

Services to Mobile Users

The Best Practice from the Top-Visited Public Libraries in the US

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ABSTRACT

Libraries are adapting to the changing times by providing mobile services. One hundred fifty-one libraries were chosen based on circulation, with at least one library or library system from each state, to explore the diverse services provided to mobile users across the United States. According to the data, mobile apps, mobile reference services, mobile library catalogs, and mobile printing are among public libraries' most-frequently offered services, as determined by mobile visits, content analysis, and librarian survey responses. Every library examined had at least one mobile website, mobile catalog, mobile app, or webpage adapted for a mobile device. Following the COVID-19 outbreak, services such as mobile renewal, subscriber database access, mobile reservations, and the ability to interact with a librarian were expanded to allow better communication with customers—all from the comfort and safety of their own homes. Libraries are continually looking for innovative methods to assist their mobile customers as the world changes.

INTRODUCTION

Searching can be done on a computer, but it's more likely to be done on a mobile device.¹ According to data from the Pew Research Center, about 96 percent of American adults own a cell phone.² Americans are connecting to the internet via their mobile devices in greater numbers than ever before. The Pew report also states that 81 percent of Americans have a smartphone.³ While direct usage is not measured in terms of how it relates to public libraries, the reality is that users are looking to connect with businesses and services through their mobile devices.

While the COVID virus' ongoing spread has had a significant effect on various public services sectors around the world, libraries, especially in suburban areas, had to evolve and adapt to the changing environment. Public libraries now offer more patron services. While many public libraries offered curbside services during COVID-19 as a way to provide continuity of service, contactless services—services without having to speak with librarians directly—also became prevalent.⁴ These services cross geographical boundaries and reduce the risk of disease transmission from direct contact with other people. However, are there areas where libraries are lacking? Are there areas where libraries can improve, especially as more and more people are relying on mobile services rather than in-person ones? This study examines current mobile services being offered in public libraries across the United States, how these offerings changed due to the pandemic, and what services libraries are looking to offer in the future.

LITERATURE REVIEW

Several studies have explored mobile devices and their usage in a broader context. Currently, it is estimated that 67 percent of the world's population has mobile devices, with most of those devices being smartphones.⁵ In the United States alone, nearly 80 percent of the population owns a

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smartphone.⁶ People across the world use mobile media to talk to one another, order food, and attend meetings and appointments. “Mobile media—referring to devices, services, and content accessible on the go—has in a decade rapidly become a part of urban culture, and the habit of using a mobile device in public is only increasing.”⁷ Once the COVID-19 pandemic hit, use of mobile media was the easy way to connect as shelter-in-place orders were mandated across the country. Even as many people are venturing out again, using mobile media for certain services is likely going to continue. The world is forever changed because of the pandemic, and organizations like libraries have sought new ways to connect with their patrons.

Status of Library Services Provided in Public Libraries

While a few research articles have addressed services provided to mobile users in libraries, none at the time of writing were focused explicitly on services for mobile users in public libraries in the United States. Some studies focused on libraries overseas.⁸ Others focused on what drives a library to provide services for mobile devices and what drives users to want to access their library through a mobile device.⁹

With time, the availability of mobile-friendly services has become critical to a library’s long-term viability. The ability to search a library’s catalog, for example, has aided a traditional library’s modern relevance. “The digital library on mobile devices has been a milestone in library industry development, leading to huge changes in knowledge carrying, spreading, acquiring, processing, and sharing of cloud computing and big data in online and offline forms.”¹⁰ Users want data at their fingertips, whether it is an online order or a library catalog. “Social sharing functions such as reading, borrowing, sharing, comment tracking, automatic retrieval, and new book recommendations on mobile devices such as mobile phones have become the popular trend of digital library development.”¹¹

When evaluating mobile library websites and apps that libraries use to offer services, the literature appears to imply that a mobile version of a library website is more prevalent than a dedicated (or “native”) app. This is because of the development cost, the different mobile platforms (Apple, Android, etc.), and the maintenance required.¹² Instead of creating an app, it is often easier to optimize the library’s website for mobile devices through responsive design techniques.

The challenge for accessing a library website on a mobile device is making sure the website has the same functionality as when viewed on a desktop computer. “Today’s mobile users are no longer satisfied with simple mobile websites with only a small fraction of the information and features that are available on desktop websites. The small screen size of a mobile device may make performing certain tasks more tedious or cumbersome, but mobile users do expect to perform more and more tasks on their mobile devices.”¹³ LeMire et al. performed a study of how mobile services have improved since 2010. While academic libraries were analyzed and surveyed, this information is helpful and relevant to the study of public libraries.

Mobile Apps Offered across Various Libraries

While mobile apps and mobile webpages aren’t precisely the same (as proven by previous literature), the study *Public Library Mobile Apps in Scotland: Views from the Local Authorities and the Public* sheds some insight on the use of mobile apps. It seems that many libraries do not have or are not interested in developing a mobile app (this coincides with the findings from LeMire et al.’s study in the United States).¹⁴ However, when the public was surveyed, they did want more

remote services offered to mobile devices from their libraries. To increase the use of library services, apps should be considered.¹⁵ “By using an app instead of a mobile-enabled website, all the functionalities of smart technology can be incorporated to the library’s advantage. Improved communication with patrons increases exposure to communities who otherwise would not use library services.”¹⁶

A similar study was done in Malawi, where mobile services to libraries were analyzed. As we might expect, since Malawi has a developing economy, it has fewer mobile services than the more mature economies of the US or Scotland. The country recognizes the potential of using mobile devices to access library services. Computer shortages are often a problem within libraries in developing countries, so by creating mobile services, users could access the library through their own mobile devices.¹⁷

Studies have also found that it is important to know what users are looking for and to use that information when creating an app design. “Perceived situation efficiency and perceived mobile library quality positively affect intention to use mobile library, demonstrating that both quality and situation efficiency are necessary to satisfy library users’ needs in mobile era.”¹⁸ The quality of the library app or mobile website is obviously important, but knowing what kind of services will be provided is also important. Users are not going to turn to an app if it is not going to provide the information they need. This reported study proved that mobile users want to quickly obtain the information they want in the most effective way possible.

Library Services for Mobile Users

Universities are often more likely offering mobile services than are small-town libraries. Nearly all prestigious universities in the United States are already using mobile-friendly services, according to a study of one hundred university libraries.¹⁹ Typically, the services for mobile users include “mobile sites, mobile apps, mobile OPACs, mobile access to databases, text messaging services, QR codes, augmented reality, and e-books.”²⁰ Public libraries may not offer all these mobile services, such as augmented reality, but the majority provide access to a mobile OPAC or library catalog.

Guo, Liu, and Bielefield examined how urban public libraries provide services for and offer content to mobile users.²¹ Their analysis explored what was being done in an urban setting to potentially help public libraries plan and create mobile services. They looked into literature dating back to 1991, when mobile data was just a thought in some forward-thinkers’ minds, as was the concept of what a “mobile device” entailed. The study used current research to group library services into two categories: “traditional library services modified to be available via mobile devices and services created for mobile devices.”²²

To conduct their study, a list of 138 urban libraries in the United States was used based on the Urban Libraries Council. All 138 were examined using the same criteria. A list of contents was created (Components of Mobile Websites, Components of Mobile Apps, Mobile Reference Services, Social Media, Mobile Reservation Services, Mobile Printing, Apps or Databases). The findings supported the hypothesis that services for mobile users have been in place in urban libraries in the United States. According to Guo et al., 95 percent offer at least one type of service for mobile users.²³

Pope and others discussed SMS or text messaging services to a mobile device. Researchers also mention the My Info Quest Project, which was trying to get more libraries on board with using text

messaging, one of the mobile services studied in this review.²⁴ Literature from the fields of information science and library science shows that in recent years, typical library services have been adapted to be accessible via a mobile device rather than a service being developed specifically for a mobile platform.

RESEARCH DESIGN

A selection of two to five of the most-visited public libraries per state was chosen based on a statistic from the Institute of Museum and Library Services' database of 9,247 public libraries (this number treats library systems as one).²⁵ The libraries were chosen based on two criteria: libraries needed to be in states having a sizable number of public libraries and to have at least 3 million yearly in-person visitors. This resulted in a list of public libraries compiled to ensure that all notable libraries in the United States were covered in this study.

The sample of 151 libraries' state and population served, total circulation, total number of programs, total visits, and other associated data were entered into an Excel spreadsheet for analysis. With a low of 168,661 and a high of 16,686,945, the average number of visitors per year (prior to the pandemic) to these libraries is 2,663,292. These libraries serve an average of 700,924 people, with a low of 8,542 and a high of 4,294,460. The dataset includes all branch libraries, with the largest system having 92 branches.

Mobile website/app visits, content analysis, and email surveys were among the study methodologies used. The mobile website examination was conducted through an Android mobile phone device, using a specially designed codebook/spreadsheet to store and analyze data collected and verified from the library websites through 2021. The services offered were checked on each library's website.

Email surveys were developed as a supplement to ensure data accuracy and additional input of the library's mobile services from the librarians who work there. IRB approval was granted (protocol #406)²⁶ because human participants did not provide personal information and simply responded to email surveys. The first questionnaire was sent out to each library via Google Forms, either through direct email addresses or the library's web form, from April 3 through April 7, 2021. The follow-up email survey was designed to act as a check for some possible limitations (such as being unable to access app features) and was sent on April 19–20, 2021. The data was verified again through the IMLS database in early 2022.

The overarching question of what services libraries provided to users via their mobile devices was designed to delve into the mobile websites and/or apps provided by libraries, as well as the resources provided by the mobile websites or apps, reference services, reservation services, remote printing, and other services provided to mobile users.

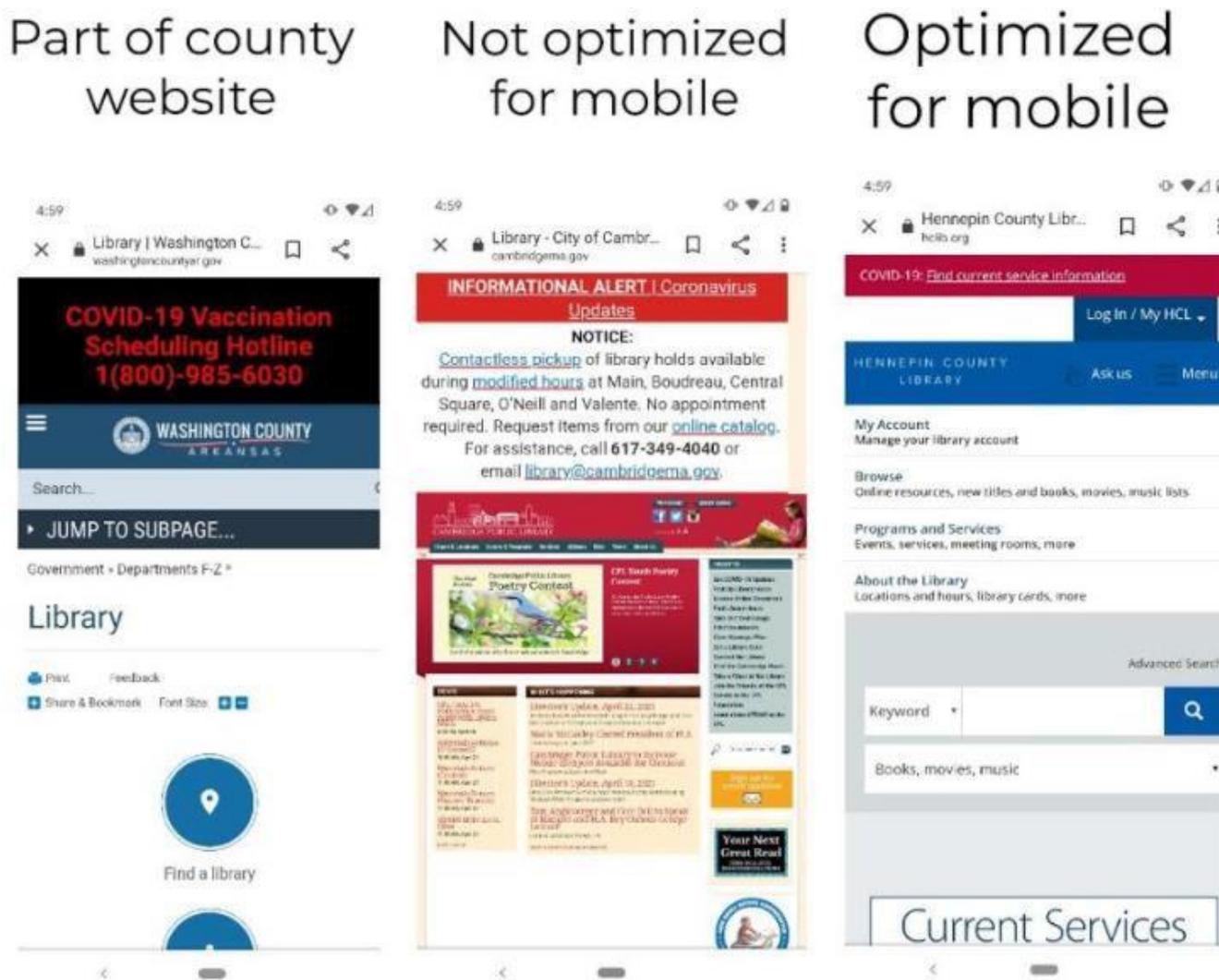
RESULTS AND FINDINGS

Examining the use of a mobile device to deliver services by these most-visited public libraries reveals intriguing and novel findings in comparison to the use of desktop access for services available to users. The poll sought to find the following information: which mobile services the libraries now provide, what they intend to provide, and any feedback received on their mobile services.

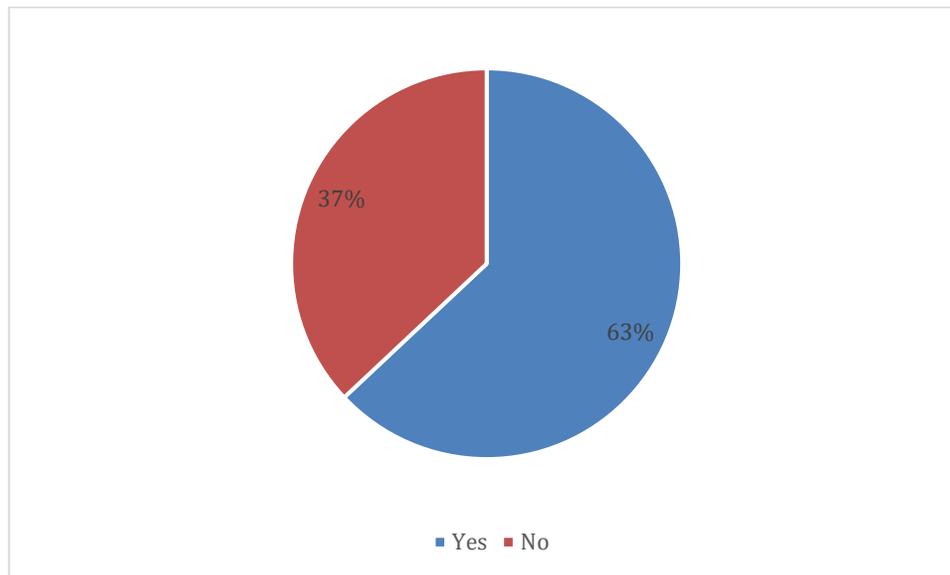
All Library Websites Are Accessible via Mobile Devices

Every one of the 151 libraries analyzed had a mobile website. In certain situations, this was the library’s website optimized and tailor-made with responsive designs for a mobile device. In other cases, all that was provided was a version of the library’s website (but not optimized, so navigation was more difficult). In other cases, the library’s website was merged with the parent organization and simply provided basic library information. Examples of these three conditions of the library mobile websites are shown in figure 1.

Figure 1. Examples of different library websites.



Library services were made available to mobile devices primarily due to COVID-19, as indicated by the responses of 60 (40%) of the 151 libraries to online questionnaires using Google Forms. Though it is practically difficult to compare the services offered in 2019 to those offered during the COVID-19 pandemic, 38 (63%) of respondents indicated that they had added mobile services in the last year (see fig. 2).

Figure 2. Mobile services added because of COVID-19.

What services were added, particularly since COVID-19? Chat features were the most popular response as a reference service and a means to connect. One example is the usage of Discord, a chat program that allows users to communicate by voice, video, and text, as a virtual communication tool to provide reference services. Nearly every library implemented curbside pickup. During the pandemic, virtual events and online reference services also became popular additions. Book delivery was still one of the mobile services that libraries provided, either using “Chomp Delivery” (a local delivery service company used by one library in Iowa) or the United States Postal Service (USPS). While these “ship to patron” delivery approaches may not be a frequent practice, it was an inventive approach to getting library books into the hands of clients who were unable to leave their homes. See figure 3 for common services added during COVID-19.

Over Half of Libraries Provide Dedicated Apps for Mobile Devices

Though all libraries had a website, more than half had a specific library app dedicated for users with mobile devices. Out of the 151 libraries analyzed, 52 percent (78) had at least one dedicated app built for the library or library system (see fig. 4). These apps could be downloaded from the Google Play Store (Android platform) or the Apple Store (iOS platform). All but one of the 78 libraries allowed patrons to log in to their accounts to look at their current checkouts, search the catalog, place holds, and request items. Other library applications such as Hoopla or Libby/Overdrive, as well as apps that were used to display upcoming events and other library data, like locations and hours, were excluded.

Figure 3. Common features added because of COVID-19.

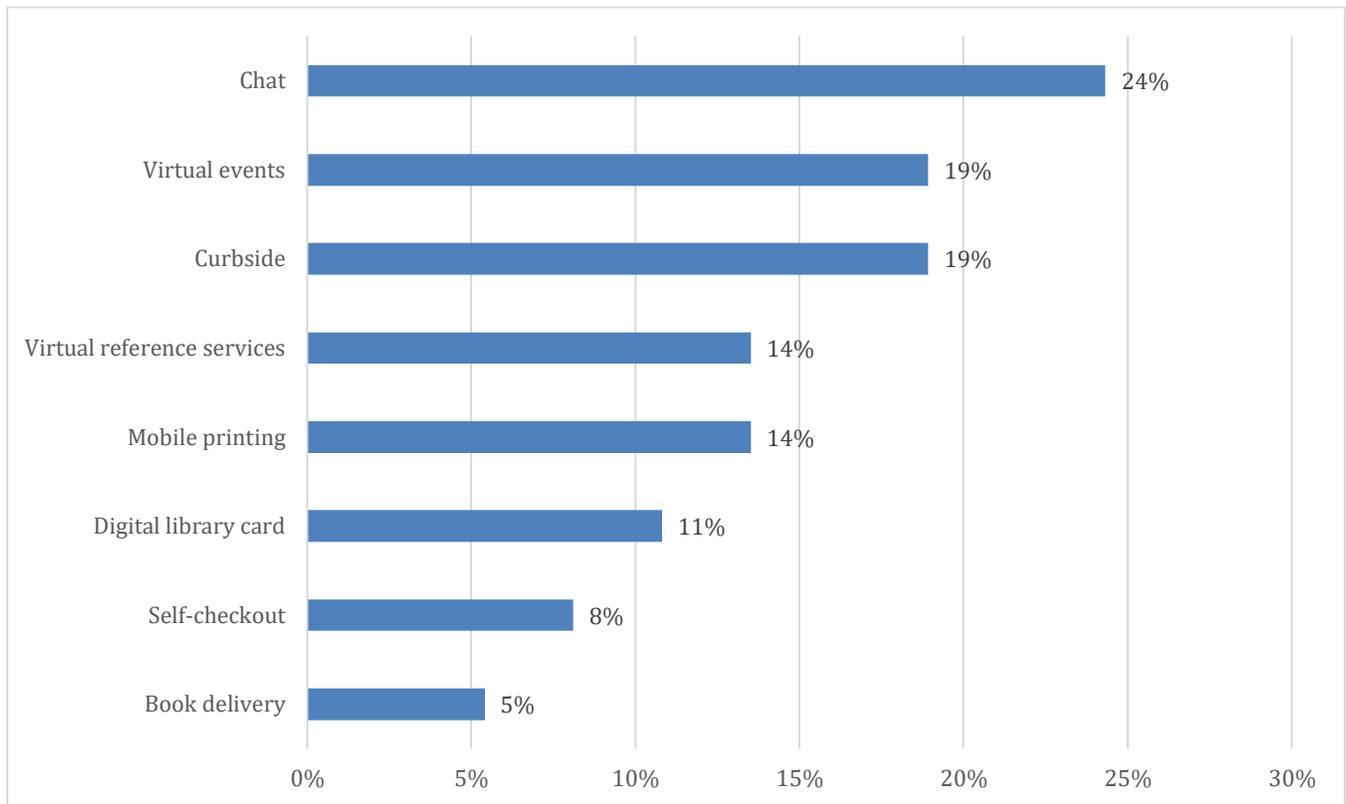
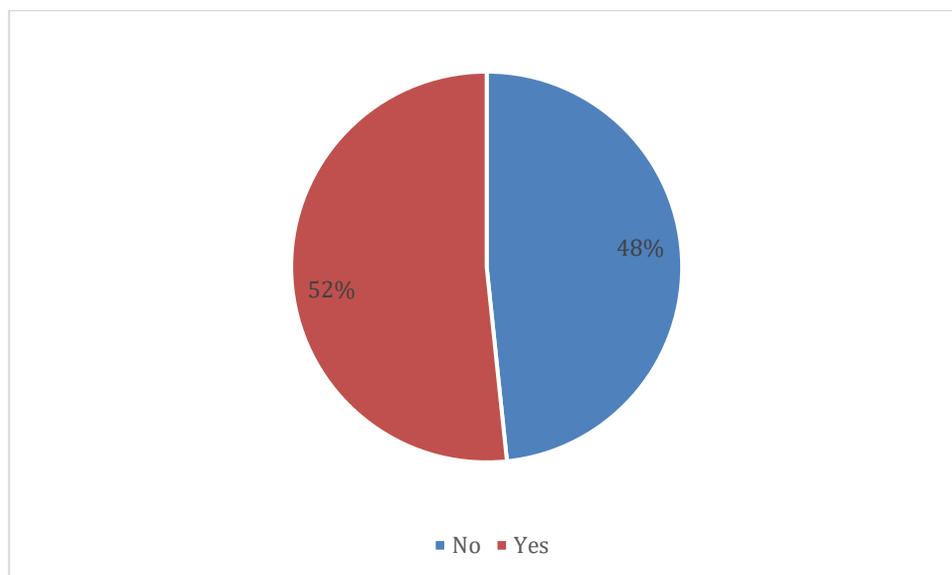


Figure 4. Percent of libraries that offer a mobile app.



Services Delivered through Library Mobile Websites

All 151 libraries had some form of mobile website. Although each website provided a lot of the same information, there were significant variances (see fig. 5). The ability to log in to one's account was available on the investigated websites. This allows customers to search the library catalog, place holds on books, and renew any books that were currently checked out. All the websites included basic contact information as well as information about the locations and hours of the libraries, and all libraries have an online public access catalog (OPAC) accessible through mobile devices.

Web-mediated services have been in place particularly since COVID-19. Nearly every library now offers services such as curbside pickup for books and other materials. Library events are now almost exclusively offered virtually. Over 98 percent of libraries have a calendar or other means of informing users about forthcoming virtual activities and events. Some libraries are now making available re-opening plans, COVID-19 protocols, and even COVID-19 vaccine information. Almost every library's main webpage mentions modifications brought on by COVID-19. As a result, certain library hours have altered, and services at all libraries have been impacted by COVID-19.

Typically, getting a library card was a service that physically took place in the library. During COVID-19, libraries had to learn to be flexible. Over 94 percent of libraries offered the ability to get a library card or allowed patrons to register for an e-card so they could check out books. Some of these libraries offered the option of printing the paperwork and necessary documentation to obtain a library card, but this paperwork did have to be dropped off at the library. However, many allowed their patrons to either extend the expiration date on a current library card or apply for a new one to be able to use the library's virtual services. Many libraries require a library card to access some of their services, such as databases.

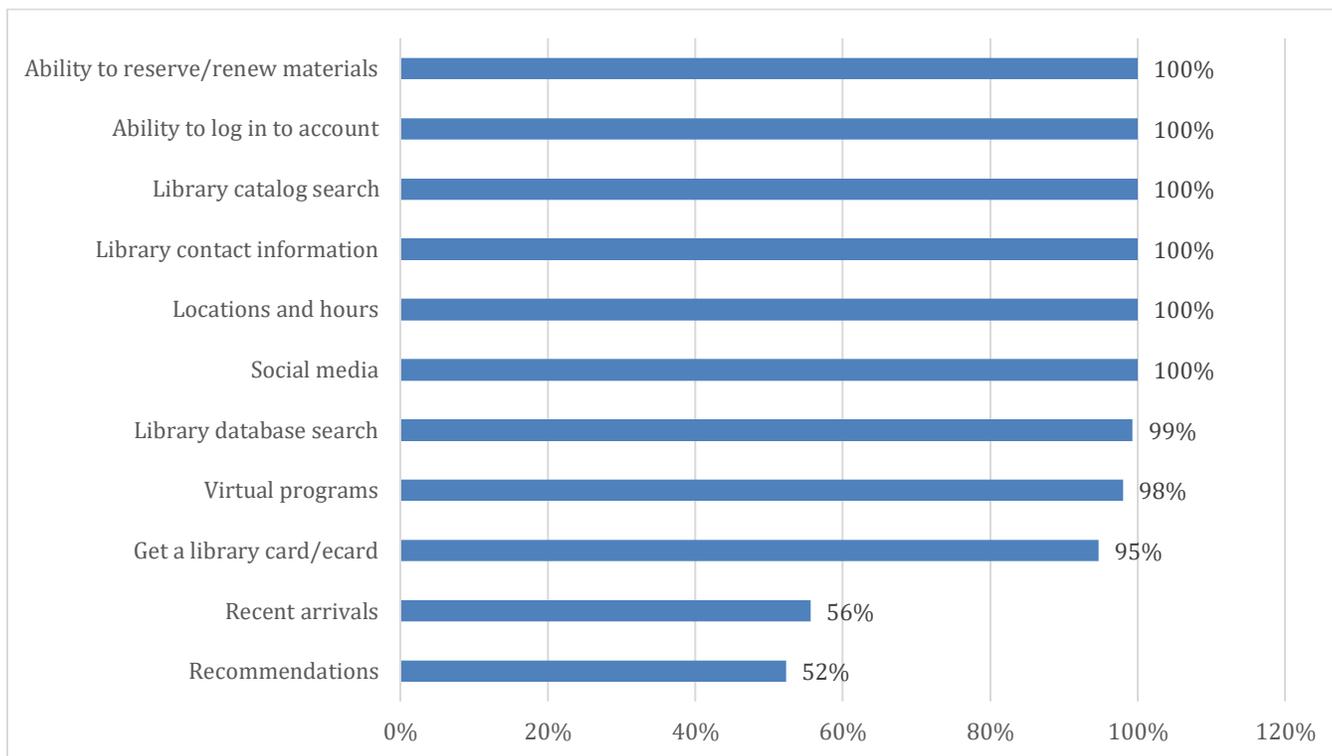
Nearly all libraries offered a variety of databases or other apps (such as Libby/Overdrive or Hoopla). A library card is needed to access all services. A couple of libraries even have their databases behind a login screen, so a user cannot even see the list of available databases until they have a library card and log in.

All libraries in the sample had a social media presence. Discrepancies on library websites were noted concerning new arrivals and recommendations. Only about 55 percent of library websites listed new arrivals and about 52 percent listed recommendations. It is possible that this data is included within the library catalog (and only accessible once a user has logged in). Out of all libraries analyzed, 43 libraries (28%) offered both recommendations and listed new arrivals. A smaller number, 31 libraries (21%) did not offer either of these.

Additional services seen on some of the library websites included the option to recommend a purchase to the library, how and if libraries were accepting donations, and a list of online classes being offered. Some libraries offered services on finding a job or becoming a United States citizen.

Overall, the library websites provided a lot of valuable information to patrons. Some were easier to navigate than others. The locations, hours, and contact information should be easy to find and access; however, on quite a few websites, these points of information are not easily accessed, since some libraries' websites required logging in. Still, with some searching and scrolling, a user could get to nearly all the basic information they might be looking for.

Figure 5. Percentage of libraries in study that offered services via the library’s mobile website.

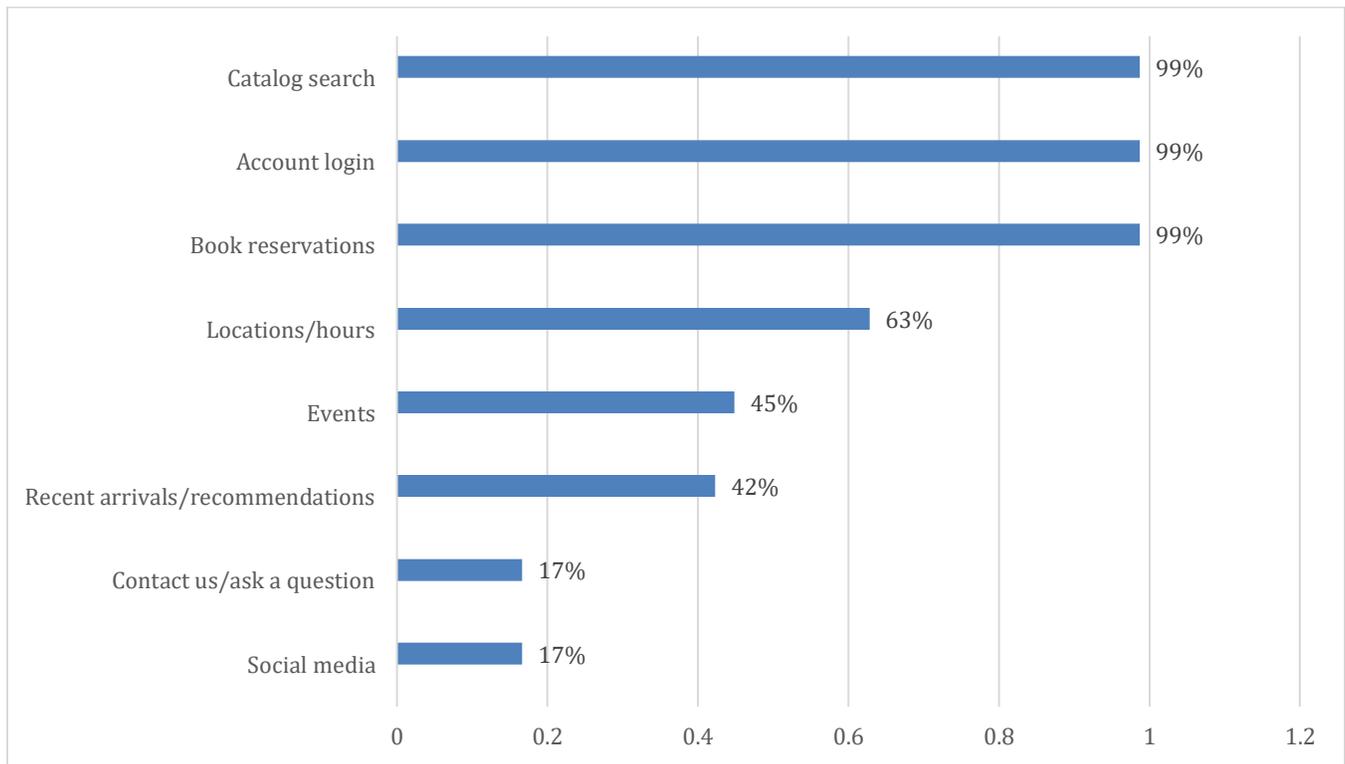


Services Delivered through Library Mobile Apps

While the primary function of a library’s dedicated app seemed to be accessing the catalog and requesting books, common services delivered through apps also include listings of events, such as webinars, found in 35 libraries (45%) that have an app; recent arrivals or recommendations, found in 33 libraries (42%); and ways to contact the library, in 13 libraries (17%). (See fig. 6 for the complete list of services.) All percentages are calculated based on the number of libraries that had a dedicated app that had that feature (78).

Gathering the information available on mobile apps was challenging as some apps require users to be affiliated with that library and log in with a library card. The information on what the app provides primarily came from the screenshots in the Google Play Store (for the investigators’ Android mobile devices) and the description on either the library’s website or within the play store. The Apple App Store applications available for library use are not disclosed in this study. As a result, the number of apps that offer additional services (such as locations/hours, events, etc.) may be higher than the percentages in figure 6. For example, the Brooklyn Public Library app (seen in fig. 8) has many features that are not shown in the sample on the Google Play Store. Clicking on library info will provide additional details beyond library locations and hours, but also contact information and links to social media. This information is only displayed to affiliated library patrons who have downloaded and logged in to the app.

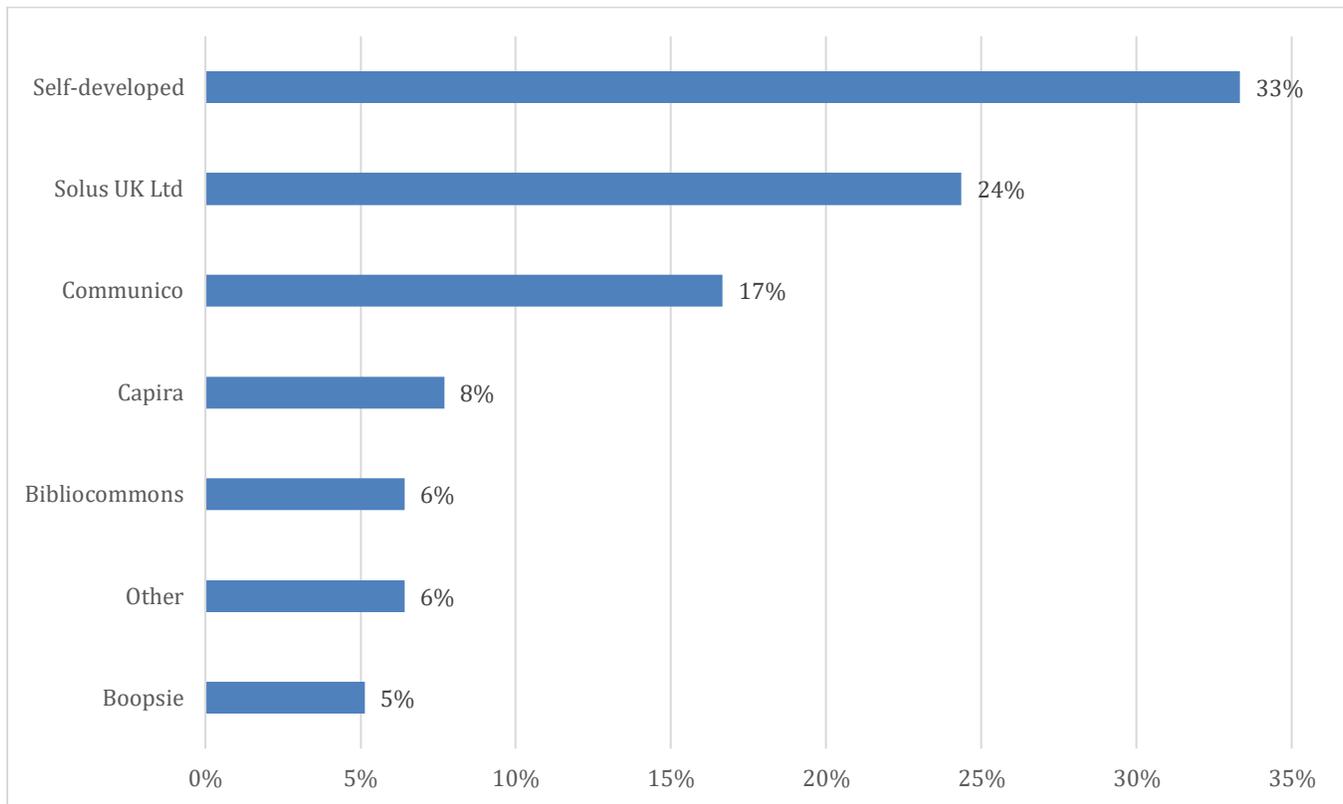
Figure 6. Percentage of libraries with a dedicated mobile app that offered services.



Apps Developed and Delivered for Dedicated Library Services

While it may appear that apps are the most popular method of connecting with patrons, maintaining an app and ensuring that it works on all mobile platforms and devices can be challenging. While creating and making an app available through the Google Play or Apple App stores may be an easy procedure for certain libraries, others are impeded by a lack of technical expertise. Designing and maintaining an app takes too much time and money, as voiced from the study survey.

An in-depth examination of the Google Play Store reveals that variables influencing the makers of each library’s app include familiarity with the community serviced, the potential for options, staff training, and phone access (see fig. 7). However, the majority of apps (67%) were commercially made, and only 33 percent were self-developed. This results in apps that are unique to the library and the user’s needs, but also require dedicated IT staff to maintain the app.

Figure 7. App developers, according to the Google Play Store.

One of the most popular software developers that provide libraries with scalable, effective mobile applications is Solus UK Ltd. Out of the 78 apps analyzed, 24 percent used this developer. Feedback from the study survey indicated that this app has strong capacity to expand or change according to user requirements, and its interface is user friendly and simple (see fig. 8). The app was obviously updated during the past year to allow for Contactless Holds Pickup, a service that many libraries are offering so patrons do not have to come into the library to pick up their books or other materials.

However, that interface is markedly different than others. Both the Chicago Public Library and the Brooklyn Public Library have self-developed apps (see fig. 9). The functionality of these apps is like that of the St. Paul Public Library, but the look is very different. Other apps, developed by other companies, also have an entirely different presentation and notion, such as responding time and user interface. The main purpose is the same: allow the user to be able to view the catalog and be able to check their holds and current materials.

Figure 8. St. Paul Public Library’s app developed by Solus UK Ltd.

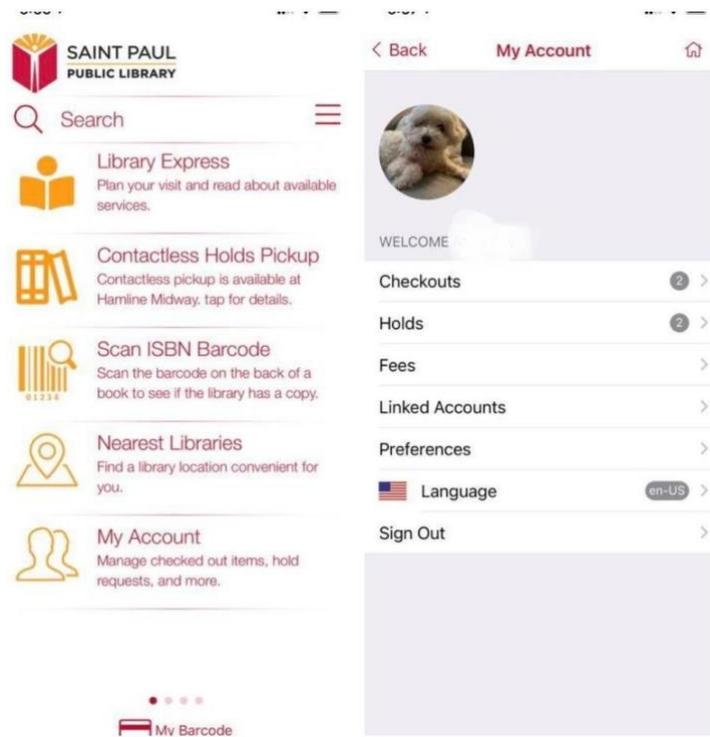
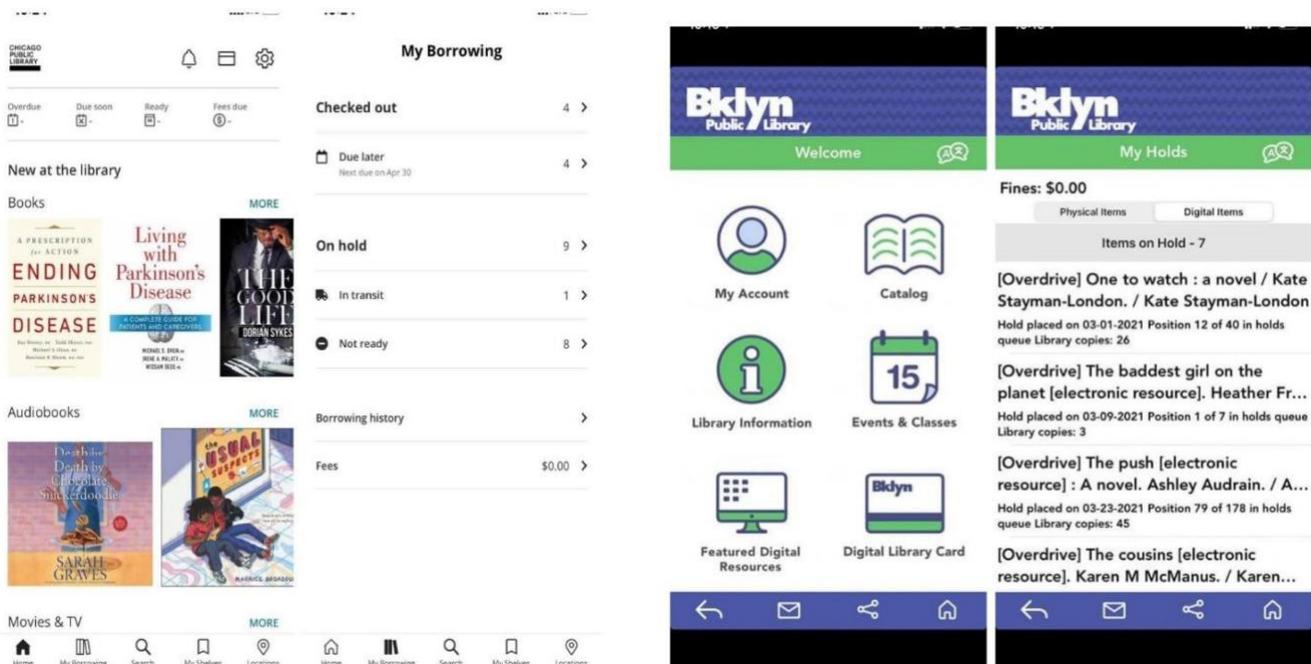


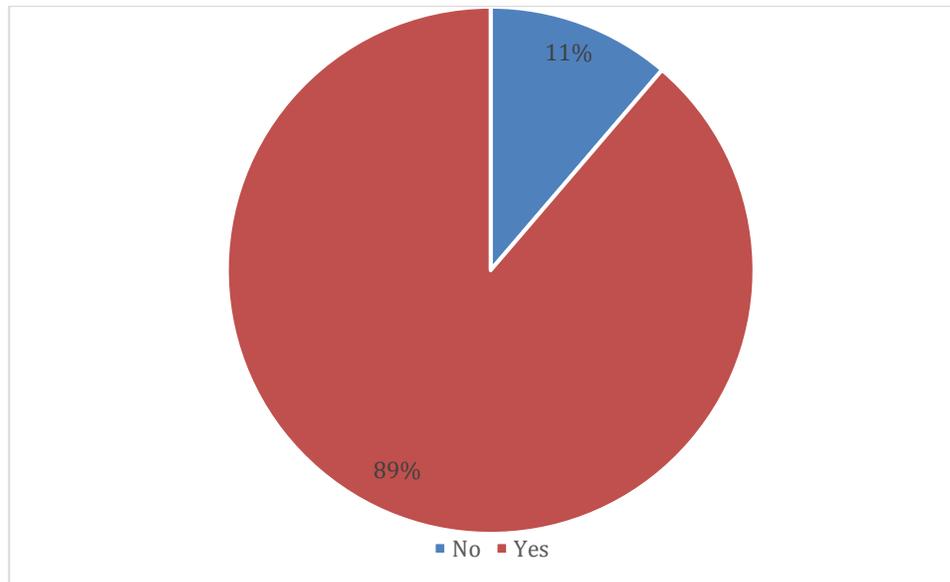
Figure 9. Self-developed apps: Chicago Public Library app (left) and Brooklyn Public Library app (right).



Major Forms of Mobile Reference Services

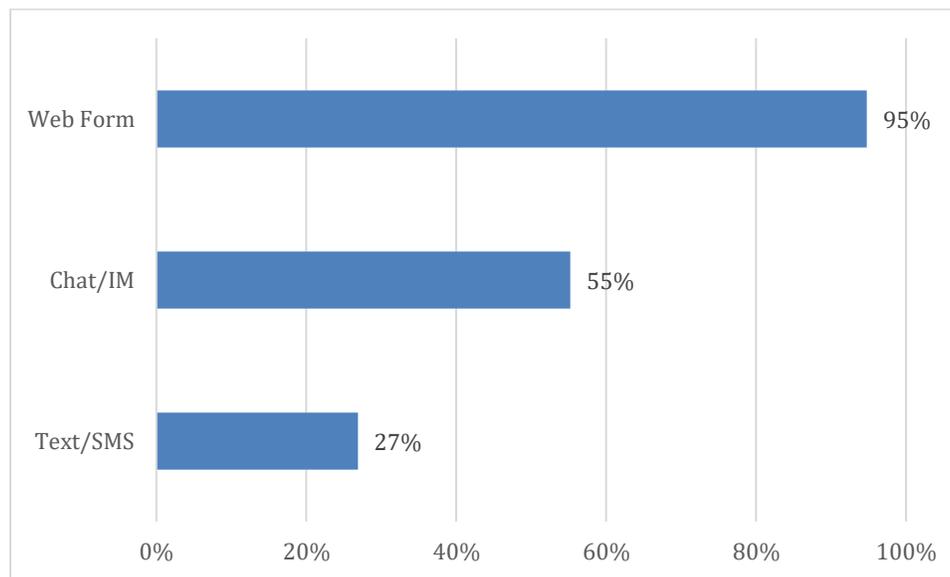
One of the most important ways for a library to connect with patrons is through mobile reference services. Even when the library is not open, many people seek help from the library reference desk. While calling the library is always an option, it is often not the most convenient one. While not all mobile reference services will work in this instance, some certainly will. An increasingly common example is the use of chatbots to offer such services. Out of the 151 libraries surveyed, 134 libraries (80%) offered mobile reference services in some format via both mobile websites and dedicated apps (see fig. 10).

Figure 10. Percentage of libraries offering mobile reference services.



Mobile reference services are described in this study as a direct way to contact the library via its mobile site. This can be done via chat, which functions similarly to instant messaging, text messaging (a patron can text a reference request to a specified text message number), or a web form (mobile friendly and reachable from remote devices) (see fig. 11).

The web form, which was found on the websites of 127 of the 134 libraries (95%), was the most often utilized channel for mobile reference transactions compared to other services (see fig. 11). The user's name, email address (and sometimes their library card or branch location), as well as their inquiry, were required. Users' phone numbers can be blank and are not collected. The librarian would then answer through email (or phone, if provided and applicable). The web form is available seven days a week, 24 hours a day. The user can submit at any time and receive a response when the librarian is available, which is convenient for both parties.

Figure 11. Major forms of mobile reference service.

Chat or instant messaging is the second most common type of mobile reference service and was used by 74 (55%) of the 134 libraries that offered mobile reference services. Chat rooms were set up in several libraries during specific hours of the day. For example, from 11 a.m. to 1 p.m., the Boston Public Library (Massachusetts) hosts a chat session. Outside of those hours, this feature is not available. The limitation of the chat option for some libraries is that it works on a computer but not on a mobile device. Also, the chat feature was unavailable outside of libraries' standard operating hours.

The SMS text option was chosen by 36 (27%) of the libraries. The fact that many questions require a lengthy response or back-and-forth conversation can sometimes make this more challenging for librarians. If a patron has a short inquiry, the text option is convenient; nevertheless, this is most often used when the library is open. In addition to the text function, all 36 libraries offered another form of mobile reference service. Thirty-five libraries offered the web form in addition to the text alternative.

While most libraries provide only one form of mobile reference service, a few provide three or more such options. Out of 134 libraries that provided mobile reference services, 56 (42%) provided only one service and 49 (37%) provided two. Only 30 libraries (22%) provided all three services (Chat, SMS, and web form) (see fig. 12).

The Provo City Library (Utah) combines all three services in one chat box in the example shown in figure 13. This allows a user to ask a question and then continue the conversation using the technique of their choice. Presently, these tools are more frequently observed in public libraries using LibraryH3lp as opposed to Mosio or LibAnswers, etc.

Figure 12. Comparison of the types of mobile reference services offered by libraries.

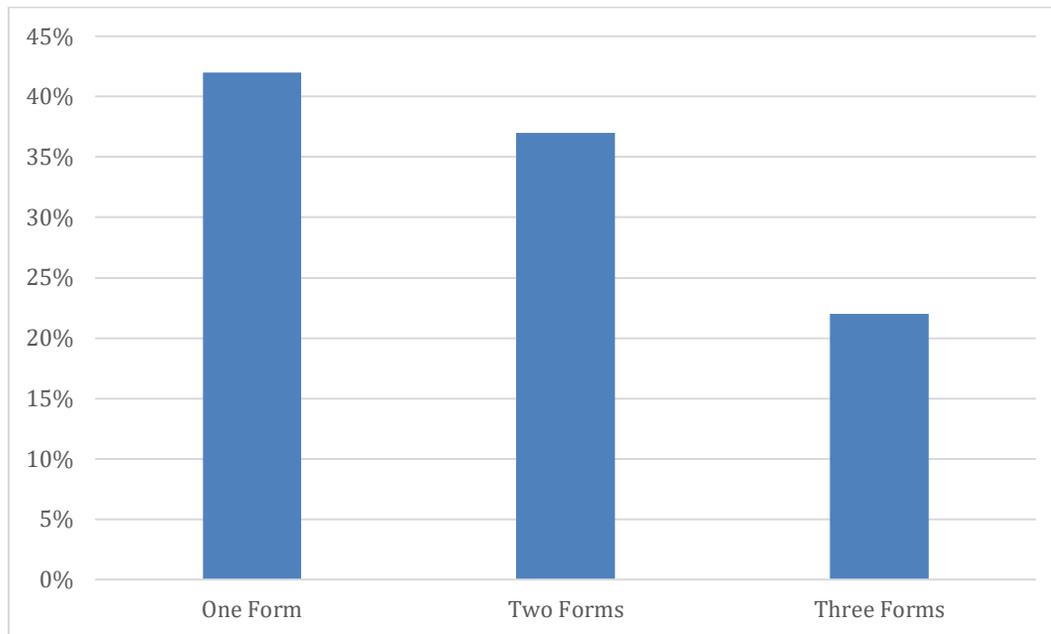
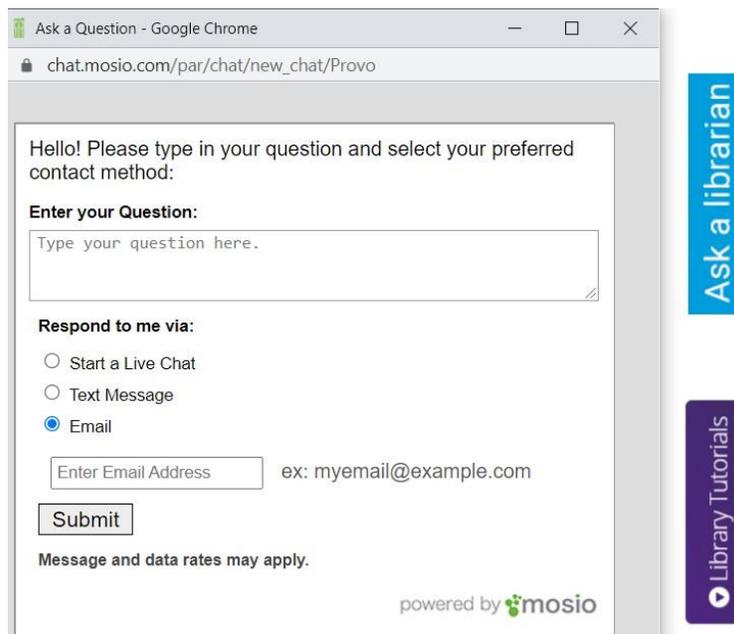
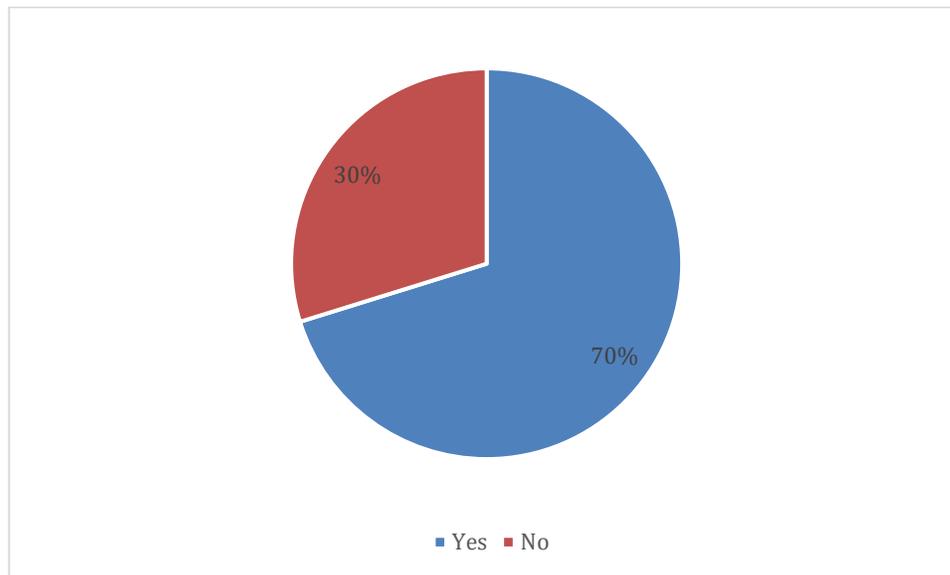


Figure 13. “Ask A Librarian” combines options of mobile services.



Mobile Reservation Services Are Widely Available

Reserving a computer, museum pass, study room, meeting room, and show space are among the mobile reservation services that were examined. At least one of these was available at 106 libraries (70%) (see fig. 14). This finding indicated that mobile reservation services became widely used as a result of the COVID-19 pandemic in the surveyed libraries.

Figure 14. Percentage of libraries offering at least one mobile reservation service.

Many libraries remained closed throughout the survey study period, making it difficult for patrons to book conference rooms, study rooms, or exhibit space. Some libraries that were open had meeting rooms and study rooms that were not available for use due to social distancing or other municipal standards. However, the option to reserve these rooms was still available on the website at the time of the analysis. Some libraries supplied meeting space information but required patrons to make a reservation by contacting them.

Some libraries, such as the Salt Lake City Public Library in Utah, closed their actual meeting rooms but offered rental of virtual meeting rooms while their physical meeting rooms were closed to the public (see fig. 15). Others offer not just rooms, but outdoor and large areas. The Indianapolis Public Library has an auditorium, an atrium, and a garden that are available to rent for a meeting—or even a wedding (the online form can be filled out requesting the date and the space for all types of events).

Figure 15. The Salt Lake City Public Library’s online announcement.



REQUEST A VIRTUAL MEETING ROOM

The City Library is now offering virtual meeting space. Zoom virtual meetings can accommodate a maximum of 300 people and are available to individuals, groups, organizations, and businesses. We will help you set up your virtual meetings and provide tech support. To request your virtual meeting space, fill out the form below.

Virtual Meeting Room availability:

Mon–Thu · 10am–8pm

Fri–Sat · 10am–6pm

If you have any questions, please review our Virtual Meeting Room [FAQ](#) page or contact Events Services at reservations@slcpl.org.

Please note, physical meetings rooms will be unavailable until further notice.

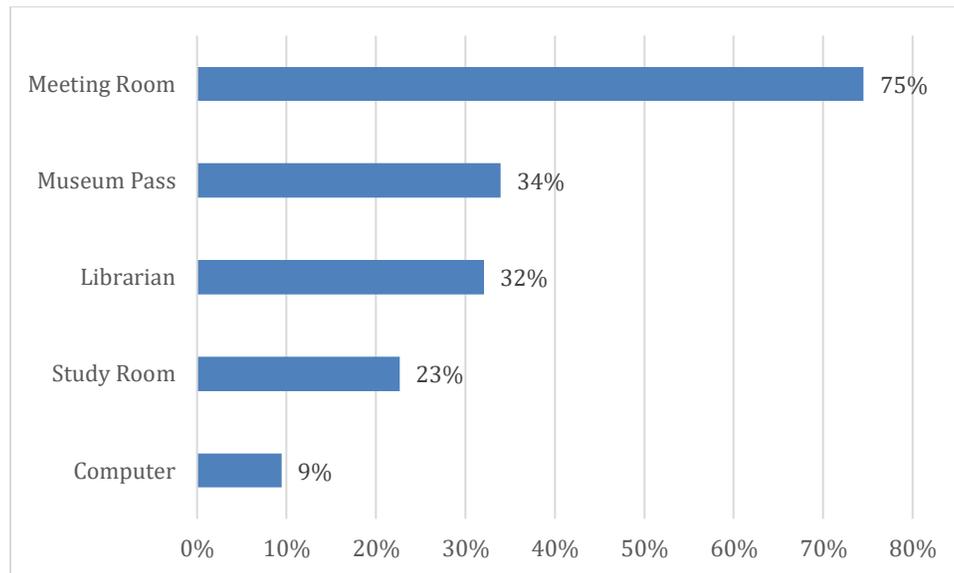
While many events can take place at a library, the spaces or rooms that could be resericed, such as wedding and exhibit spaces or rooms, are not commonly offered (see fig. 16). Rather, the rooms at most libraries are used for either meetings or study sessions. The most common mobile reservation is for a meeting room, as 79 libraries (75%) out of the 106 libraries offering mobile reservation services allow patrons to reserve this space online (although, again, this service may not currently be available because of COVID-19).

Study rooms are less commonly offered, with only 24 libraries (23%) offering mobile reservations for those online. However, some study rooms may be included with meeting rooms at some libraries.

Because libraries are closed or have COVID-19 restrictions, book-a-librarian and reserve computer services are also paused. Some libraries have pivoted to booking a librarian for a virtual meeting (34, or 32%), but often, that is just done through reference services.

Many libraries are limiting computer use and, as such, booking one can only be done in person to limit the number of people on the computers at one time. Only 10 libraries (9%) of the libraries offering mobile reservations provide a service where a patron can reserve a computer. Libraries are typically a great resource for free or discounted museum passes, but with some museums closed or having limited hours, some museum passes may not be available either. Only 36 (34%) of the 106 libraries offering mobile reservation services allow patrons to book a museum pass online.

Figure 16. Percentage of libraries offering reservation of various kinds of services via a mobile interface



Mobile Printing Services Become an Emerging Phenomenon

The ability to print from a laptop computer or a mobile device is a newer service that many libraries are starting to offer to their patrons. With libraries being closed because of COVID-19, the mobile printing service has become even more important. Patrons can send a printing job to the library and then pick it up curbside. This service is another way libraries are adapting to the world during a pandemic.

Most libraries (114, or 76%) do offer mobile printing (see fig. 17). The majority of these libraries have their users download a specific app that allows them to connect to the library's printers remotely with a variety of instructions. Some libraries offer the ability to print wirelessly, where a user can connect to the library's wi-fi (even in the parking lot if the library is closed) and send a document to the library that way. In this analysis, wireless printing and mobile printing are included together, as it is difficult to differentiate them because of the pandemic.

As part of a remote service, some libraries are also starting to offer 3-D printing services, allowing patrons to submit 3-D print jobs from their mobile devices. This typically is also done through a specific app and sometimes comes with a fee allowing users to 3-D print and then pick the product up curbside. Some libraries include this service as part of their makerspace and make it available for free with a library card. Overall, 17 libraries (11%) offer 3-D printing. As more locations are utilizing 3-D printing technology, libraries can offer such 3-D service libraries to the general public wisely.

Figure 17. Percentage of libraries that offer mobile (or wireless) printing.

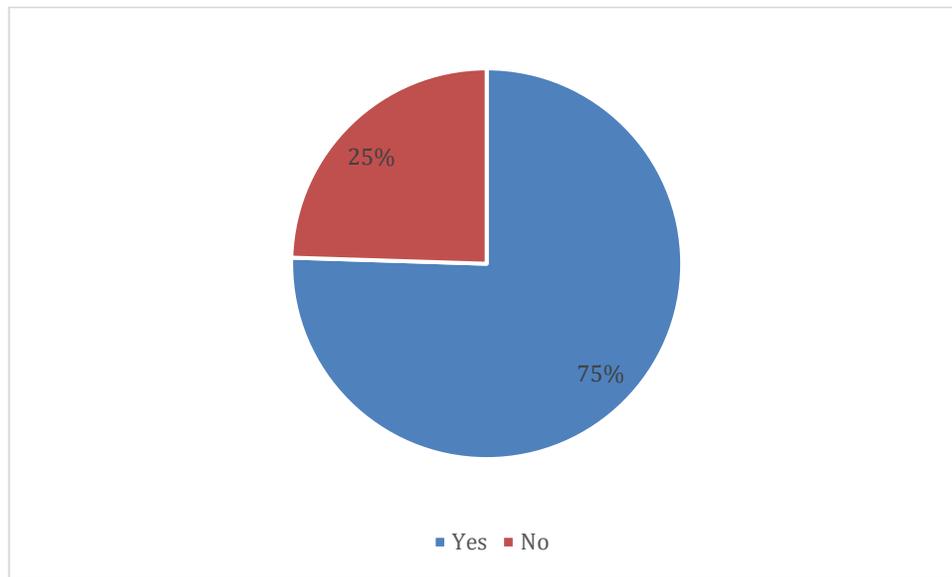


Table 1. Databases & applications accessible via a mobile website

App/Database	Percent of libraries providing	App/Database	Percent of libraries providing
ABCmouse	18%	Learning Express	65%
Ancestry	78%	Lynda.com (LinkedIn)	57%
BookFlix	27%	Mango Languages	57%
BrainFuse	32%	MasterFILE	40%
Britannica	39%	Morningstar	57%
Chilton	35%	National Geographic	15%
Consumer Reports	49%	New York Times	58%
Driving-Tests.org	29%	NoveList	81%
EBSCOhost	51%	Overdrive/Libby	62%
Eric	31%	ProQuest	17%
Explora	46%	RBDigital/Zinio	27%
Flipster	39%	Reference USA	57%
Freegal	33%	Rosetta Stone	15%
Gale	72%	Tumble Book	47%
Heritage Quest	55%	Tutor.com	20%
Hoopla	48%	ValuLine	56%
Kanopy	41%	World Book	33%
Khan	10%	WorldCat	44%

Subscribed Databases are Available via Mobile Devices

Patrons should be able to access databases via their mobile sites. When consumers think of public library services, databases are not always the first thing that comes to mind. However, when users were at home and libraries were closed, it was critical for patrons to have access to these databases. A library card was necessary to access the majority, if not all, of the databases. Some libraries locked their databases behind a login screen so users can't access them without a valid library card.

A wide range of databases were available, and some libraries seemed to cater to their target audiences, with some offering more databases geared at children or teens (ABC Mouse, TumbleBooks) and others focusing on their adult patrons (Consumer Reports, ValuLine). Ancestry, Gale (which includes Academic OneFile), and Learning Express (also known as PrepStep) were the most widely used databases and were mentioned by 108 libraries (72%) of the 150 libraries that have databases available through their library mobile websites. Table 1 lists the most commonly offered databases. Many others were available at various libraries across the country, but none were offered by more than 10 percent of the libraries examined.

Social Media Bridges Mobile Devices from Libraries to Patrons

All the libraries surveyed have social media links on their mobile websites. Some libraries include apps that connect to social networking. Every library had a Facebook page, and almost all had a YouTube channel (96%) or an Instagram account (95%). The amount of access to some of these pages varies. One expectation from users is that all libraries would promote their social media on their main (or contact us) page, but some did not do so. Figures were double-checked by browsing YouTube, Instagram, and Twitter for each library. A YouTube channel with fewer than 20 subscribers and postings was found for several libraries. Ninety-three percent of libraries use their Twitter accounts to promote their programming and other activities.

Following the listing of the primary social media, some libraries have a "drop-off" for how they interact with their users (see fig. 18). Only 48 libraries (32%) used Pinterest, and fewer used Flickr (27, or 18%) or LinkedIn (25, or 17%). A very small percentage used Tumblr (10, or 7%) or GoodReads (6, or 4%). It is possible that more of these libraries used these social media channels but did not include the logo on their web page with their other social media.

An extensive check was done on YouTube, Twitter, and Instagram to verify that the libraries had a social media presence on those channels. These are the primary ways libraries connect users to their services, as they are the more popular on social media. Other social media used include blogs from each library, e-newsletters, podcasts, RSS feeds, Vimeo, and TikTok.

Actions and Barriers to Advance Mobile Services

Despite the fact that more individuals are visiting libraries again and the facilities are open, many users might be hesitant to do so. Fifty-six percent of the 54 libraries responding to the survey questionnaire said they would like to provide more mobile services in the future (see fig. 19).

Figure 18. Percentage of public libraries using various social media services.

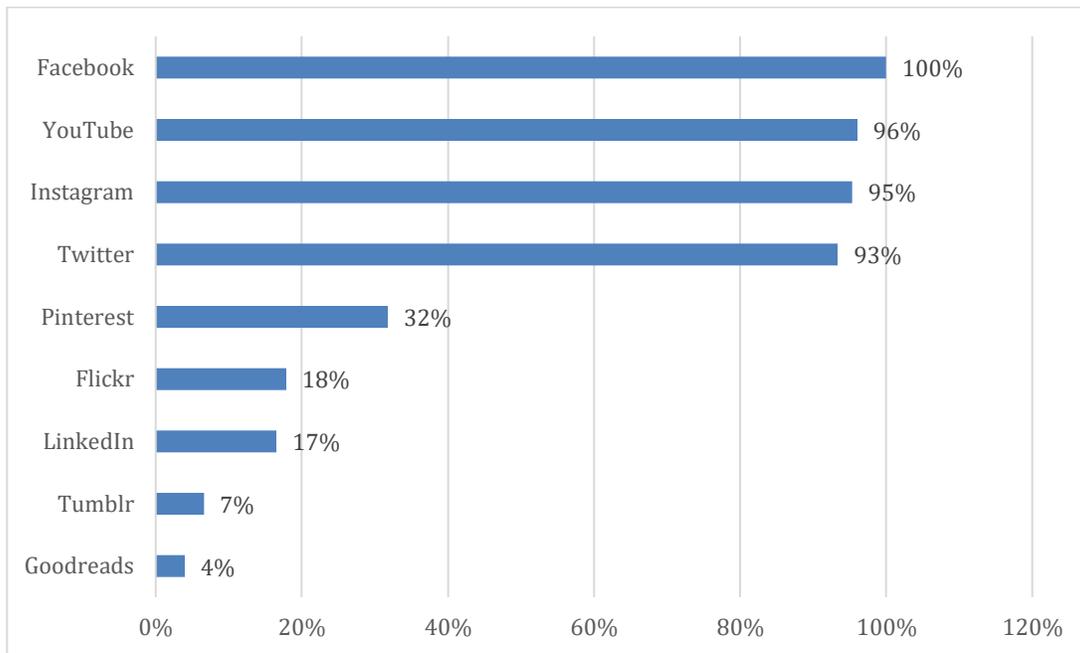
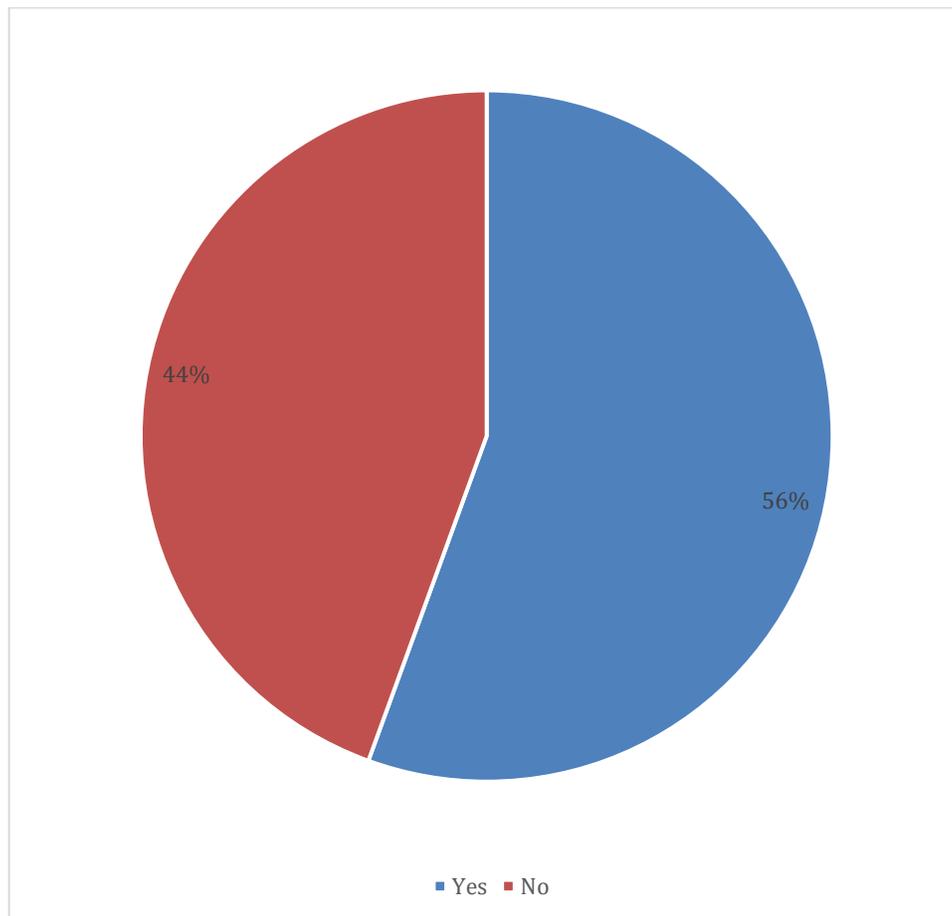


Figure 19. Percentage of libraries wishing to add mobile services.

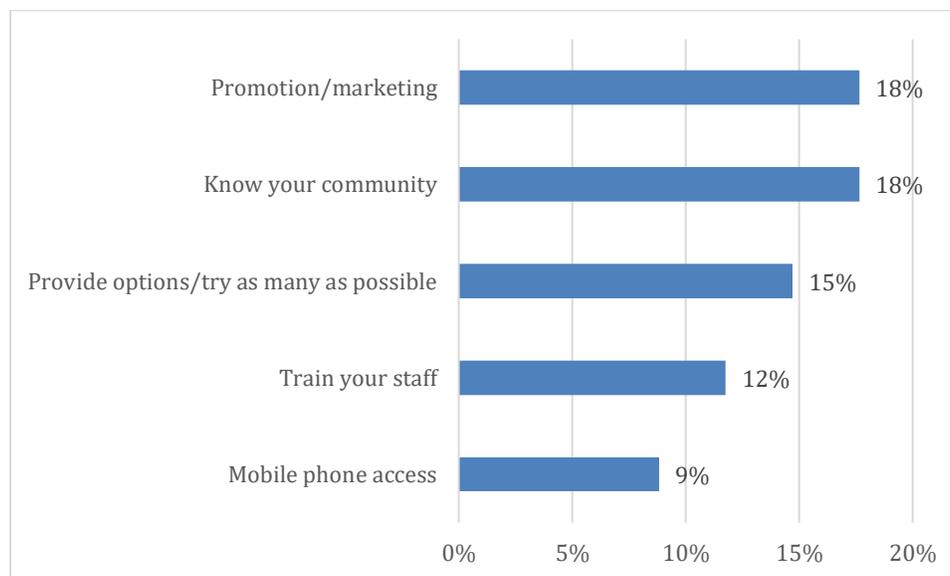


When libraries were asked what services they were looking to add, the two most common responses were: an app and text services. Both responses were given by seven (21%) out of the 33 libraries that responded. The SMS texting service was not just mobile reference, but also text notifications for program updates or reminders or account notifications. The rest of the responses were spread out, in that three libraries (9%) said that they were looking to add chat features and two libraries (6%) were looking to add mobile printing. Other answers to the question by a single library included bookmobile, mobile checkout, and virtual story time.

Many libraries aspire to expand their offering of mobile reference services. The number of libraries that employ chat and SMS text messaging appears to be substantial in the upcoming year.

Considerations are being given to expanding mobile services at libraries (see fig. 20). A total of 34 libraries responded, with the most common considerations being getting to know the community and promoting/marketing the services (18% of the libraries responded for each). A popular mobile service does not imply it will work for patrons, according to the surveyed libraries. The advice from survey respondents was to really attempt to figure out what people want and then give it to them.

Figure 20. Percentage of libraries giving consideration to expanding mobile services to various areas.

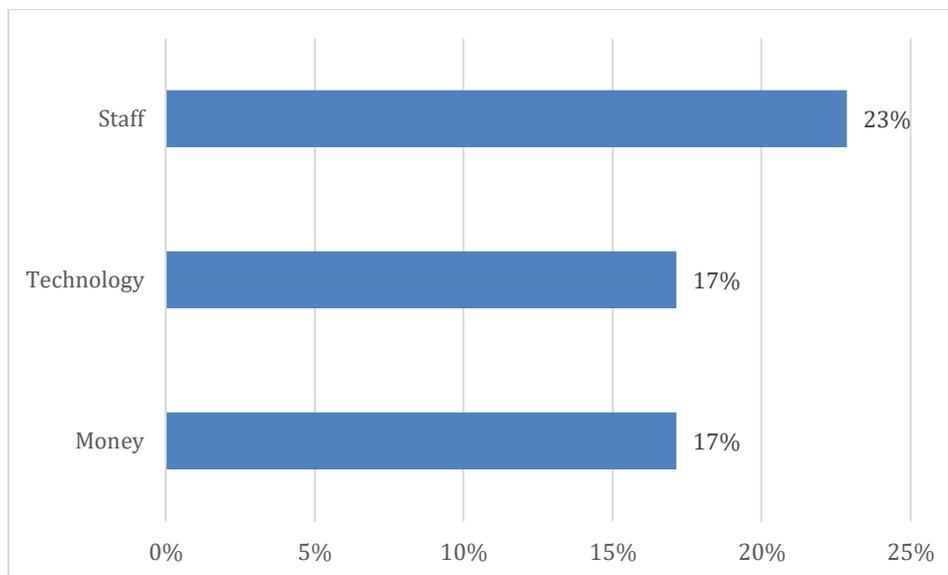


The research showed that libraries frequently test services to see what works and test services frequently to make sure they are operating properly. One library urged other libraries to do the best they could with what they had. They recognized that their customers were frustrated by their inability to provide mobile services and urged that they push out whatever mobile offerings they could. They agreed that it would not be flawless, but users would prefer to communicate with library staff when encountering a bug-free app/website/service.

Staffing, technology, and money were by far the three most significant difficulties that libraries faced, based on the response from 36 libraries (see fig. 21). While expanding mobile services is something that these libraries want to accomplish, finding employees to manage them and

understand how to utilize them is difficult. Furthermore, many upgrades necessitate funding, whether for staff training or the development of an app.

Figure 21. Percentage of libraries facing resource challenges in offering mobile services.



One of the top technical issues is ensuring that their mobile services are interoperable across several platforms. Six libraries (17%) indicated that anything they add will operate on both Android and Apple platforms on mobile devices.

Another technological challenge is that any service the library introduces must be compatible with what they already have. When new apps or platforms are required, integrating them with existing technology can be tricky.

CONCLUSION AND SUGGESTIONS FOR FURTHER STUDY

After examining 151 public libraries across the United States, it is obvious that libraries are attempting to engage with their consumers via mobile services. All 151 libraries have either a mobile website or one that is mobile friendly. As such, the website, in all cases, contained contact information, library locations and hours, access to the library catalog, and the ability to log in and renew or reserve a book. During a period when many libraries were closed, these primary services were critical in connecting with the bulk of users.

Libraries adapted to the times by introducing curbside service, which allowed users to place holds on books or materials remotely using their mobile devices and then return to the library to pick up their holds without having to go inside. A bit more than half of the libraries polled had a specialized mobile app that performs some of the same functions as the mobile website. Some libraries are considering developing an app to help their patrons in the future. Many libraries have incorporated remote reference services, such as booking a librarian with an online reservation, SMS notifications, and chat, in response to the pandemic. These services enable the library to communicate with its patrons when face-to-face interaction is not possible.

Libraries are continually assessing their mobile services to determine what will work best for their users. Mobile printing, chat, and an app are among the new features they're introducing. According to a poll, 56 percent of libraries plan to continue to provide mobile services in the future. Many businesses, including libraries, have had to reconsider and adapt their business models. Libraries are relying on mobile services to maintain their relationships with their clients as the world continues to change because of COVID-19 and the rise of mobile devices.

ENDNOTES

- ¹ StatCounter Global Stats, "Mobile and Tablet Internet Usage Exceeds Desktop for First Time Worldwide," press release, November 1, 2016, <https://gs.statcounter.com/press/mobile-and-tablet-internet-usage-exceeds-desktop-for-first-time-worldwide>.
- ² Pew Research Center, "Mobile Phone Ownership over Time," mobile fact sheet, April 7, 2021, <http://www.pewinternet.org/fact-sheet/mobile/>
- ³ Ash Turner, "How Many Smartphones Are in the World?," accessed March 2021, <https://www.bankmycell.com/blog/how-many-phones-are-in-the-world>.
- ⁴ Yajun Guo, Zinan Yang, Zhishun Yang, Yan Quan Liu, Arlene Bielefield, and Gregory Tharp, "The Provision of Patron Services in Chinese Academic Libraries Responding to the COVID-19 Pandemic," *Library Hi Tech* 39, no. 2 (July 24, 2020): 533–48, <https://doi.org/10.1108/LHT-04-2020-0098>.
- ⁵ Turner, "How Many Smartphones."
- ⁶ Turner, "How Many Smartphones."
- ⁷ Petter Bae Brandtzaeg, "How Mobile Media Impacts Urban Life: Blending Social Cohesion and Social Distancing," *Interactions* 27, no. 6 (November–December 2020): 52–56, <https://doi.org/10.1145/3424682>.
- ⁸ Yajun Guo, Zinan Yang, Yiming Yuan, Hulfang Ma, and Yan Quan Liu, "Contactless Services: A Survey of the Practices of Large Public Libraries in China," *Information Technology and Libraries* 41, 2 (2022): 2–21, <https://doi.org/10.6017/ital.v41i2.14141>.
- ⁹ Theophilus Kwamena Ocran, Peter Graham Underwood, and Paulina Afful Arthur, "Strategies for Successful Implementation of Mobile Phone Library Services," *The Journal of Academic Librarianship* 46, no. 5 (2020): 102174, <https://doi.org/10.1016/j.acalib.2020.102174>.
- ¹⁰ Li Liu, Xin Su, Umair Akram, and Muhammad Abrar, "The User Acceptance Behavior to Mobile Digital Libraries," *International Journal of Enterprise Information Systems (IJEIS)* 16, no. 2 (April–June 2020): 38–53, <https://doi.org/10.4018/IJEIS.2020040103>.
- ¹¹ Liu et al., "The User Acceptance Behavior."
- ¹² S. LeMire, Stacy Gilbert, Stephanie Graves, and Tiana Faultry-Okonkwo, "The Present and Future of the Library Mobile Experience," *Library Technology Reports*, 49, no. 6, (2017).

- ¹³ LeMire et al., “The Library Mobile Experience.”
- ¹⁴ LeMire et al., “The Library Mobile Experience.”
- ¹⁵ Alan Kerr and Diane Rasmussen Pennington, “Public Library Mobile Apps in Scotland: Views from the Local Authorities and the Public,” *Library Hi Tech* 36, no. 2, (2018): 237–51, <https://doi.org/10.1108/LHT-05-2017-0091>.
- ¹⁶ Kerr and Pennington, “Public Library Mobile Apps in Scotland.”
- ¹⁷ Aubrey Harvey Chaputula and Stephen Mutula, “eReadiness of Public University Libraries in Malawi to Use Mobile Phones in the Provision of Library and Information Services,” *Library Hi Tech* 36, no. 2, (2018): 270–88, <https://doi.org/10.1108/LHT-10-2017-0204>.
- ¹⁸ Min Zhang, Xuele Shen, Mingxing Zhu, and Jun Yang, “Which Platform Should I Choose? Factors Influencing Consumers’ Channel Transfer Intention from Web-Based to Mobile Library Service,” *Library Hi Tech* 34, no. 1, (2016): 2–20, <https://doi.org/10.1108/LHT-06-2015-0065>.
- ¹⁹ Yan Quan Liu and Sarah Briggs, “A Library in the Palm of Your Hand: Mobile Services in Top 100 University Libraries,” *Information Technology & Libraries* 34, no. 2, (June 2015): 133–48, <https://doi.org/10.6017/ital.v34i2.5650>.
- ²⁰ Liu and Briggs, “A Library in the Palm of Your Hand.”
- ²¹ Yajun Guo, Yan Quan Liu, and Arlene Bielefield, “The Provision of Mobile Services in US Urban Libraries,” *Information Technology and Libraries* 37, no. 2 (June 2018): 78–93, <https://doi.org/10.6017/ital.v37i2.10170>.
- ²² Guo, Liu, and Bielefield, “The Provision of Mobile Services.”
- ²³ Guo, Liu, and Bielefield, “The Provision of Mobile Services.”
- ²⁴ Kitty Pope, Tom Peters, Lori Bell, and Skip Burhans, “Twenty-First Century Library MUST-HAVES: Mobile Library Services,” *Searcher* 18, no. 3 (April 2010): 44–47.
- ²⁵ Institute of Museum and Library Services, “Library Search and Compare,” <https://www.ims.gov/search-compare/>.
- ²⁶ Yan Quan Liu and Sarah Lewis, IRB protocol 406, for “The Use of Mobile Services in Public Libraries across the Country,” The Department of Information and Library Science, Southern Connecticut State University (2021).