well as the implications for success, may serve as a model for libraries' seeking to enhance their mobile resources.

Introduction

In 2011, Long Island University recognized the increasing trend of higher education student use of mobile devices to access the Internet. In response, the university, a medium size private institution with two main campuses and multiple satellite campuses, initiated an iPad program. The program offered free iPads to full-time undergraduate students and discounted iPads to graduate students. The program's goal was to provide students ubiquitous access to cutting edge mobile devices for classes, research, and personal use. To support the iPad program and improve mobile library services, Long Island University Libraries implemented a student survey. The survey consisted of 51 multiple choice and open-ended questions focusing on technology integration, library use, as well as research and study habits. The results indicated that students were not using their mobile devices as expected. Most students that owned mobile cell phones did not use them to access the web-based resources on the libraries' site. In addition, the students that took advantage of the free iPads rarely used them for academic work. Subsequently, students indicated that they did value access mobile library resources, as well as, help in using them to effectively perform "research on the go".

At the turn of the 21st Century, the concept of a "mobile library" was relatively new and not clearly defined in the literature. To ensure a well-developed strategy and the greatest return-on-investment of Long Island University resources, a library team used a systematic approach to analyze, design, develop, implement, and evaluate mobile library interventions. A native productivity application (app) titled Research Plus™ was one outcome of the project. The app's purpose was to guide students through basic research

steps "on the go" as well as support the students' information literacy needs that align with Association of College and Research (ACRL) standards in a mobile learning environment. Features included choosing a research topic, accessing digital library resources, generating citations, and evaluating resources. Students had the ability to save the results of the session in a report and emailing a copy of the report to the library for further assistance. The app was tested internally by librarians and by representative samples of the student populations. At the time of this writing, the prototype app is being implemented for beta testing by University students at large.

Literature Review

Higher education students own more Internet capable mobile devices now than ever. According to the Educause Center for Analysis and Research (ECAR) Study of Undergraduate Students and Information Technology, device ownership continues to increase with 86% of undergraduates owning a smartphone and nearly half (47%) of students owning a tablet (Dahlstrom and Bischel, 2014). Despite this increase, students' attitudes regarding the value and importance of using mobile devices for academic work is declining. The lack of guidance by educators and institutions on how to use mobile technology in meaningful and engaging ways has contributed to this decline (Dahlstrom and Bischel, 2014). The 2015 Horizon Report Library Edition (Johnson *et al*., 2015) emphasize that students lack the direction, skills, and knowledge necessary for effectively using mobile devices for a wide range of educational purposes, referred to as "digital literacy". The 2016 Horizon Report Higher Education Edition augments the argument that higher education lacks concrete strategies for integrating mobile technologies into the learning landscape. Instead, the trend is to encourage students to "bring your own

device", or BYOD, and use it as seen fit in order to foster a "greater sense of ownership over their learning" (Johnson *et al*., 2016).

As student adoption of mobile technology becomes widespread, academic and public libraries have hastened their plans for a mobile Internet presence (Vassilakaki, 2014). The terms "mobile library" or "m-library" were coined to denote information services (i.e., "text a librarian") and digital resources (i.e., online articles) accessed using mobile technology including smartphones, tablets, and wearable devices such as smartwatches. Academic libraries lacked a distinct direction as to what and how to deliver mobile access. This was partially due to the lack of understanding about what was useful to students in a mobile learning environment (Bomhold, 2013). Usability studies began to clarify students' mobile usage and acceptance for library related tasks (Becker *et al.,* 2013; Conrad and Shen 2014). Additional studies regarding the adaptation of information seeking strategies when performed on mobile devices provided important insight into the concept of "mobile information literacy" (Walsh, 2012). These studies provided an important opportunity to re-evaluate library services and resources rather than repackaging the status quo into a digital format (Bell and Peters, 2013). In response, many libraries began to formulate an effective strategic approach to transitioning to mobile library technologies based on best practices identified by other institutions and within their own library environment (Becker, 2015). The literature also emphasizes that although students recognize the value of ubiquitous access to library resources they also require assistance and support in effectively using them (Vassilakaki, 2014).

The three most common methods for mobile app development are web based, native, and a hybrid approach that combines elements of the first two. A web based "app"

runs on a mobile browser, like Safari or Chrome, akin to websites. Native apps are developed for a specific platform, like iOS and Android, and can integrate the rich functionality of a mobile device with library data including wayfinding GPS-like functionality, location-based recommendations, camera data, information resources, and OPAC systems (Hahn and Ryckman, 2012). Native apps are advantageous in that they deliver the fastest and most responsive user experiences.

   While many libraries use a third-party vendor, like Boopsie™, to customize a standard off-the-shelf library app (Miller, Vogh, & Jennings, 2013) other libraries tap into specialized development resources to design more extensive, cutting edge apps. Bradley et al. (2016) used Apple's version of location-based beacon technology, referred to as iBeacon, to develop a self-guided library tour app. App developers programmed iBeacon devices to emit information about specific areas in the library. As students approached these areas with iPad Air 2 tablets provided by the library, the app used Bluetooth technology to automatically play a video about the library location. A curriculum component allowed students to take a quiz at the tour's end and for faculty to be notified upon completion. With funding from a federal grant, Hahn, Ryckman, and Lux (2015) developed an app that incorporated augmented reality (AR) and optical character recognition (OCR) features that guided students to relevant "topic spaces" outside an immediate browsing area. When students scanned a barcode from the physical area the app suggested relevant resources in a different section of the library. The app also included the ability to notify students about books in the area that were currently checked out. In 2015, the University of Rochester River Campus Libraries were also awarded a federal grant to develop a "study space engagement" app that provided

students with the mobile capability to examine the current occupancy of preferential library study spaces. Using indirect wireless usage data, the app created a heat map of space occupancy in near real-time. The app was expected to increase student productivity by decreasing study and research downtime and to improve the overall library user experience (Collins, 2015).

Research Plus Mobile Application Development

The Long Island University Libraries strategic plan for developing mobile library interventions was based upon the ADDIE model. The encompassing five phases (analysis, design, development, implementation, and evaluation) represent a systematic and integrative approach for building effective pedagogical and performance support tools in five phases. Each phase is described in detail below.

Analysis

In general, the purpose of the analysis phase was to identify the problems and goals associated with a given situation. This was done through a needs assessment to determine the "gap" between the current situation and the desirable situation. A student survey was used to provide insight as to how students used mobile devices and technology to complete their academic work. The results of the analysis were used to plan for effective mobile library interventions.

Survey Research Questions

The analysis phase was guided by the following survey research questions:

1. How are students using mobile devices and other technology for their academic work?

2. How many students participated in the iPad program?

3. For students that received an iPad, how are they using them for their academic work?

4. What future mobile library tools and technology do student suggest to improve their library experience?

Survey Development, Implementation, and Analysis

The survey included 66 multiple choice, dichotomous, free text, and rating scale question. Several questions used skip logic allowing the respondents to bypass questions depending on their answers. Students were not required to answer all the questions and no identifying information was collected except general demographic data. The survey was highly marketed to all campus locations through emails, press releases, prize incentives, and a "kick off "celebration in September 2012. Students could access the survey for a two-week period on any of the libraries' computers, through the web, or via QR code on their mobile device.

The survey sample consisted of 1182 students from multiple campuses. The qualitative and quantitative data was analyzed using the SPSS version 23 statistical software package. The data was summarized using descriptive statistics in the form of frequency counts and inferential statistics, specifically Pearson's Chi-square, when significant. A content analysis of free text responses was used to calculate quantitative data by categorically coding each response. Table 1 presents the most impactful results of the survey.

Table 1: Impactful Survey Responses

Based upon the results, the majority of students owned mobile cell phones but did not use them to access the library resources found on the website. This was attributed to

the lack of mobile library resources available at that time. Approximately one-third of students did not take advantage of the iPad program; the majority who did were freshmen. Those that did receive iPads were not using them for academic work. This was attributed to a number of factors. First, the iPad program was new and marketed largely to incoming freshman although the program was available to all students. Students who did use iPads most often did so on their own accord as a means to access and record class information or perform personal research. Student suggestions regarding helpful mobile library tools and technologies indicated that they value access to mobile library resources but desire help in using them to effectively perform "research on the go". Based upon these outcomes a library application was proposed to support the iPad program and add value to mobile learning needs in hopes of increasing student usage and acceptance.

Design

A team of librarians was charged with using the information compiled from survey analysis to design effective mobile library interventions. The team began the design phase by answering the following logical questions:

1. What type of mobile access will be developed?

2. What would be the app's purpose?

3. Who would be the app users?

4. What content should be included?

5. How should the user-interface appear?

In order to answer the question regarding the type of mobile access to develop, two potential options were explored. The most practical option was to create an optimized library website for mobile access so information could be read on smaller

screens. The second option was to develop a native app developed specifically to run on the iPad. This option would require more time, specialized personnel (i.e., app programmer), and budgetary resources. The team agreed that the return-on-investment with a native app outweighed web optimization and would likely increase student adoption and use of mobile library services. The app was named Research Plus™. The Dean of Long Island University Libraries applied for a University Instructional Innovation Grant to secure funding for a mobile app programmer.

The next questions addressed by the team were the app's overall purpose and its potential users. The discussion included whether the application should reflect the information and resources on the libraries' current website or be a more innovative application that could enhance students' research productivity and information literacy competencies. The team decided to focus on developing an innovative application with the understanding that a more standard library app reflecting the major resource found on the website would be addressed in the future. Next the team addressed the app's potential user. The following questions were discussed:

1. Should the app be geared to the novice researcher who requires additional support or the expert researcher who has more complex research needs?

2. Should the app be designed for general education or focus on a program that requires significant use of library resources such as the biomedical sciences?

In the end, the team consensus was that the app should be useful to as many students as possible. As a result, the decision was to design the application in such a way that novice users would have extra guidance and skilled researchers would be able to access the necessary information or tools on an as needed basis.

The third question addressed the mobile app content. The team reviewed the students' survey suggestions within the context of the Association of College & Research Libraries' (ACRL's) Information Literacy Competency Standards for Higher Education in place at the time of the app's development. Based on these criteria, the team proposed that the app help students identify a topic for a research paper (standard 1.1.b, 1.1.e, 2.2.b), evaluate source validity (standard 3.2a), generate citations (standards 2.5.d, 5.3.a), and incorporate direct access to the libraries' digital collection (standards 2.3.a). Additional recommendations included the ability to save information produced during the session in a report and the ability to send a copy of the report to the library for further assistance.

Finally, discussions regarding the user-interface continued at length and there were a number of design iterations. The designs included graphic user interfaces including a "subway" map theme as well as a text-based interface. The team used a low-fidelity rapid prototyping approach which included pen and paper sketches and PowerPoint slides. This low-tech, "proof of concept" development process was advantageous in that it was a cost-effective approach to making design decisions and clarifying app functionality before tapping into programming resources. At the end of the design phase, PowerPoint storyboards were sent to the programmer for feedback.

The programmer provided suggestions regarding mobile functionality and interface design. One important suggestion by the programmer was the use of the "search autocomplete" feature for brainstorming a research topic. This feature suggests topics based upon text typed by the students. This functionality supports the key principal that students are better at recognizing topics than recalling them. Also, this type of interaction

is invaluable in mobile technology when accurate typing on smaller keyboards is more difficult. Finally, this functionality increases research effectiveness by helping "build student confidence with an unfamiliar topic, to speed up the search process, to focus broad searches, and to augmenting search-term vocabulary" (Ward et. al., 2012). Other best-practice functionality built into the app included opening external links to digital resources (i.e., catalogue, databases, Google scholar) in a new window while keeping the current window unchanged, using one level of navigation menus, saving the current application state when the application is minimized and restored again, and making titles, links and navigation items self-explanatory (Shitkova, et. al. 2015). Finally, the design takes advantage of mobile features that supports effective research including the standard keyboard autocorrect function and the use of the "microphone icon" to speak and record information in input fields (Christiansen, 2015).

Development and Testing

Upon the development of a functional prototype, alpha and usability testing occurred. Alpha testing was the first round of internal testing performed by the designers and developers. In this case, all librarians were encouraged to participate in the testing. Several necessary changes were made as a result. First there were minor spelling and grammar error corrections. Also, some screens required redesign because the virtual keyboard covered up some input fields. Next some content was removed due to redundancy including a second topic brainstorming activity and the merging of two output reports into one. Finally, the default option to send a copy of the report results to the Library was changed from on to off in order to protect student confidentiality.

Although the response from the alpha testing phase was very positive there was

significant feedback from librarians suggesting the library leverage the idea in other platforms including Android tablets and smartphone devices, and the iPhone. This idea was strongly supported by the student survey findings indicating that these were the most commonly used mobile devices for academic work. While the general interface and functionality would remain the same the developer would need to rewrite the app for the other platforms because the screen resolutions and programming languages are different. In order to fund the programming resource for this phase II of development, the University Library Dean secured additional funds through the University Instructional Innovation Grant.

After the re-development for multi-platform use, small scale in-house usability testing was performed. The purpose of the usability testing was to verify the prototype was ready for distribution to the general student population. Actual members of the undergraduate and graduate student body were formally recruited and scheduled for in-person testing. A small sample totaling eight students was used based upon the research of Nielsen and Landauer (1993) that 85% of usability problems can be identified with five users, after which the same usability problems tend to be repeated. The student sample represented a variety of demographics including:

- International and non-international students

- Students who live on and off campus

- Two freshman, one junior, one sophomore, two seniors, two graduates

Students were observed in small groups of two or three students so that detailed reporting could be achieved. A facilitator who was involved in all planning stages designed, moderated, and took notes during the testing process. The facilitator designed

the test by identifying performance tasks and corresponding authentic scenarios that would be presented to the student (Blakiston, 2015) as illustrated in Appendix A. A variety of iOS and Android mobile devices were tested including the iPhone 6, iPad 3rd Gen (iOS 8.4.1), iPad Air 2 (iOS 9.3), Samsung Galaxy5 Smartphone, and Verizon Ellipse 7 Tablet.

Overall, student reaction to the app was very positive. Comments included "Why hasn't something like this been developed sooner?"; "Can I use this right now?", "To bad I'm graduating and won't be around to use it". Student comments regarding ways in which the app could be improved included:

"On the resources page, the 'websites' button should go to the Google web search page and not Google Scholar. Also, Google scholar should be under Articles in my opinion."

"I expected the research topic I entered on the first screen to pass along to the resources page and automatically list resources on the topic. For instance after entering the topic 'renewable energies' on the first screen and then continuing to the next screen for resources, I click on books but the topic 'renewable energies' is not in the search box."

"The cite tool can create incorrect citations since it does not correct the entry but basically spits out what is entered."

"The links to resources should open in a new window so I can refer back to the app without losing the results in either window."

"When I tried to export my information I got a blank email."

"Send a copy to Librarian" and "Start Over and Clear" functions that were not working properly on my Android phone."

Based on the comments, some changes to the app's functionality were implemented including link modifications, the resource pages opening in a new window, and device specific bugs. Other changes that required more complex programming or further investigation were tabled for future revisions including determining whether there was existing Application Programming Interface (API) code that could integrate a more reliable third party citation tool.

Implementation and Evaluation

Final deployment of the Research Plus™ beta app is expected in late fall of 2016. Appendix B includes screen prints of the app. A "launch" party and marketing campaign will be used to promote the app. Students will also have the option to download the app from Google Play, iTunes, or from the University server to their mobile devices. Because academic instructors play a critical role in the user acceptance of technology, library liaisons will work with faculty on how to promote the app to students and how to integrate it into their class curriculum. Finally, all freshmen will be introduced to the app during a core curriculum course that incorporates information literacy instruction. User feedback will continue to be collected via surveys and focus groups. There are also plans to re-evaluate the app in the context of the 2016 ACRL's Framework for Information Literacy for Higher Education. Future versions will be deployed as needed.

Discussion

There were a number of limitations and lessons learned during this project. First, when dealing with the dynamic nature of technology and student use of it, projects with long development cycles run the risk of becoming obsolete before their completion. As with this case study, the original app was designed for Apple's iPad use only. As

smartphone and Android use became ubiquitous, additional programming efforts were required to re-develop the app for use on multiple platforms. It would have been more time and cost effective to initially design for the larger technology landscape. Also, it became apparent that the development of mobile technologies required specialized personnel and significant funding. In today's economic climate, academic libraries do not have the budgets or resources to continually align with educational technology demands. While the programmer's input was invaluable, the library team was not well versed in app design. Due to the learning curve needed to effective design a mobile app, there were a number of design iterations that slowed the development process. It may be worthwhile to either hire a designer or become knowledgeable in the niche of mobile app design prior to embarking on a similar project. Finally, the Long Island University Libraries, as most libraries must, continues to seek additional funds and grants needed to maintain the app and the level of service and technology expected by students.

Based on these and other implications, the following suggestions may be of value to libraries considering mobile app development:

- Use a goal-driven approach based upon user-centered design (UCD) principles. Libraries should have a distinct vision of the final product based upon what students truly need, not what they think they need. Data collected from student surveys, interviews, and focus groups regarding how they use or would like to use mobile technology and library resources results in effective decision making about app functionality, design, and scope[1].

- Identify the time, personnel, and budgets available for the project's lifecycle upfront to make informed decisions about the app's platform (i.e., iOS, Android),

[1] American Disabilities Act (ADA) compliance standards apply to mobile apps

format (i.e., native, web based, or hybrid), level of customization, and potential use of advanced technologies.

- Due to the dynamic nature of technology and student use of it, consider securing long term resources necessary to develop and maintain an app over time to avoid the risk of obsolescence.

- Errors and lessons learned are least expensive at the early stages of design. Therefore, use a layered design-evaluation cycle at the beginning of the project to avoid cost prohibitive programming and development hours at the end of the project.

- Tap into skilled personnel resources who contribute to a well-designed, effective library app including instructional designers, graphic designers, information technologists, app programmers, as well as, librarians.

- Further manage costs by using the following:
  - Inexpensive, low fidelity app design approaches that may be as simple as pen and paper mock ups of screens and functionality.
  - API code that already exists for mobile apps, including popular databases, citation generators, and library guides rather than duplicating programming efforts.
  - Smaller numbers of users to test the app multiple times. Research shows that the first five testers identify 85% of usability problems. You will want to fix these problems in a redesign and test again rather than funding much larger, less informative usability test (Nielsen and Landauer,1993).

Conclusion

Emerging technologies, including the mobile Internet, continue to disrupt the world in which we live and learn. Academic libraries have led the charge toward cultures of innovation and digital literacy for the express purpose of learning. Rather than repackaging the status quo into a digital format, we must consistently re-evaluate and transform library resources to align with new information seeking behaviors and dynamic educational technologies. It is with much promise that some libraries are actively developing forward thinking applications that integrate location based beacon technology, augmented reality, robotics, and optical character recognition (OCR). This is especially challenging during an economic climate of decreasing higher education resources and funds. Research Plus™ is one more attempt at contributing to a culture of innovation. Future usability studies, ongoing research regarding information seeking behaviors in a mobile learning environment, and a consistent eye on the technology horizon are all critical to the success of the Research Plus™ application, as well as, the development of other apps that support the academic library community.

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