How Technology is Changing the Way Users Access Libraries

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ABSTRACT

Libraries in the United States are undergoing technological changes that are being driven mainly by changes in user demands. One major change is in how users access the library and its resources through those modern technologies. Traditionally, public libraries have offered fair and equal access to all members of a community. But the changes in technology reveal that barriers to access still exist for some users. Those with low incomes, the elderly and minority groups are being left behind. In this paper, a review of the current library literature reveals different approaches to this "digital divide," (Smith, 2010) as well as trends in the ways public libraries are addressing barriers through the use of e-readers and tablets, smart phones and open source software. The potential impact for library users of emerging technologies, such as creative spaces and 3-D printing, will be considered.

Introduction

Libraries in the United States are undergoing technological changes that are being driven mainly by changes in user demands. One major change is in how users access the library and its resources through those modern technologies. Traditionally, public libraries have offered fair and equal access to all members of a community. But the changes in technology reveal that barriers to access still exist for some users. Those with low incomes, the elderly and minority groups are being left behind. In this paper, a review of the current library literature reveals different approaches to this "digital divide" (Smith, 2010), as well as trends in the ways public libraries are addressing barriers through the use of e-readers and tablets, smart phones and open source software. The potential impact for library users of emerging technologies, such as creative spaces and 3-D printing, will be considered.

Libraries exist so users may access information. The mission statement of the American Library Association states, "To provide leadership for the development, promotion, and improvement of library and information services and the profession of librarianship in order to enhance learning and ensure access to information to all" (American Library Association, 2013, para. 1). The mission statement of the American Library Association is from the perspective of the librarians; the statement reflects the ethics of providing free, unbiased information to all users. In 1964 the International Federation of Library Associations concluded that computers could be used in the libraries (Dech, 2012).

Literature Review

Libraries and the "Digital Divide"

There are many ways in which people experience the digital divide. One of the demographic groups the digital divide affects most is the elderly over 65 (West, 2011). The digital divide also affects the low income populations, working class, African Americans, Native Americans, Hispanic Americans and users who live in rural areas (Higgins, 2013). In addition to the before mentioned demographics are children of single parented households and adults who did not finish high school (Kidd, 2009). Users who have low literacy levels and the differently-abled (a term used to describe physical or mental impairments) are also deeply affected by the "digital divide" (Cullen, 2003). Users who are from a different country and do not speak English are also affected by the "digital divide" (Cullen, 2003). Libraries served as a beacon for users learning how to use technology along with providing users access to Internet connectivity. West (2011) states, "That job has become the task, some say the unfunded mandate, of America's public libraries" (p. xxv). Some users may not understand how technology may help them to access informational wealth: However the public libraries with their free computer labs are there to help when users do decide to join the "knowledge economy" (Cullen, 2003). Other users may want to learn how to use new technologies and applications, but cannot afford to have Internet at home, much less a desktop computer, laptop or tablet. For the ready to learn users, the library serves as a bridge for the technology gap so they may learn and continually build their computer skills.

Libraries do not entirely close the digital divide. However, libraries have brought users close to lessening the digital gap by offering computer labs outfitted with Internet access (West, 2011). Some of the technologies provided by libraries include Internet access through computer labs, wireless access for user's personal devices such as smart phones, and laptops. One significant way libraries may help close the divide is by lending out e-reader devices and tablets

for users for a set period of time, and instructing users on how to send email or use the Internet (Dech, 2012). Libraries also may have computer classes that help users understand how to operate a computer, such as how to turn a computer on (West, 2011). Libraries have set budgets, so purchasing iPads, tablets, and e-readers may not be feasible. For low-income households, libraries are indispensable and completely necessary for closing the scholarly achievement and technology gap. Cullen (2003) states that, "libraries, with their commitment to freedom of access to information, and promotion of life-long learning have an important role to play in closing the digital divide" (p. 256).

West (2011) found a very large portion of users get access to computers at their public libraries, quoting an American Library Association statistic that indicated "71% of libraries report that they are the only source of free access to computers and the Internet in their communities" (p. xxxix). According to Dech (2012), one financial hurdle the library is bridging is that, "During these hard economic times, some patrons simply cannot afford Internet access in their homes, and use the computers at the library to keep connected with family and friends" (p.59). Likewise, Kidd (2009) characterizes the digital divide in this manner:

> Regardless of the social economical, or racial characteristics one attributes to the Digital Divide, it is clear that there are two distinct groups that have emerged as a result of the information age: those who have the ability to access information and technology at will and those who do not have the means, access, or support to acquire and utilize information and Technology (p. 90).

User Access to Library Technology

Libraries have been providing users with Internet access beginning in the 1990's (Bertot, 2009). Bertot (2009) illustrates the benefits of public access technology in libraries as, "public access to the internet through public libraries provides a number of community benefits to different populations within served communities" (Bertot, 2009, p. 81). A public access technology, for example, included the public library's Internet-enabled computer lab. Public libraries offered a variety of technology-based services, including "online databases, digital reference, downloadable audio and video, and others" (Bertot, 2009, p. 83). Libraries also offered services such as, "access to homework resources, video content audio content and digitized collections." (Bertot, 2009, p. 82) Libraries also now offer wireless fidelity access (WiFi) for users (Bertot, 2009). There are many methods by which libraries have provided user access to technology, and new technologies are carefully examined within this context before being added to the array.

Basic Library Services

Users may sign up for library cards before they check out print or digital materials. All users have a barcode assigned to them as they sign up for a library card. These accounts allow patrons to check out books, as well as make requests for new items such as DVD's, CD's, language kits, printed materials and e-resources. A user may use the barcode on the back of the card along with a password to request items either through the library's online catalogue or over the phone. One of the ways users' access libraries with the current technology is by viewing the library websites to request materials to be picked up at a later time. Users may also check their online accounts to see when materials are due and what materials are waiting for them at their libraries. If a person does not have access to a computer at home, they can in many cases opt for a phone call reminder instead of an email reminder where available. Those users without home Internet access can come to the library to use the computer labs to gain access to the Internet and

set up personal email accounts through cloud computing services such as Google mail (Chen, et al., 2012).

Library Website Services

Library websites allow users to see what is going on at their library. From the website users might view and sign up for classes, or view newly added print and digital materials. They may also be able to view full text or even 'check out' digital materials from a remote location. Libraries have computer labs for all users, many of whom do not have access to the Internet from home. Patrons may come in and use the library computers to connect to the Internet. Among the most popular uses of computer labs are social networking, research, Internet browsing, and job searching (West, 2011). Some users also need to access government services through the libraries' computer lab (West, 2011). Libraries provide access to frequently requested government materials such as tax forms, and may create web pages that provide direct links to information about local municipal and other governmental services for ease of user. Many libraries offer access to the internet via personal devices through free wireless fidelity (Wi-Fi) to the users within the vicinity (Bertot, McDermott, Lincoln, Real & Peterson, 2012), as for example, the libraries within the Duluth Public Library system. Many libraries are accessible at any time online through their web pages, along with providing users access to free broadband while the user is within the facility, and many e-readers and tablets will have built-in wireless fidelity (Bertot, et al., 2012).

Public Access to the Cloud

Users are embracing cloud computing such as email, and open source networks and software are readily being adopted by libraries. Yet, some libraries are unable to implement cloud computing because of limited bandwidth (Breeding, 2012). Two widely utilized examples of cloud computing are email of any kind and Facebook (Kroski, 2013). Libraries are also using cloud computing to store data and to provide outreach thorough social media sites such as a library Facebook page (Kroski, 2013). Libraries are utilizing Facebook pages to promote their services and create public awareness of services and classes offered therein.

Remote Public Access for Users

Users may also access the library's collection from any place that provides wireless connections. Users have embraced the mobile devices and they are now used more than personal computers (Breeding, 2012). With the new and current technologies it is important for libraries to remain, "equally, and equitably accessible to all" (American Library Association, 2004; Richard, Koufogiannakis & Ryan, 2009). Women and minorities are more likely to connect to a library with a mobile device, such as a smart phone (Zickuhr, Rainie, & Duggan, 2012). According to Purcell (2010), "half of all African-American adults in the US (48%) have used their smart phone to access the internet, compared with 40% of Hispanic adults and 31% of white adults (slide 11). Young people are also accessing the Internet with smart phones in September of 2009, 75% of 12 to 17 years olds used smart phones (Purcell, 2010). According to the data Purcell (2010) gathered, the majority of young people from low-income households did use their smart phones to access the Internet (slide 11). Purcell stated (2010) that among household earns less than $30,000, 41% of teens within those households will likely access the Internet from their smart phones. Out of all of the devices a user has to access the Internet, smart phones are the number one device of all users across the board (Purcell, 2010). The main

attraction and functionality of a smart phone is the ability to access information whenever the user needs it (Purcell, 2010).

Public access technology does lessen the digital divide for many users aware of the public library services. Public access technology includes Internet enabled public computer labs, such as those found in Public and Academic Libraries. Users on average only have one hour at a time to use the Internet in the computer labs. They have to sign up for each hour session, and if the user traffic is high some will have to wait, and others may not get a chance to use the computers if there are many users in line ahead of them. Libraries also allow users to print materials from the public access computers for a small fee (Bertot, 2009). For many public access computer labs, libraries have adopted management software that helps manage users set time allowed for computer use, and frees up the librarians time for helping users with other tasks (Bertot, 2009). According to Bertot (2009), "82.5 percent of public libraries report that they do not have and adequate number of public-access computers some or all of the time and have resorted to time limits and wireless access to extend public-access services" (p. 82).

Many libraries provide classes for users to learn how to use technology (Bertot, 2009). In fact, 83.4 percent of libraries provided users training in how to navigate and utilize technology (Bertot, 2009). Seventy-four percent of libraries helped users to access e-government online applications (Bertot, 2009). Over half of the public libraries reported e-book access (Bertot, 2009). According to an independent project report supported by the Pew Research Center, 81% of parents said it was very important for libraries to offer "free access to computers and the internet" (Miller, Zickuhr, Rainie & Purcell, 2013, p. 50). While print books remain the dominant format for users, many users are embracing electronic source materials (Zickuhr, Rainie, & Purcell, 2013). The same report showed that 65% of respondents "want to see libraries offer a broader selection of e-books" (Zickuhr, Ranie & Purcell, 2013, p. 54). Computer labs are indispensable to public libraries, and because of the high volume of users that many see, libraries need to outfit their computer labs with management software that will enable librarians to have more time to assist users with other needs. Software, such as self-service kiosks, may also free up librarians' time to assist users who may need help while leaving the checkout services to the automated machines.

Users and Self-Service Applications

Self-service kiosks are one of the technologies that many libraries are embracing for users (Enis, 2012). According the Enis (2012), one type of kiosk called "smartserve 400™," allows users to, "buy a bus pass, register to vote, schedule a tee-time at a local public golf course, or pay local taxes, bills, and traffic tickets" (p. 33). The kiosks free up librarians' time to answer questions and help users find the materials they need, while the kiosk handles the checkout traffic (Enis, 2012). Aside from the self-service technology, users are buying and utilizing personal computing devices such as e-readers, tablets, and smart phones.

Users and E-Readers

E-readers are increasing in popularity with users because of their small size, minimal weight and portability (Praino, 2012). Generally, e-readers do not use a backlight. They use the light in the surrounding area or simple book light, which makes reading at night more of a challenge; however this leads to less eye strain (Praino, 2012). E-readers have additional features for note taking, a book mark feature, and the ability to highlight passages (Braun, 2012). E-readers use an electrophoretic display called "E ink" (Praino, 2012). The average battery life spans several weeks to a month (Praino, 2012). The price of an e-reader ranges from $80 dollars

to $380 dollars (Praino, 2012). One difference between the Kindle™ and Nook™ are the accessibility to users with print impairments (Enis, 2013). Nook™ e-readers support a form of proprietary electronic publishing called 'EPUB.' The Nook's EPUB 3™ format provides a new format version that changes text to speech for users with vision impairments (Enis, 2013). In contrast, Amazon's Kindle Fire™ has built-in voice guide navigation and adjustable font sizes (Enis, 2013). In addition, both e-readers meet the consumer needs for light weight and portability, making them ideal for accessing library collections. While studies showed that many consumers own their own devices, libraries are purchasing equipment that may be checked out by users who do not own such devices (Ranie, 2012). Increasingly, however, library users want not only the ability to read on-screen, but also to employ multi-dimensional features available on more complex tools, such as tablets.

Multifunctional Computing

A tablet is a multi-functional device that performs more than one task, such as Internet browsing capabilities, streaming movies, and down-loading e-books (Praino, 2012). Tablets are very ergonomic, lightweight and portable, with such generic features as an LCD screen and internal keyboard with touch interface, as well as a backlight feature and built-in wireless fidelity (Wi-Fi) (Praino, 2012). The average battery life for a tablet is 6 to 10 hours, and the price range for tablets varies from $130 to over $1,000 dollars, depending on the amount of features, size and quality (Praino, 2012). Users who want to read an e-book or browse the web would use tablets, although many newer e-readers now have the ability to browse the web.

Users may also access library materials using a device called a smart phone. Apple released their version of a smart phone, the iPhone™, in 2007 (Haefele, 2011). The release of Apple's smart phone brought a new dawn of mobile web access (Haefele, 2011). Other examples of smart phones include Android™ and BlackBerry™, which are all web enabled (Haefele, 2011). Over 50% of all library users report they have and use smart phones (Haefele, 2011). Smart phones combine calling features with web browsing. They are small and lightweight, with LCD screens. In a sense they are mini-computers capable of connecting to the Internet through their built-in wireless access, making phone calls, and text messaging.

Libraries are starting to acquire more electronic materials for users. Devices such as e-readers, smart phones, tablets and home computers are allowing users to read and access more electronic materials. With the growing popularity of smart phones, tablets and e-readers, the demand for e-books has blossomed. According to Duncan (2011), the purchase of e-books will rise to around 50% of all books purchased by the year 2020 (p. 47). Libraries are aware of the increasing popularity of the e-books and e-audiobooks, and are doing what they can to keep up with user demands.

Libraries are now purchasing e-readers, and in some instances tablets, for circulation. Many libraries offer e-readers for users to borrow, which may then be loaded with e-books from the library catalog. The demand for e-books and e-audiobooks is going up; this demand will continue to rise as long as costs for the devices such as e-readers and tablets are driven down by competition between technology companies, in conjunction with the increasing capabilities of the devices (Duncan, 2010). However, for libraries the cost of e-books may be something of a hindrance, as some publishers required a library to renew or repurchase their subscription for popular items after 26 checkouts (Duncan, 2011). This renewal fee may not make much financial sense for small libraries.

According to an independent study funded by the PEW charitable trusts entitled *Parents, Children, Libraries and Reading*, families with children throughout various socioeconomic

groups are readily embracing tablets and technology (Miller, Zickuhr, Rainie & Purcell, 2013). Children are growing up in the information technology era, and libraries have not failed to notice these trends. Users are increasingly using digital media and accessing digital materials through the libraries, and the study reflects this growth. The study found that parents of young children report are more likely to use all library services than other adults across all socio-economic groups. The browsing and information retrieval habit of many users begs the question of how our increasingly digital society will continue to afford and support its reliance on open access.

Open Access

Open access refers to the ability of users to browse the Internet and find and view subscription-based publications for free. Some libraries embrace open access journal databases such as those available via the *Public Knowledge Project*. (Richard, Koufogiannakis & Ryan, 2009). One issue libraries must address revolves around the financial practicality of open access. For most libraries, open access helps the budgets and saves money; however, open access in not entirely free. While cheaper than subscription databases, there are still costs to the library, and many publications that users want to view are not available through open access. Velarde (2013) makes a valid and important point regarding the cost of open access: "of course, providing access had never been "free" – someone else, unseen, had been footing the bill on the user's behalf." (p. 38) According to Richard, Koufogiannakis & Ryan (2009), published research should be made readily open and accessible to all. The movement towards open access, spearheaded by the way users have embraced the Internet expecting to find exactly what they need, has begun to change the publishing industry through direct, one-off purchasing. One example of open access with an upfront cost attached is iTunes™ store. There is a price attached to the iTunes™ store; however, there are some items that are free to download. This service is cloud-based and relies on users to have an account password, and to make purchases with a credit card. Open access has changed the way users access a variety of information.

Assistive Technologies

Libraries ensure that all users have access to their materials, including assisted access for users with hearing, physical, sight, and learning impairments. There are many types of technology libraries employ to ensure that all users may access the materials and content they require. As part of its code of ethics as expressed in the Library Bill of Rights, the American Library Association (ALA) professes specific commitment to provide service to persons with disabilities, as interpreted by the ALA Council in 2009:

> "The First Amendment to the U.S. Constitution mandates the right of all persons to free expression and the corollary right to receive the constitutionally protected expression of others. A person's right to use the library should not be denied or abridged because of disabilities. The library has the responsibility to provide materials "for the interest, information, and enlightenment of all people of the community the library serves" (para. 2).

Libraries seek to provide assistive technologies for differently-abled users with a variety of impairments that prohibit them accessing or creating their own information. For example, users with visual impairments may use voice-assisted technology. Libraries must provide digital access to all users, including the users whom are differently-abled. In this digital age everything must be made accessible for all users (Enis, 2013). Users who have hearing impairments should

have access to materials that accommodate them, such as sign language materials. An example of friendly personal computing devices for the visually impaired are incorporated into Apple's products. Such devices such as iPods, iPads, and iMacs have a built-in feature called "voice over", which allows a user to employ their voice to navigate around their personal computing device (Junus & Booth, 2012). It is important to note, however, that not all personal computing devices have equally user-friendly applications, and not all libraries have Apple products in their public computer labs, so use of the voice-over application is limited. The decision in regards to purchasing these devices is then left up to the users' discretion.

Libraries have many options for different types of assistive technology, to make the library accessible to all users. The Assistive Technology Act of 1998 was enacted to provide people with disabilities universal access to jobs, public spaces, that includes libraries (Guder & Booth, 2012). According to the Pew Research Center, over half of the differently-abled users access the Internet (Guder & Booth, 2012). Screen reading technology is for users who have sight impairments to browse or use electronic materials, while having the content of the materials read aloud to them by the software program or enlarging text (Guder & Booth, 2012). Some of the technologies available for disabled users include screen reading technology, magnifying technology, literacy software and hardware, speech recognition software, and a variety of peripheral devices (Guder & Booth, 2012). According to Enis (2013) "Apple's iPad™ is currently the gold standard for accessible e-readers, featuring gesture-based "voice over" screen reading in 36 languages, text to speech, zoom functions and compatibility with multiple hardware and software products designed for special needs" (p. 32-33). An example of magnifying technology would be Bierley Electronic Magnifiers™, which enable a user to adjust the text they are reading on a computer or printed material to any size (Guder & Booth, 2012). Literacy software and hardware, according to Guder & Booth (2012), would help with tasks associated with reading and writing. Programs particularly recommended for library use are the Kurzweil 1000™ and 3000™ (Guder & Booth, 2012). This software allows users with reading and writing impairments to have text read aloud to them while they follow along.

Users who have MP3 players may save a text file to a MP3 player on their personal devices (Guder & Booth, 2012). Speech recognition software can be found in all iPads™, iPods™, and Macs™. Braille embossers allow text from a computer to be printed out in Braille (Guder & Booth, 2012). Peripheral devices such as speakers, headphones, and various mouse options are also available (Guder & Booth, 2012). Along with the assistive technology, libraries may designate a workspace to accommodate differently-abled users either integrated into or set apart from the general computer lab.

Conclusion and Future Studies

Future Trends

Users expect 24/7 library websites and database access. Libraries are rising to meet the challenges of these demands by embracing technology through cloud computing and open source software, and free wireless fidelity (Wi-Fi) connections while at the library. Users have come to depend on having access to computer labs to connect to the Internet or request an item in print or electronic form from the comfort of their homes. Portions of the user population have yet to catch up on using technology, and many do so through accessing technology through the library computer labs. Many of these users fall into "the digital divide" (West, 2011). Libraries must also continue to keep up with technologies available for users who have disabilities, and provide

services accordingly. Libraries are so far meeting these challenges, and the users are benefitting from the innovation and technology available at their local libraries.

Libraries are not alone in bridging the digital divide. There are private owned companies are taking drastic steps to close the digital divide. According to Mendoza and Perry (2013), "Google began launching Internet-beaming balloons" (para. 1). Google is launching these balloons over New Zealand as a trial to see if it is practical to bridge the digital divide for 4.8 billion people who do not have Internet access by providing Internet access in truly remote locations, or during crises (Mendoza & Perry, 2013). Google Internet service will not be free, yet the receivers will be cheaper than a complete installation of cable that is currently needed for provision of such service (Mendoza & Perry, 2013). However, there are worries, as addressed by communications professor Patrick Murphy, who believes that this will increase over-consumption of products and further degrade the Earth's current environmental state (Murphy & Perry, 2013). Murphy argues that Google would stand to connect more users of the Internet, along with increasing their business (Mendoza & Perry, 2013). The balloons look like large floating parachutes filled with helium, and fitted with internet capable hardware that beams signals bounced up to the receivers on the balloons back down to receivers on Earth. The balloons are meant to float up to the stratosphere and orbit the globe, giving billions access to the Internet. One reason for launching this lofty goal is to bridge the digital divide worldwide, and bypass the costly intense labor associated with installing Internet cables in hard-to-reach areas and sparse communities, mainly in Africa and Southeast Asia (Mendoza & Perry, 2013).

Future trends for libraries include more and more dependence on mobile web applications, as mobile devices continue to increase among users (Haefele, 2012). Cloud computing options such as social networking, and email are also being embraced by more users. More users may decide to purchase their own personal devices when the prices drop due to increased competition between companies. The format of the Internet is driving the changes, as many users become accustomed to cloud computing and open source services. Users want information that is readily available, as well as free access to that information. Future trends show that as e-books and e-audiobooks use increase, so will the library collections to meet the user demands. But these trends are only the beginning.

The most recent trend in library technology is the adoption of creative spaces, a completely new concept for libraries. Creative spaces (also variously called hacker spaces, maker spaces, and entrepreneurial spaces) are spaces in the library where users convene to share ideas and create art (Britton, 2012). Britton (2012) explained the space as,

> A Maker space™ refers to people coming together to create and share resources, knowledge, and "stuff." There are a number of freestanding and school-based Maker spaces™ nationwide, and several forward-thinking libraries have started developing them for their communities (p. 20).

These spaces are created to foster the imagination and provide the ability to make a product based on a user's imagination, ideas and creativity. Creative spaces implement STEM skills (Kenney, 2013). STEM skills are science, technology, engineering and math; these skills are being cultivated and brought forth in creative spaces. The beauty of a creative space is in the intergenerational aspect of learning, as they represent environments where the both young and older experienced users will come together to collaborate (Kenney, 2013). He believes that 3D printers have a place in the library as the centerpiece of the creative space (Kenney, 2013, p. 20).

Coupled with access to 3D printers, creative spaces will revolutionize how users access not just library materials, but how people share and transmit information and creative ideas (Kenney, 2013).

One such printer, called the MakerBot™ 3D printer, is changing not only how but why users access libraries. The 3D printer makes three dimensional items made of plastic. A user can design the dimensions on an application such as Google's Sketchup™ and then feed the information to the 3D printer and watch as their creation manifests itself from the printer (Kenney, 2013). The information is fed into the 3D printer through software called computer-assisted drawing (Kenney, 2013). The cost for a MakerBot™ 3D printer is just over $1,000 dollars, making it a worthwhile investment for the library community (Griffey, 2011).

Conclusion

The physical and digital landscape for libraries and the way users access them is continually evolving. From the creation of creative spaces and the transmission of ideas from user to user in a physical space within the library, to the increased use of smart phones for all users especially low income minorities, technologies are going to impact the amount of content needed and made available in libraries. The increased accessibility for the differentially-abled users within a library is making a difference in who is included – or no longer excluded – from the "knowledge economy" (Cullen, 2003). Public libraries will continue to help users with bridging the "digital divide" and assist users with their life-long learning goals. Yet the delivery mechanisms continue to change, freeing access to ideas and information from the traditional physical space to a more vast electronic landscape.

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