A mobile future for academic libraries

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Abstract
Purpose – Society may be on the verge of a revolutionary phase of mobile device use in higher education generally and in libraries in particular. This paper seeks to address this issue.
Design/methodology/approach – Through an examination of trends and technological developments in the area of mobile devices and a review of the potential of mobile devices, the paper analyzes the potential of mobile devices in academic libraries.
Findings – Most college students own cell phones and laptops and the capabilities of these and other devices are expanding.
Research limitations/implications – Libraries have the opportunity to extend new types of services to users of mobile devices and to develop, license, or otherwise make available scholarly content that is configured for mobile devices. Ideally, libraries will become part of an institutional planning process for the development of services for mobile devices.
Practical implications – The more pervasive use by students of smartphones, the uptake of e-book readers, and the increasing use of mobile devices in some areas of the curriculum all have implications for libraries.
Social implications – Some writers in this area believe that the increased capabilities of mobile devices could lead to new forms of engagement with student learning; this possibility can be embraced by academic libraries that seek to be strong partners in the teaching and learning process of their institution.
Originality/value – The paper synthesizes developments and provides suggestions for the future.

Keywords Mobile communication systems, Academic libraries, Higher education, Information management

Paper type Conceptual paper

Introduction
In the past few decades, some technological changes have appeared gradually and their impact on higher education has been incremental. In other cases, over relatively short periods of time, technological changes, such as the introduction of Web browsers, have had a major, and some would say revolutionary, impact on higher education as well as the broader society. Which will it be for mobile devices? Will their impact be gradual and incremental or sudden and revolutionary? There is a case for both points of view. Since individuals have been using devices such as laptops and mobile phones for decades, one might argue that the impact of the use of mobile devices on peoples’ behavior in general and on higher education in particular has been relatively gradual. On the other hand, as devices with compelling new features emerge and wireless connectivity is almost ubiquitously available, we may be on the verge of a revolutionary phase of mobile device impact on higher education and libraries.

This article will examine trends and developments for mobile devices and will discuss what impact they may have on the future of academic library services. The
article focuses on a few types of mobile devices (particularly smartphones and e-book readers), selected applications for mobile devices, and provides some thoughts on the implications for library information and services.

While many academic libraries are experimenting with various types of reference services for users of mobile devices, fewer are thinking of the potentially dramatic changes that the uptake of devices with sophisticated capabilities may have on their user community and more specifically on the use of digital information resources. Keeping abreast of this rapidly changing arena can be challenging, and this article attempts to provide an overview of developments of significance to academic libraries.

The 2010 edition of the annual and influential Horizon Report (New Media Consortium, 2010), sponsored by the New Media Consortium and the EDUCAUSE Learning Initiative, came out at the time of the writing of this article. Mobile computing was the first trend they identified, with an adoption timeframe of one year or less. The 2010 report marks the fourth appearance of mobile computing on this annual list of key technology trends for higher education. The report is compiled through a process to first identify a wide array of current and emerging technologies, which are then ranked in importance by an international advisory board using a modified Delphi process[1]. Therefore, many individuals around the world who are involved in developing, using, and monitoring technologies in higher education believe that mobile computing has great significance for our education institutions. Last year’s report commented, “Over the past several years, we have watched mobiles become ever more capable and more common. The rapid pace of innovation in this arena continues to increase the potential of these little devices, challenging our ideas of how they should be used and presenting additional options with each new generation of mobiles” (New Media Consortium, 2009, p. 9).

The students that we serve in higher education often own a variety of mobile devices, including laptop computers, cell phones, and MP3 players or other audio player devices. In 2008, the annual EDUCAUSE survey of undergraduates’ use of technology stopped asking about student ownership of cell phones because they are so ubiquitous. However, they have been asking about ownership of Internet-capable handheld devices for the past few years so that they can monitor this emerging trend. In the 2009 survey, about half of students reported owning an Internet capable handheld device and around 12 percent said they plan to purchase one in the next year (Smith et al., 2009, p. 87). Many students do not use the internet capabilities of their devices at present, primarily due to cost considerations. In order to better understand how students might want to use internet-capable cell phones, the survey asked this year about potential uses. Only 14.8 percent selected “library services” as one of the top three institutional services they would most likely use from a smartphone (Smith et al., 2009, p. 102). While librarians might feel discouraged by this number, I think it is likely that students do not yet understand the full range of library content and services that they might potentially reach via a smartphone.

**Devices**

Mobile devices include laptops, netbooks, notebook computers, cell phones, audio players such as MP3 players, cameras, and other items. This article will focus on smartphones (and assumes the inclusion of the iPod Touch, which has the features of a smartphone minus traditional telephone capabilities) and on e-book readers. The array
of names used for telephone handheld devices can be confusing, e.g. cell phone, mobile phone, handheld device, smartphone, etc. The use of the term “smartphone” has become popular to identify devices that have Internet capability and functionalities that are similar to computers, although there is no industry-wide standard definition of the term (Wikipedia, 2009). The capabilities and uses of smartphones have gone well beyond the simple cell phones of 20 years ago. When Americans first bought cell phones, they used them for communication on-the-go and the communication was solely via voice phone calls. While Europeans, Asians, and Africans have long used their mobile phones for text messaging, many Americans were much slower to move into this different mode of communication via the phone device. Only when the service became more predictably affordable and teenagers in households quickly adopted the mode of communication did texting begin to take off in the US. The third way that individuals use some cell phones – smartphones – for communication is e-mail; internet-capable models such as Blackberries and iPhones make checking and writing e-mail from many venues possible and more convenient than carrying a laptop computer in all travel situations. In a period of around twenty years, mobile phone devices have become much more versatile, allowing communication between and among individuals in at least three ways that are now considered mainstream, e.g. voice, texting, and e-mail. In addition, other modes of communication, such as the use of Twitter or communicating updates on a Facebook page, are becoming popular activities on cell phones.

While this range of communication capabilities has significance for libraries, especially in the provision of reference service, it is possible that it will actually be the use of smartphones for reading, watching, listening to, and producing digital content that will have the most impact on libraries. The lightning pace of development of new applications, or apps, for smartphones such as the iPhone, is enhancing the ability to use a wide range of information resources in various formats on handheld devices. At MIT, with the introduction of the iPhone in spring, 2007, they found that the functionalities “spurred mobile web access on the MIT campus, especially among students. For many users, the mobile device was no longer just a telephone; rather, it was quickly evolving into a handheld information retrieval device (Albrecht and Pirani, 2009, p. 6).”

The 2010 Horizon Report states, “Third party applications for all kinds of tasks can now be developed once and ported to a variety of mobile platforms... It is these applications that are making mobiles such an indispensable part of our lives. Tools for study, productivity, task management, and more have been integrated into a single device that we grab along with car keys and wallet (New Media Consortium, 2010).”

It is truly remarkable to consider the kinds of activities one can engage in today using a single handheld device, including:

- Voice and video calling.
- Sending and receiving e-mail.
- SMS text messaging.
- Searching the internet.
- Searching databases of scholarly information.
- Organizing citations.
In effect, the smartphone can provide capabilities that are very similar to laptop computers.

One of the questions for the future is whether individuals will prefer to own one device that has many functions but may not perform all of them well or own a number of devices. It is likely that individuals will vary in their reliance on a smartphone for various functions. For example, a serious photographer will likely own and use a separate camera, and someone who writes lengthy documents (e.g. college students and faculty) will likely continue to have some type of computer that has a larger monitor and keyboard. Another question is what other types of devices will emerge and win popularity. Roy Tennant (2009) reports on prototype wearable technology devices that include cameras that can record information and use it to find information related to an item and then project that information onto a surface. A library user could aim the camera to a code on a book in the stacks, software could connect the code to information or reviews about the book, and then project that information onto a surface. We may see more use of codes on labels, similar to bar codes that will link physical objects to information on the internet. Lorcan Dempsey (2009) reports that the University of Bath in the UK is already using codes – specifically a type called QR codes (EDUCAUSE Learning Initiative, 2009), in its catalog. A user can scan the code into his or her phone and go into the stacks to find it with the call number readily available on the phone. In addition, the user can save the information provided by the code to begin compiling a bibliography.

Libraries have traditionally served as a public good, providing resources and services to all, including those who could not afford to purchase some types of content or services on their own. While it is unlikely that libraries will provide smartphones, either for use within the library or for loan because most would agree that provision of telephone service is outside the scope of library service, many libraries are already loaning a wide variety of mobile devices. For example, laptops are one type of mobile device, and many academic libraries have laptop loan programs. Some libraries also loan cameras, video cameras, MP3 or similar audio player devices, headphones, etc. A small number of libraries are loaning Internet-capable devices such as the iPod Touch. It is also possible that more departments or institutions will begin to require that students have a mobile device that can be used for a variety of purposes in their coursework. The library will want to be part of campus discussions on such decisions so that they can ensure that library content and services will be able to interoperate with the device and platform selected (Lippincott, 2010).

The proliferation of mobile devices will have implications for library space configuration and services. For example, libraries may want to offer large monitors and
keyboards that students can use with their personal mobile devices. They may want to install lockers with electrical outlets so that students can recharge their devices while they go to class or take a break. And, they may want to change the ratio of desktop computers to open tables as more students rely on their own devices. Currently, many students who own laptops do not bring them to campus, but students almost always bring their cell phones wherever they go. In fact, this is true of people of all ages and nationalities. In an international survey, three quarters of respondents said they never leave home without their mobile phones. A market researcher affiliated with the survey commented, “...the mobile is part remote control, part security blanket. Mobiles give us safety, security and instant access to information. They are the number one tool of communication for us ... They are our connections to our lives (In:fact, 2009).” As smartphones become our users’ key information devices, libraries will want to have a significant presence in offering content and services suitable for those devices.

E-books and e-book readers
E-books, or books in digital form, may be purchased or freely downloaded in formats that will enable individuals to read them on standard computers, or they may be configured in proprietary formats for particular devices. Most academic libraries already offer e-book content that users can download and read on standard computers. Amazon’s Kindle device and SONY’s e-book reader will soon be joined by the nook from Barnes and Noble; these are purpose-specific handheld mobile devices. These devices are linked to content purchase programs that limit what may be put on the device and in some cases, what may be shared with others. Both companies that produce e-books for computers and companies that produce e-books for their proprietary systems are now offering or promising to offer content configured for Smartphones.

Some academic libraries are already experimenting with lending e-book readers loaded with content or providing specific content to fulfill interlibrary loan requests on an e-book reader. It is difficult to predict whether such devices will grow in popularity or will cede their market share to smartphones. The larger screen makes these devices more acceptable for some users to read online materials they might have formerly preferred to have in print. However, the current limited functionality, for example inability or poor capability for annotation or note taking, has made them less acceptable in some areas of higher education, particularly as textbook substitutes.

The app for smartphones, released by Eucalyptus (Eucalyptus, 2009) in fall, 2009 may be a harbinger of some trends. First, it has a page-turning function that gives the feeling that one has when turning the pages of a physical book; readers may like this feature. Second, it makes available books from Project Gutenberg, one of the earliest projects to digitize books and make them available to the public; all books are out of copyright. The Eucalyptus homepage even advertises one of its functions as “Search like a librarian,” a positive attribute of their system. The availability of a large collection of digitized books, Project Gutenberg, also brings to mind the potential impact that the Google Book Settlement may have on the availability of e-book content. Will collections of content be marketed through the e-book reader producers? Will the content, either public domain or in-copyright, be repackaged in collections and made available to libraries or the general public in formats for various devices or with enhanced functionalities for particular devices?
E-books may be seen as a mechanism to promote environmentally friendly practices. Princeton University has launched a small experiment in which around 50 students enrolled in three courses have been given Kindles in order to determine whether the use of the device reduces the amount of printing by students (Cliatt, 2009). The university estimates that 10 million pages were printed by students in computer labs in a year, and they believe that much of that printing was of materials on electronic reserve from the library. The experiment will help the university determine whether e-book readers reduce the cost of printing and conserve resources. While the experiment was developed primarily for financial and environmental reasons, at least one of the professors whose course is included is also interested in whether the e-book reader can enhance student learning. The library, computer center, and faculty are collaborating on this project.

Making payments via devices
Another trend that may have an impact on libraries and other areas in higher education is the capability to use mobile phones for payments for goods and services. In particular, there is an emergence of applications for contactless mobile payments that use radio frequency identification technology (RFID) to enable mobile subscribers to make payment by waving their device directly in front of a terminal or automated device, such as a vending machine. Globally, the payments made via these systems have exploded, from $3 billion in 2007 to $10 billion in 2009 (Ezell, 2009). Libraries will want to keep abreast of any campus initiatives to move to this type of technology for vending machines, printers, etc. so that their needs can be taken into account. This will be yet one more activity that mobile phones may be used for by our community.

Mobile devices, students, and learning
As librarians work with students as part of information literacy classes, at service desks, and in cyberspace, it is important to realize that for students, the mobile device will increasingly become an instrument for creation of digital content, and not just a device for access to content. Students can use smartphones to create short videos, to type a blog entry for a class assignment, to “tweet” in response to a question posed by a professor or to create a group poem, or to take photos or record audio to embed in a Powerpoint presentation or text document. Some of this content creation may be in connection with independent assignments and some may be developed as part of coordinated class field work. In describing the potential use of mobile devices for elementary students on field trips, the researchers wrote, “Mobile devices can capture authentic educational multimedia data, in context, that have previously been unavailable. Data captured in context allows for sharing and remembering experiences upon return to the classroom . . . Using multiple forms of data capture, for example, supporting photographs with audio recordings and student notes can assist students and teachers in seeing the whole picture of a learning experience (Hey et al., 2007, p. 447).” Librarians can teach students about the availability of access to information from their mobile devices in the field, to support research. They can assist students in learning about software to organize their information on their smartphones or how to develop mash-ups using geographic applications and other information resources. They can support students’ creative work with mobile devices. This requires an awareness of innovative assignments, outreach to faculty, and the skills to teach these technologies.
In one application developed for students with laptops and targeted for science classes, LectureTools allows students more functionality than a typical personal response system or “clicker.” The professor can ask students questions beyond multiple-choice, enabling them to work with images or respond to more complex questions. In addition, a student has developed some applications for LectureTools, including one that enables students to connect with others, finding which students may live in the same dorm or share particular interests. While LectureTools is employed on laptop computers, these types of functionalities may be adapted for smartphones in future. The incorporation of active learning functions along with social networking capabilities makes this a particularly interesting tool. One can imagine librarians incorporating the use of such tools in information literacy classes.

Another model is the Hotseat application, which allows students to use either their laptop or their mobile phone to comment or ask questions during class. Faculty involved in pilot classes using Hotseat have found that the application encourages participation by more students when controversial issues are discussed, enables students to share information among themselves and to set up ad-hoc study groups, and encourages more interaction between professor and students (McCrea, 2009).

As more and more students buy internet-capable phones and when phone plans that include internet access become more affordable, students will seek streamlined ways to locate the kinds of information they need. Campus information portals for mobile devices are one emerging model, and some academic libraries are already represented in these venues. Another model will be the development of applications, sometimes by members of the university community, including students. At Stanford University, two undergraduates along with friends built an iPhone app “iStanford” that provides some of the features of standard university portals, e.g. access to the course catalog (Quittner, 2009). In addition, they are releasing features that will allow students to access grades, add and drop courses, and perform other activities usually restricted to the secure campus network. The students have worked with the Stanford information technology unit to integrate, with university approval, their application into core computer systems at Stanford.

Librarians should seek faculty on their campuses who are developing or using innovative tools like those described here and begin experimenting with them in partnership with faculty and students. Mobile devices can offer more opportunities for students to be actively engaged in their learning and to fully participate in the social nature of learning. Librarians might encourage, through contests or other means, student development of apps that make library content and services more useful for specific groups of users.

**Conclusion**

It is possible that the uptake of the use of mobile devices for access to and creation of content will be uneven and slower than indicated by some of the trends highlighted in this article. Slightly under half of respondents to the ECAR survey agreed or strongly agreed that in the next three years they would do many things on a smartphone or similar mobile device that they currently do on a laptop or desktop computer (Smith et al., 2009). On the other hand, almost three-quarters replied that they anticipated that their use of the internet from a handheld device would increase or greatly increase during that same time period (Smith et al., 2009). The data suggest that student...
perception of their future use of the internet and other features or activities from their phone depended at least somewhat on their current ownership or anticipated ownership of an internet-capable device. Some studies, like the ECAR report, characterize individual’s uptake of devices and applications according to a schema of user types, such as “power users” and “occasional users.” While I think such categorizations may help understand user behavior in some instances, I also believe that it is important to correlate student use of devices and applications with their major area of study. For example, some departments or colleges in professional areas such as health sciences, business, or journalism may integrate the use of mobile devices and applications into the curriculum more quickly than the overall curriculum (Lippincott, 2010).

It is also important for libraries to internalize some of the lessons learned by the technology industry. Academic libraries have the reputation of thinking long and hard, debating all of the fine points, before deciding to implement a new technology or technology-based service, sometimes missing the peak of the trend (Jacobs, 2009). In describing the great popularity of the MP3 format for digital music, which is inferior in sound quality to other formats, Senior Editor of Wired Magazine Robert Capps (2009) writes that we need to understand the lesson to be learned, that “the qualities we value have simply changed. And the change is so profound that the old measures have almost lost their meaning . . . The attributes that now matter most all fall under the rubric of accessibility . . . we're now focused on three things: ease of use, continuous availability, and low price.” The challenge for academic libraries is to create compelling information services and to make digital content available in a way that our user community will find not only acceptable, but tailored to their needs.

In an interview, John Ittelson of California State University – Monterey Bay stated, “The most important challenge for mobile learning is whether we can embrace the technology as a genuinely new form of engagement with students” (Grush, 2009, p. 26). Will libraries move quickly to implement strategies for mobile devices, moving beyond pilot projects, such as SMS text message in reference, that address only one segment of user needs? Will the library be perceived as less and less central to the academy’s content needs? Will the library values of stewardship of cultural heritage, provision of fee-less access to information, and education of informed information users survive in the wake of personal ownership and management of information? The mobile revolution offers both challenges and opportunities for academic libraries.

Note
1. I was a member of this advisory board for the first time for the compilation of the 2010 report.

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