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Primo on the Go: A Usability Study of the Primo Mobile Interface

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ABSTRACT

Primo Analytics from two campuses of the California State University system has revealed that a dramatically low proportion of Primo searches originate from mobile devices. The current study focuses on usability concerns as one area that may be preventing students from searching the Primo mobile interface. The sample for this study includes students from two campuses with a variety of experience with library instruction and searching the library's discovery system. Participants were given the same set of six common academic tasks to complete. Both mobile and desktop participants found three tasks relatively easy to complete. When there were differences in completion rates between the mobile and desktop users, the desktop users were overall more successful. No task was consistently difficult for desktop users to complete, while mobile users found two of the tasks very challenging to complete. Based on the findings, the authors make recommendations for improving the experience of mobile users.

KEYWORDS

User interfaces; information-seeking behavior; smartphones; online library catalogs; task performance; academic libraries; usability; web-scale discovery; discovery layers; mobile device usage

Introduction

The adoption of discovery systems has been increasing in academic libraries over the last several years. Several discovery systems are on the market. Many academic libraries and consortia, including both the Orbis Cascade Alliance and the City University of New York system in 2015, have selected Primo from Ex Libris.

The California State University (CSU) system is the largest four-year public university system in the United States. The CSU system has 23 campuses throughout California with over 481,000 students. The 23 campuses operate independently of each other, and each campus maintained its own, independent library management system until 2017. In 2015, the CSU system issued a request for proposals to migrate all campuses to a single library management system. **In mid-2015, Ex Libris's Alma was selected as the underlying system with Primo as the search interface, and the libraries**

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of the CSU system went live with the new system in July 2017. All 23 campuses branded Primo as “OneSearch” to ensure consistency across the system.

The current study focuses on two of the CSU system campuses: CSU East Bay and CSU Maritime Academy (Cal Maritime). It builds on a prior study analyzing data from Primo usage at these campuses plus a third one, CSU Northridge (Adams et al., 2018). Primo Analytics revealed various trends in user behavior. A finding from the previous study was that a dramatically low proportion of Primo searches originated from mobile devices, which surprised us because mobile device usage is widespread among college students.

Primo uses responsive design to deliver a mobile interface to small screens such as smartphones and a standard interface to larger screens including desktops, laptops and tablets. For the purposes of this study, we use the term “mobile” to refer to the interface for small screens and the term “desktop” to refer to the standard interface for larger screens.

Studies show that 96% of 18–29-year-olds in the U.S. have a smartphone (Pew Research Center, 2019), and 58% of 18–29-year-olds in the U.S. report that they access the internet predominantly through their smartphones (Anderson, 2019). Furthermore, the University of Central Florida found that over 54% of students used a mobile device for accessing university apps (Seilhamer et al., 2018). However, usage statistics show that only 5–6% of Primo search sessions from the two campuses in this study originate from mobile devices (Adams et al., 2018). Given those statistics and the expense of desktops and laptops, as well as the limited availability of library computers, we were curious to learn whether usability issues affecting Primo mobile were an obstacle to successful student searching, and thus could be a contributing factor to the low usage of the mobile interface.

There may be many reasons for the low usage of Primo from mobile devices. The current study focuses on usability concerns as one area that may be preventing students from searching the Primo mobile interface. We wanted to test how intuitive the design of the Primo mobile interface is by asking students to accomplish the following common academic tasks: finding and limiting search results to books on the shelf and peer-reviewed articles, limiting by publication date, and saving articles to read later.

Literature review

There is a vast corpus of literature on best practices for usability testing. Usability testing differs from other types of survey sampling in that neither a large nor representative sample is necessary. Clear trends begin appearing after only a few participants (Bailey, 2006; Nielsen, 2012b; Nielsen &

Landauer, 1993). Usability.gov includes guidelines for conducting usability studies on mobile devices (Usability.gov, 2015). Usability studies may be planned in coordination with platform providers, as Galbreath et al. (2018) did by choosing their usability tasks in consultation with Ex Libris. Moreover, Ex Libris provides guidelines to develop usability studies testing the Primo interface (Ex Libris, 2017). Steve Krug's sample usability script (Krug, 2010a) is freely available on his website (Krug, 2010b). The think-aloud protocol commonly used in usability testing is explained by Nielsen (2012a).

Much research has been published on the usability of the Primo discovery service. Thus far, Primo usability studies have focused exclusively on the desktop interface (Azadbakht et al., 2017; Brett et al., 2016; Galbreath et al., 2018; Hamlett & Georgas, 2019; Hanrath, & Kottman, 2015; Kliever et al., 2016; Nichols et al., 2014; Perrin et al., 2014; Porat & Zinger, 2018; Promann & Zhang, 2015; Valentine, & West, 2016). These desktop usability studies are critical for improving the desktop experience of Primo. Usability studies on the CSU system implementation of Primo have informed consortial and local decisions to improve user experience through changes to the interface, but they have focused exclusively on the desktop interface (Dahlen et al., 2018; Jacobs et al., 2019). We found no published usability studies on the mobile interface of Primo or any other library discovery service.

Despite the dearth of literature on mobile discovery interfaces, usability studies have been published on mobile versions of library websites (Christiansen, 2015; Pendell & Bowman, 2012; Rempel & Bridges, 2013; Tidal, 2017) and a few on library-specific mobile apps (Miller et al., 2013; Wei et al., 2015). Since libraries often have direct control over their own mobile websites, unlike vendor platforms, these studies incorporate a wider variety of methods such as A/B testing and wireframes or other prototypes (Dahlen et al., 2018). Some of these studies also include multiple iterations, with modifications between the rounds of testing (Tidal, 2017). In recent years, libraries have been moving away from maintaining separate mobile sites as responsive design becomes the standard for web design (Rempel & Bridges, 2013). Ex Libris's Primo interface makes use of responsive design.

Most Primo usability studies use a task-driven user testing process, asking participants to find known items or perform other specific activities (Azadbakht et al., 2017; Brett et al., 2016; Galbreath et al., 2018; Hamlett & Georgas, 2019; Hanrath, & Kottman, 2015; Jacobs et al., 2019; Nichols et al., 2014; Perrin et al., 2014; Porat & Zinger, 2018; Promann & Zhang, 2015; Valentine, & West, 2016). Some have used other methods, such as surveys, interviews, event tracking/analytics, or a mixed methods approach (Hamlett & Georgas, 2019; Hanrath, & Kottman, 2015; Kliever et al., 2016; Perrin et al., 2014).

These studies discuss the ease of searching Primo, because most college libraries have a single search box on their website to search Primo, as well as significant difficulties participants encounter using Primo, especially related to the use of filters and limits, and actions such as emailing and saving records. Perrin et al. (2014) found that participants want all filters/limits/facets/search options in one place. Galbreath et al. (2018) and Kliever et al. (2016) reported that participants had difficulty using or understanding the purpose of filters. Galbreath et al. (2018), Hamlett and Georgas (2019), and Nichols et al. (2014) describe participants having great difficulty trying to determine how to email, save, or generate a citation for, an item they found.

Galbreath et al. (2018) expressly state the need for studies on the Primo mobile interface. This study will address a gap in the literature related to user experience of the mobile interface.

Methods

The sample for this study comprised 13 students from two campuses within the CSU system: CSU East Bay and Cal Maritime. Although the campuses are located in the same region, student populations at each campus vary by several measures, including size of student body; demographics such as gender, ethnicity and age; and degree programs offered.

Before conducting the study, we received Institutional Review Board (IRB) approval from both campuses. At each campus, we recruited students through a variety of channels. We posted recruitment flyers on library bulletin boards and at the reference desk. We added an entry to the library news blog and sent out a call for participants via the all-campus messaging system. We asked other instructors to mention the study in class or to forward email requests to their students on our behalf. We also asked students in person when they were already in the library and invited them to participate. CSU East Bay testing took place in November and December 2018, and testing at Cal Maritime took place in March 2019. Both campuses were using the New UI (user interface) version of Primo. Although Ex Libris updates the New UI with monthly releases, there were no discernible public-facing differences between the October 2018 release interface tested by CSU East Bay and the February 2019 release interface tested by Cal Maritime. On the larger campus of CSU East Bay, the most effective recruitment method was the all-campus messaging system, but on the smaller Cal Maritime campus, in-person invitations were the most successful. On both campuses, students were given a participation incentive of \$10 gift cards from Starbucks or Amazon upon completing their participation in the study.

For our usability tests, we were able to accept only the first 14 respondents to participate in the study because we were limited by the availability of only one librarian researcher per campus to administer tests, and by the number of incentives we could offer. Nonetheless, this sample size followed accepted industry practice of using a small sample to identify usability issues. According to Nielsen, “Testing with 5 people lets you find almost as many usability problems as you’d find using many more test participants” (Nielsen, 2012b). The purpose of this study is to evaluate the mobile interface of Primo, so we focused more of our participant tests on the mobile version. We used only a few desktop tests as a comparison group since usability testing of the desktop interface of Primo has been thoroughly documented, as illustrated by our literature review. The researcher at CSU East Bay conducted six mobile tests and five desktop tests, and the researcher at Cal Maritime conducted three mobile tests, with a total of nine mobile tests and five desktop tests. Due to technical issues, only four of the desktop tests were usable for analysis.

We wanted to see how students would accomplish tasks that they often need to do, so we designed assessment tasks based on our experience working with students at the reference desk. All participants were given the same tasks to perform (see Appendix 2). One of the main differences between the Primo desktop and mobile interfaces is the location of search limits. We wanted to see if test participants would find and use the filters in Primo mobile, so we developed some tasks that are most efficiently accomplished by using search limits. The first set of three tasks prompted the participants to find peer-reviewed articles about climate change. The second set of three tasks instructed participants to find a book about terrorism. We selected search topics that provided comparable results across both campuses, despite the differences in collection size and curricular focus.

Prior to each usability test, participants reviewed and signed a copy of the informed consent form and completed a brief anonymous pre-survey of demographic information (see Appendix 1). After completing the pre-survey, we gave verbal instructions to the participants emphasizing that the purpose of the study was to evaluate the interface, not the participants. We asked participants to explain out loud the actions they were taking as they completed the tasks, encouraging them to clarify their thought process as well. Since talking out loud about their thoughts and decisions is not natural to most people, we found it necessary to prompt for more explanation when the participants stopped narrating their choices or actions. In these prompts, we were careful not to ask leading questions that would reveal our personal familiarity with the Primo interface.

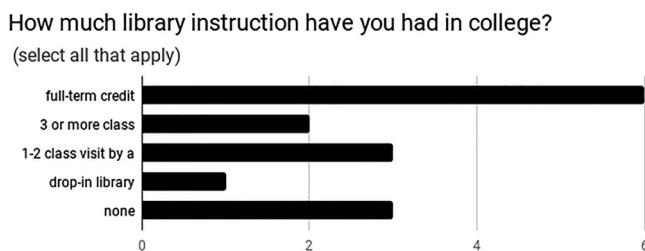


Figure 1. Amount & type of prior library instruction (n = 13).

During each usability test, the researcher facilitated the test session with each participant. The researcher videorecorded participants' screen interactions and verbal explanation for each session, which we later analyzed and coded. The desktop participants used library computers with Windows operating systems and Chrome browsers to complete the tasks. Three mobile participants used the library's device (iPhone using Safari) and six mobile participants used their own device, using the operating system and browser of their choice. For each of the six tasks that participants were asked to complete, we rated their task completion as "easy", "struggled", or "failed". We assigned "easy" when the participant completed the task quickly and with no difficulty at all, whether or not they used search limits and Primo functions to complete the task. "Struggled" indicates the participant completed the task, but took a while to complete it, perhaps going down a dead end before successfully completing the task. We assigned "failed" when the participant did not complete the task fully.

Findings

Pre-survey data

Our sample included students who had a variety of experience levels with library services. The pre-survey included their class standing, amount of prior library instruction, frequency of Primo use, and preferences for browser and mobile device operating system.

Most participants (10) were in the third or fourth year of their undergraduate degree, with two in their first or second year, and one graduate student. When asked how much library instruction they had received in college, six of the participants reported taking a full-term credit course, two reported several (three or more) class visits by a librarian, three reported one or two class visits by a librarian, one had attended a drop-in library workshop, and three participants had not received any library instruction (see Figure 1). Some participants selected multiple options that applied to their situation, which is why the responses in Figure 1 total more than the number of participants. An uncommon attribute that CSU East Bay and

How often do you search Primo on a desktop or mobile device?

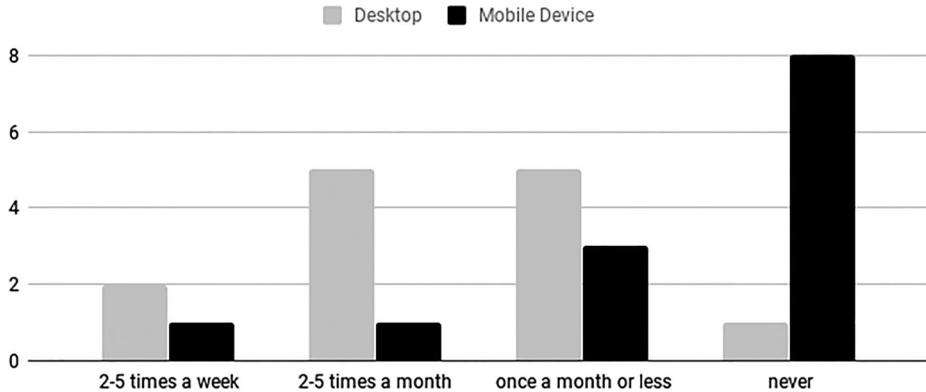


Figure 2. Frequency of Primo use on a desktop or mobile (n = 13).

Cal Maritime share is a required information literacy credit course for some of the student body, so the responses to that question may seem unusually high compared with other institutions.

Participants reported varying experience levels searching Primo, with a marked difference between the frequency levels for desktop versus mobile device. For the desktop-related responses, two participants reported searching Primo very frequently, 2–5 times per week. There were five responses for each of the medium-low-frequency categories of 2–5 times per month and once a month or less. Only one participant reported never searching Primo on a desktop. In contrast, there were only a handful of participants reporting any level of experience searching Primo on their mobile devices, one at 2–5 times a week, one at 2–5 times a month, and three at once a month or less. The majority of the participants (eight) had never searched Primo on their mobile devices. None of the participants responded that they searched Primo every day on either type of device (see [Figure 2](#)). The self-reported low level of mobile use from this pre-survey corresponds with our findings in our previous study (Adams et al., 2018).

We asked participants which browser they use most frequently, and what type of operating system they use on their mobile devices. Chrome was the most popular browser among participants, however, the responses did not indicate whether this referred to mobile or desktop use. Apple's iOS was the most prevalent operating system on participants' mobile devices. These questions were intended to help us observe any variations on the mobile interface using multiple combinations of browsers or operating systems. Although participants did not all use the same operating system and browser, no significant differences in the Primo interface were observed among browsers or operating systems that had any impact on user experience during testing.

First task set: Articles

In Task 1, we asked participants to use a browser to go to the library website and search for climate change in Primo. At both campuses, the Primo search box can be found on the library homepage. Unsurprisingly, all but one participant completed this task easily. One mobile user struggled to find the search box on the CSU East Bay website, because users need to scroll down to find it, and the participant clicked on various links before scrolling down enough. **This revealed a usability issue for the responsive design version of the Library homepage on mobile devices that had not previously been identified, independent of the Primo interface.**

Students frequently ask for help at the reference desk finding a specific number of peer-reviewed articles to fulfill assignment guidelines. To test Primo usability for this common task, in Task 2, we asked participants to identify and select three relevant, peer-reviewed articles on climate change. We were curious to see whether participants would make use of search limits, since search limit locations are a primary difference between the mobile and desktop interfaces of Primo.

On the desktop interface of Primo, there are two locations where the user can limit search results (see [Figure 3](#)). An Advanced Search option can be expanded by clicking a text label that appears next to the simple search box. Additionally, a variety of other filters is displayed on the left side of the screen under a label that is customizable at the campus level. CSU East Bay invites users to “Refine My Results,” while Cal Maritime’s label invites users to “Focus My Results.”

At the time of testing, these two search limit areas were also available in the mobile interface, but they were not displayed by default (see [Figure 4](#)). The mobile Advanced Search option expanded from the top right, with a slider icon that was familiar to some study participants. What was usually found on the left side of the desktop interface was collapsed at the bottom of the mobile interface. It could be expanded by clicking a funnel icon with a campus customizable label (see [Figure 5](#)).

Not all participants used limits to complete the task of selecting peer-reviewed articles. Seven mobile users completed this task easily and two struggled to complete it. Five of the mobile participants who completed the task easily did not make use of any search limits, because the results were highly populated with peer-reviewed articles, and they were able to scroll through the first 10 results and identify peer-reviewed articles by the format label displayed for each result (see [Figure 4](#)). Two of the mobile participants who completed the task easily applied search limits: one selected the “Articles” material type from Advanced Search and one expanded the mobile filters menu and used the “Peer-reviewed Journals” filter. The two who struggled clicked on Advanced Search, which offered material type

The screenshot displays the Primo search interface. At the top, the search bar contains the query "climate change" and the location "Maritime Academy Collections". The "ADVANCED SEARCH" button is highlighted with a red box. On the left side, a sidebar contains several filter categories: "Search Books & Media at other CSU libraries:", "Focus my results", "Sort by Relevance", "Available at Maritime" (with sub-filters like "Available in the Library (326)", "Peer-reviewed Journals (688,084)", "Full-text online (1,228,720)", "Open Access"), "Format" (with sub-filters like "Articles (808,566)", "Newspaper Articles (328,834)", "Text Resources (29,665)", "Reviews (17,142)", "Book Chapters (13,110)", "Show More"), and "Year" (with "From 1700" and "To 2019" and an "Apply" button). The main results area shows five items: 1. BOOK "Climate change" ©2008 with "Online Access"; 2. ARTICLE "Climate change" by Hodson, R. (Nature, 11 October 2017, Vol.550(7675), p.S53) with "PEER REVIEWED" and "Find full text"; 3. ARTICLE "Climate change" by Weart, S.; Cicerone, R.; Gleick, P.; Oreskes, N. (Proceedings of the National Academy of Sciences of the United States of America, 24 June 2014, Vol.111(2), pp.9340-9345) with "PEER REVIEWED" and "Find full text"; 4. BOOK "Climate change: global risks, challenges and decisions" by Richardson, Katherine (2011) with "Online Access"; 5. BOOK "Climate Change: What It Means for Us, Our Children, and Our Grandchildren". The "PAGE 1" indicator is visible at the bottom right.

Figure 3. Desktop interface of Primo results, showing Advanced Search and filters locations.

limits such as “Journals” or “Articles” and these two participants selected “Journals” which retrieved journal-level records rather than articles (see Figure 6).

Two desktop users completed this task easily and two struggled. One of the two who struggled went to Advanced Search and had the same confusion as some mobile participants about journals versus articles. The other desktop user who struggled found the peer review filter on the left-side bar, but then re-loaded the search, which wiped out the peer review filter. **Currently, when one does a new search in Primo, any filters that were selected (e.g. peer review, date limit) are cleared and the user has to re-apply the filters post-search.** Ex Libris announced in July 2019 that it would develop “sticky filters” that allow a searcher to maintain filters when modifying the search, but the feature was not available at the time of this study.

Student researchers may not have time to read research materials at the exact moment they find them, so saving items to read later is often a necessity. For Task 3, we wanted to find out what techniques students use to save articles from Primo. Task 3 proved to be the most challenging for

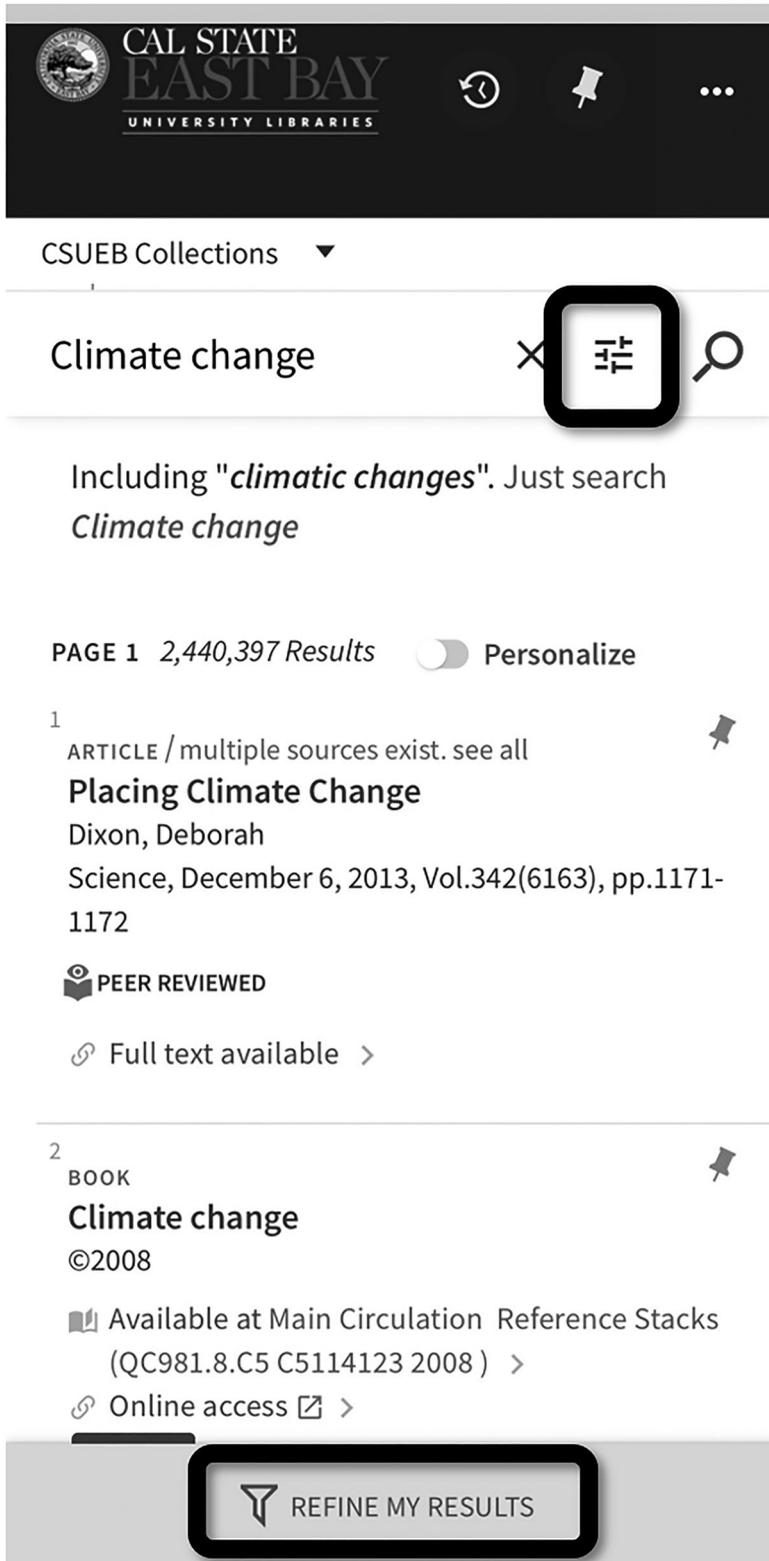


Figure 4. Mobile interface of Primo results, showing Advanced Search slider icon and funnel icon for filter menu.

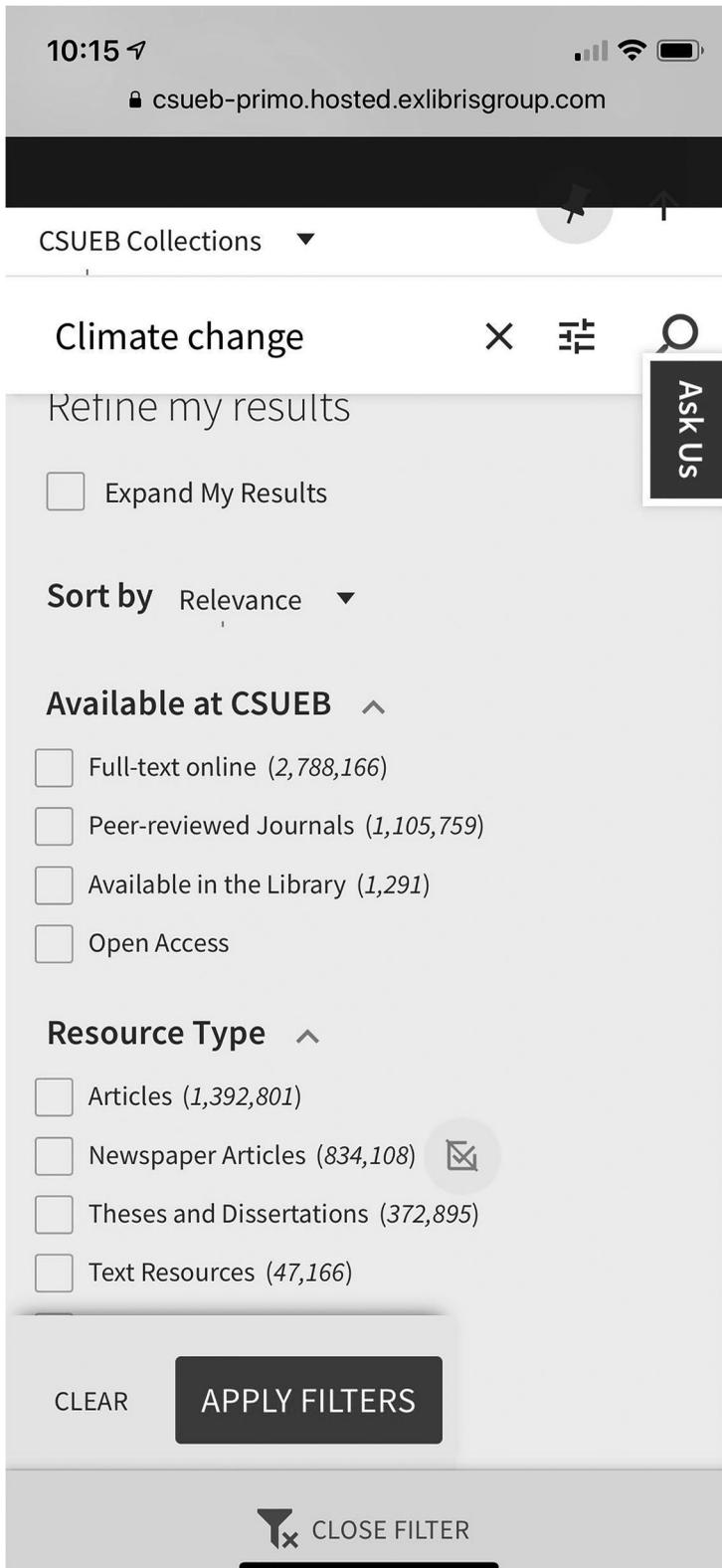


Figure 5. Mobile filters menu expanded.

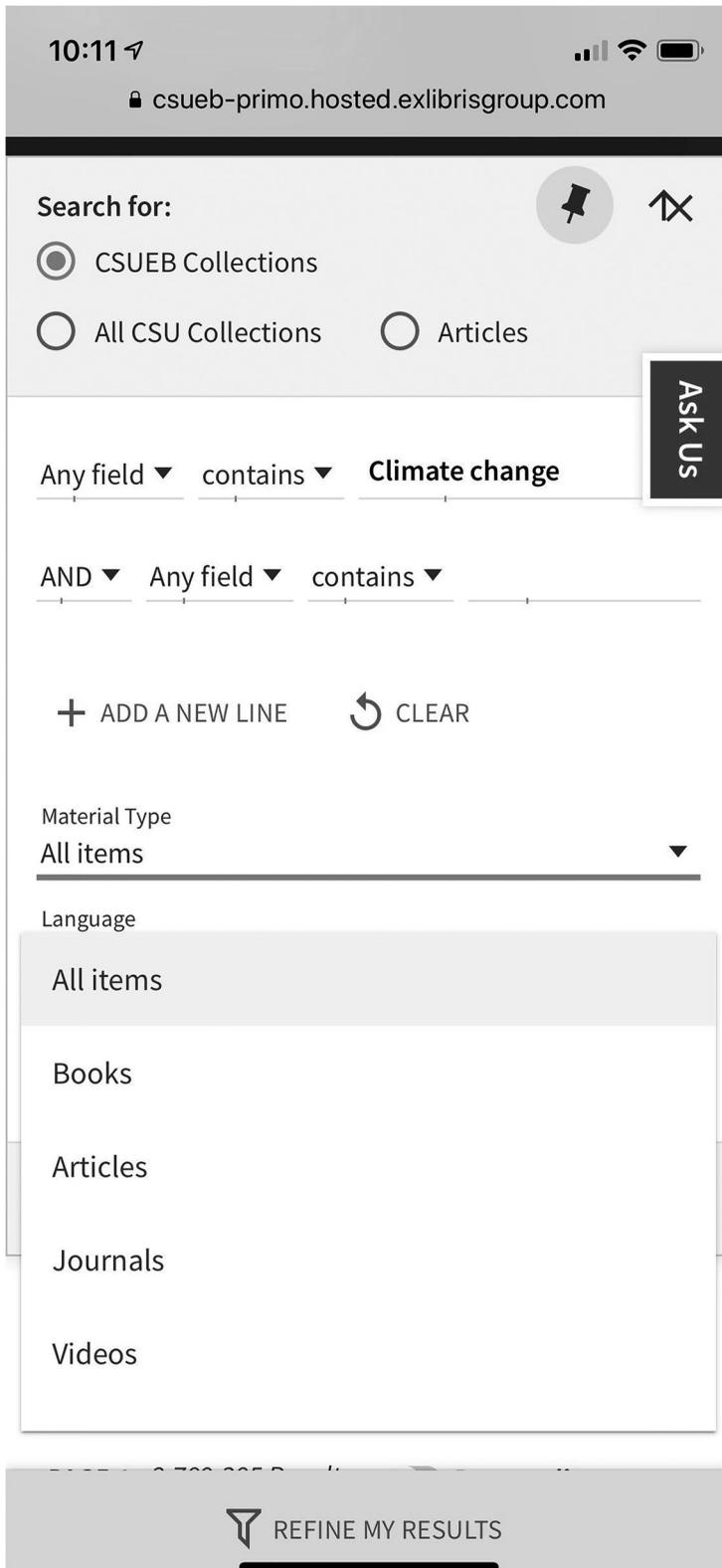


Figure 6. Mobile Advanced Search expanded.

mobile users. This task required participants to save three articles so that they could read the full text later, using a method of their choice. One mobile user easily completed this task, one struggled, and seven mobile users failed in saving the articles for later reading. The mobile user who easily completed the task used Primo's "pin" function (see [Figure 7](#)) and logged in to Primo to save the articles. Pinning is the method in Primo to create a list of items. The mobile user who struggled with this task pinned the articles, looked in several places before eventually finding the pinned items list, then used Primo's email function. Six of the mobile users did not successfully complete this task. They started by pinning items, but either looked unsuccessfully for the pinned list or stated that they assumed the pinned list would be saved for later. **Unless users email, print, download to a citation manager during the search session, or log in to their Primo account to save items, the search session will time out, losing search results and any temporarily pinned items.** One mobile user who failed to complete the task clicked through to the articles within the hosting databases such as EBSCO, then pasted the session-specific web address from the URL bar into a Google Doc, which is not a permanent URL.

All four desktop users easily completed this task. In contrast to the mobile users, desktop users opened the item records and saved items for later from within the record, instead of the results page. Two emailed the article records individually to themselves, and two explained they would download the full text PDF immediately if they were using their computer.

Second task set: Books

After the participants completed the tasks related to finding articles, we asked them to find a print book on terrorism published in the last five years (see [Appendix 2](#)). We let the participants determine how they would approach completing this, and in the post-test analysis we evaluated the participants' performance on three conceptions of the task. Task 4 is finding a book on terrorism; Task 5 is finding a book on terrorism published in the last five years; and Task 6 is finding a book on terrorism published in the last five years on the shelf in the library.

Seven mobile users easily completed Task 4 (finding a book about terrorism) by limiting the material type to books in Advanced Search, while one mobile user struggled and one failed. The one who struggled said they knew there should be a way to limit results to books, but had a hard time finding the books filter. However, they eventually found it in Advanced Search (see [Figure 6](#)). The participant who did not complete this task failed to find the filters because they were hidden, preventing them from knowing that limiting to books was an option. They "loaded more results" (Primo

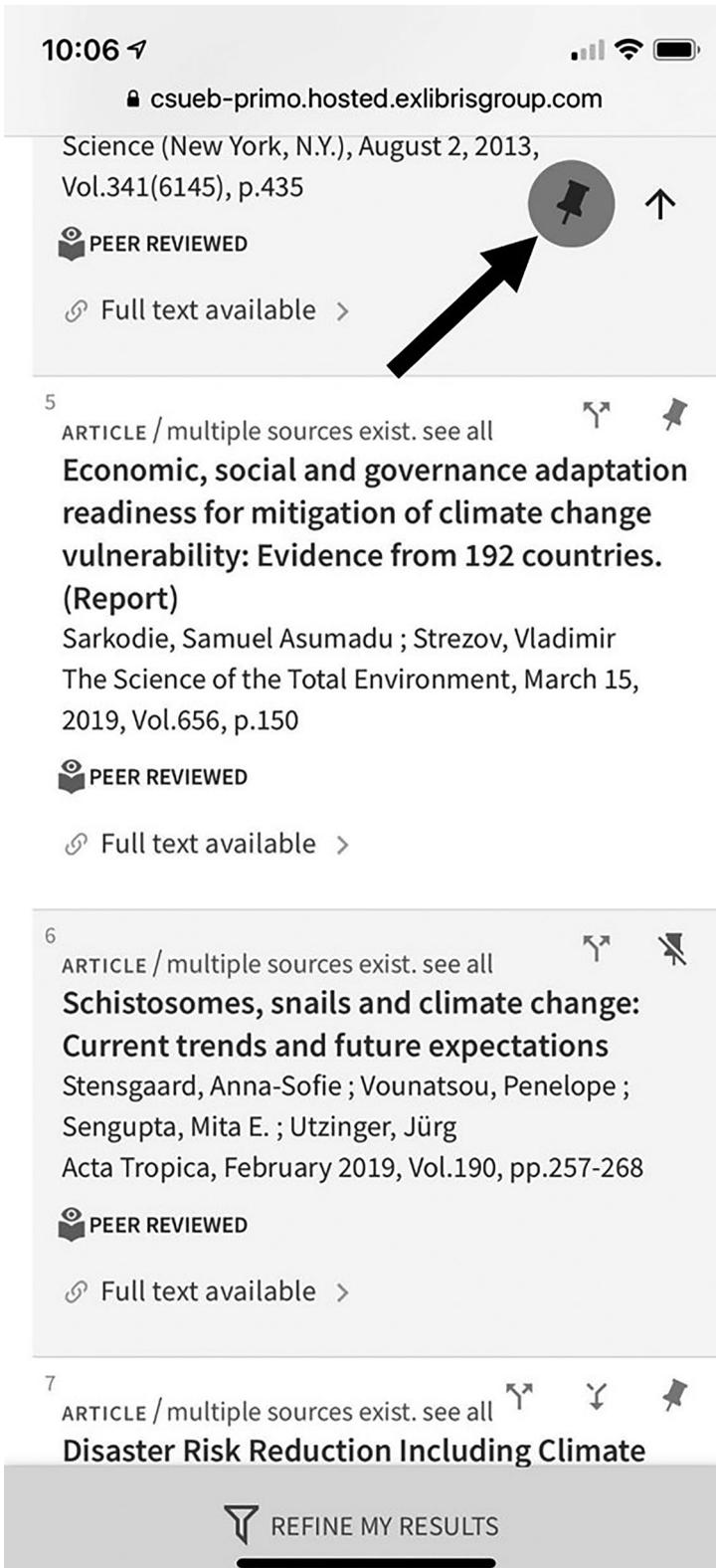


Figure 7. Pinning items in Primo mobile.

terminology for displaying the next 10 results) three times and then gave up, because the first 30 results were all articles.

Three desktop users easily completed Task 4 and one failed. One desktop user failed because the “books” filter was hidden. **The filter side bar displays the top five resource types, such as article, video, etc. One needs to click “show more” to see the other options.** This participant selected a resource type “text resource,” which in fact removed all the books from the results. **“Text resource” is a miscellaneous resource category for all text-based resources that are not books or articles.**

Many research topics require current information, so **we wanted to discover what techniques participants would use to find recent books.** Task 5 (finding a book on terrorism published in the last five years) was overall an easy task for both mobile and desktop users. Seven of the mobile users easily limited by date, using Advanced Search (see [Figure 8](#)). One mobile user struggled to find the date limit, but eventually found it in Advanced Search. One mobile user failed to find the date limit because it was hidden and the **relevancy ranking offered older materials before newer ones.** Three out of the four desktop users easily limited by date, while one struggled before finding the date filter on the left-side bar. **No participant used the sorting by date function to accomplish this task.**

Students sometimes prefer physical books, yet Primo results are often populated with online materials. **Primo does not provide a specific filter for physical books, so we designed this task to understand how students might find them.** Task 6 (finding a print/hard copy book, not ebook) proved difficult for mobile users. Like many university libraries, our campuses have an increasing number of ebooks, which dominate results lists. In order to avoid ebooks overwhelming the results, using filters is most efficient. Four mobile users struggled with this task, and five mobile users failed. The four who struggled scrolled and clicked in various places before eventually finding the filters, which are hidden behind the funnel icon at the bottom of the results (see [Figure 9](#)). Two of the participants used the “Available in the Library” filter, and two switched to the consortial results, which displays results for physical books and media from all campus libraries in the CSU system. The five who failed at this task scrolled through multiple pages of results before giving up without finding any physical books. Two of these participants experienced **issues relating to labeling. Some e-resource records stated “online access” and some stated “full text available.”** These two participants incorrectly assumed that “full text available” referred to physical items.

For desktop users, two easily found the “Available in the Library” filter. One struggled, but eventually found it. The participant who failed on this task was unable to complete it because they never found the books filter in Task 4.

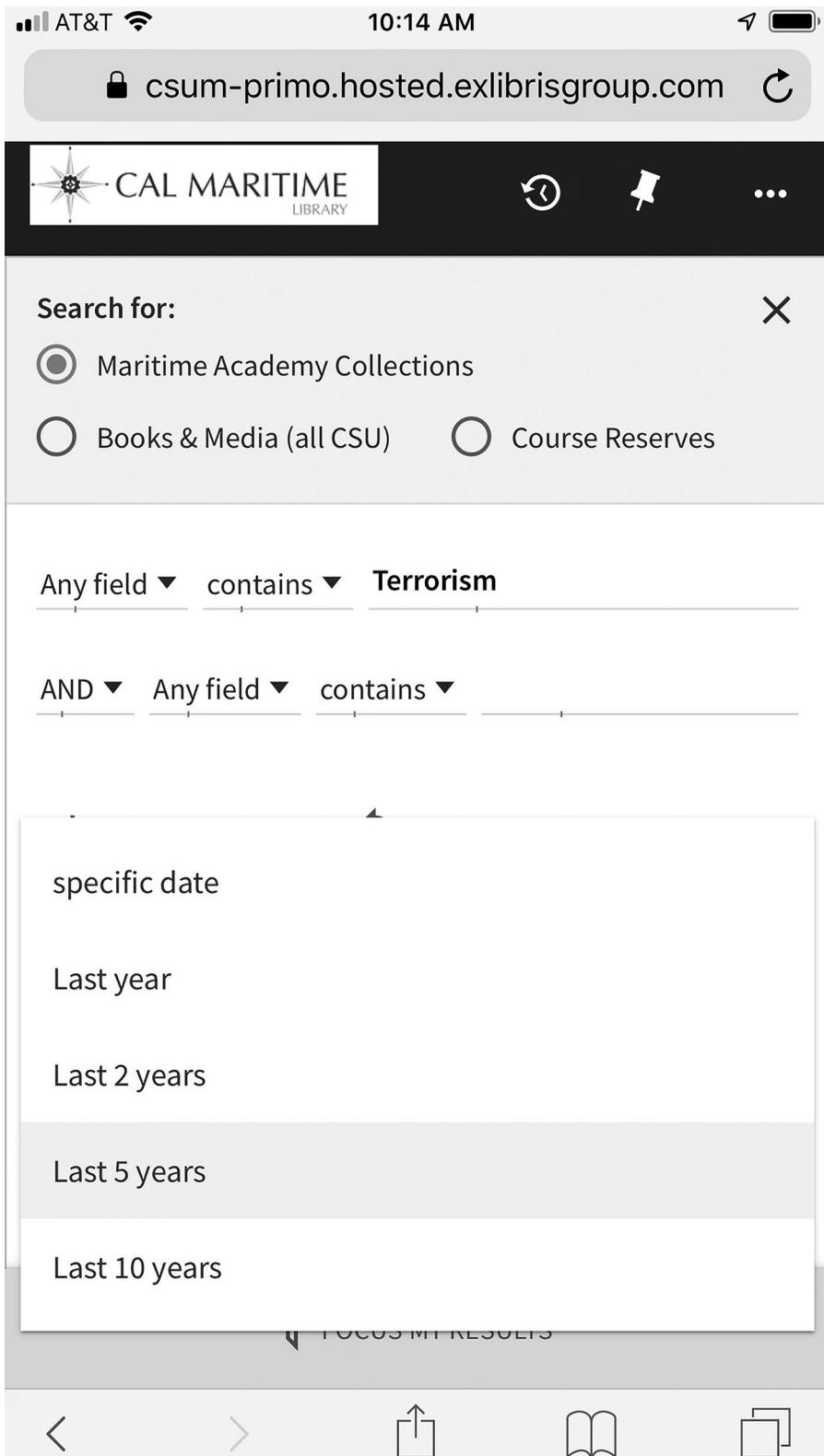


Figure 8. Date limit expanded in mobile Primo Advanced Search.

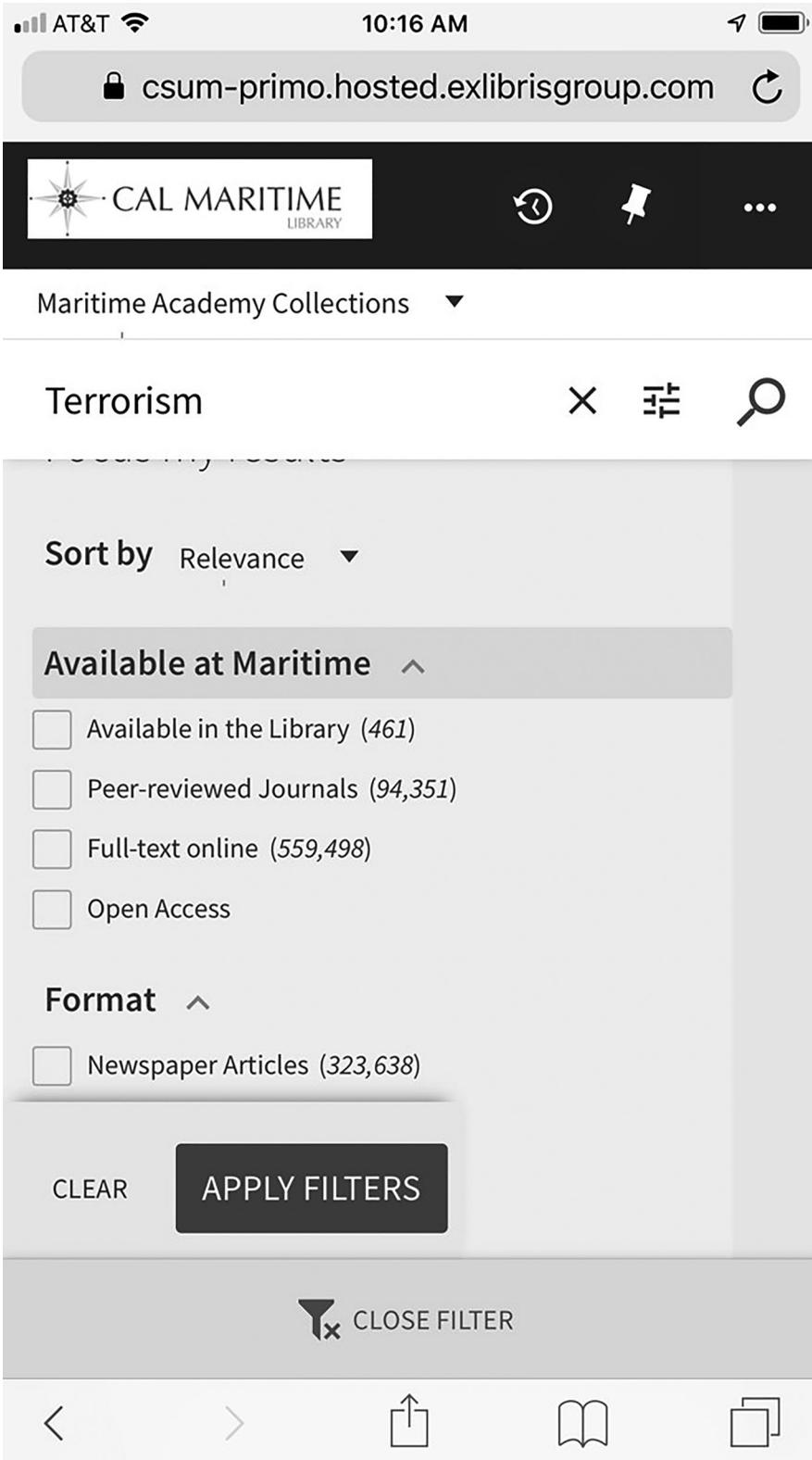


Figure 9. Primo mobile "Available in the Library" filter expanded from bottom filter menu.

Task Completion - Mobile Participants

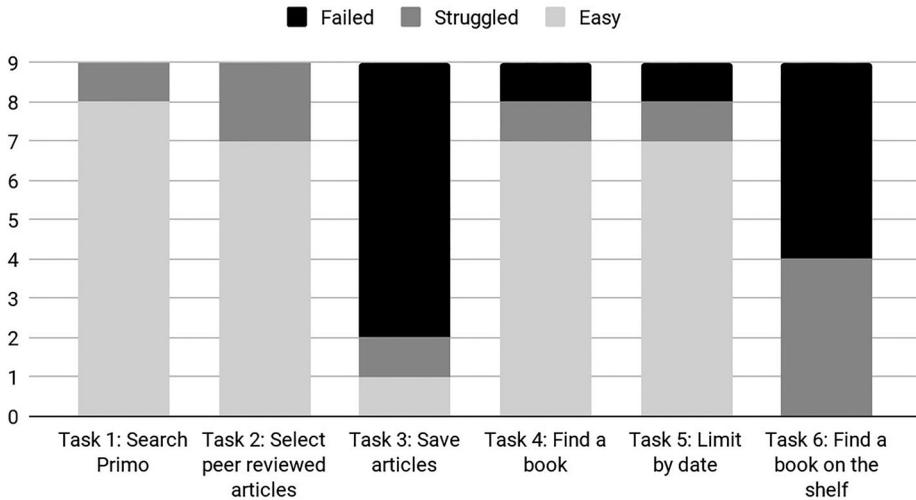


Figure 10. Task completion rates for mobile participants ($n = 9$).

Figures 10 and 11 show the task completion rates for mobile and desktop participants. This visual comparison highlights the differences between mobile (Figure 10) and desktop (Figure 11) completion rates, which are most significant for Tasks 3 (saving articles) and 6 (finding a book on the shelf).

Our final question asked participants if something happened that they did not expect during any of the tasks. **There were two significant comments that came from more than one participant.** Four mobile participants were surprised by how difficult it was to filter for books on the shelf. They expressed frustration that one cannot filter for physical books in Advanced Search. The other comment related to there being two places to focus your results (filters and Advanced Search). Two mobile participants were surprised and expressed confusion that there were two places to go to modify their results.

Discussion

For some of the tasks, the difference between the mobile and desktop interfaces did not affect the participants' success. Most participants, whether desktop or mobile, successfully selected peer-reviewed articles (Task 2) because peer-reviewed articles dominated the search results and are clearly indicated as peer-reviewed in the results list. Most limited to books easily (Task 4), as well as books published in the last five years (Task 5).

When there were differences in completion rates between the mobile and desktop users, the desktop users were overall more successful. There was

Task Completion - Desktop Participants

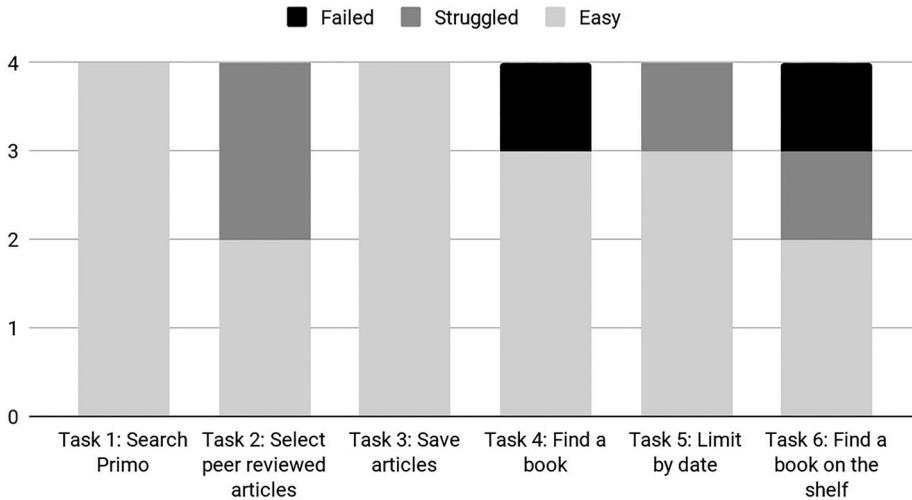


Figure 11. Task completion rates for desktop participants (n = 4).

no task that was consistently difficult for desktop users to complete, while mobile users found two of the tasks very challenging to complete. First was saving items to read later (Task 3). One mobile user completed this task with ease, one struggled, and seven failed. In contrast, all desktop users completed this task with ease. Secondly, finding a book on the shelf (Task 6), four mobile users failed and five struggled. By comparison, desktop users had a mixed level of success: two completed this task easily, one struggled, and one failed.

We noticed commonalities when participants struggled or failed that contribute to our recommendations below. Although search limits were not required to complete the tasks, they would have been the most efficient means to success. We observed that many of the mobile users wanted to use search limits to complete the tasks, but had trouble finding them. Research has shown that students utilize facets to a varying degree, depending on what search platform they are using and how it is configured (Dahlen et al., 2020). We found that participants were confused that there were two separate places to add limits (Advanced Search and filters). One study participant from the mobile group stated, “There are two different sections to change your search results... change that so it’s all one thing instead of having two separate.” This is consistent with the desktop users that Perrin et al. (2014) studied. They found that “most of the users wanted all their search options in one place” (p. 66).

Since the current study was conducted, the February 2020 Primo New UI release has updated the location of the search limits. The Advanced

Search has moved from the right side of the search box to a menu located behind an ellipsis in the top banner. The funnel icon representing filters has moved from a bottom bar to the upper right, under the search box. **Although the search limit locations have been updated, there are still two separate locations for search limits.**

Multiple options were available to complete Task 3, saving articles to read later, and Primo's pin function proved a popular choice among mobile users. However, several participants did not realize they needed to do something further after pinning an item for reading later, such as log in to save the pinned items to their account or email the pinned item records. This finding is consistent with previous studies of desktop users who did not notice the email or pinning function (Galbreath et al., 2018; Hamlett & Georgas, 2019; Nichols et al., 2014) even though all our desktop users succeeded with this task. **Primo does not automatically prompt users to log in when they pin items, unlike other online services that students are accustomed to using, such as Google Scholar.** One mobile user expressed concern about whether pinning the article really saved it. They wished that Primo gave a visual cue, like when they save something in Facebook, and it indicates immediately that it is successfully saved for later. Another mobile user stated as they were using the pin function, "I'm assuming this is to save it and pin it for later."

Participants had difficulty with Task 6, limiting to print books. Currently, there is no simple way to limit to either ebooks or print books. Users familiar with the interface, such as librarians, have developed workarounds such as combining filters for books and physical or online items. To limit search results to ebooks, users can limit to books combined with the full-text online filter. **Limiting to books in combination with the "Available in the Library" filter eliminates any physical books that are currently checked out or otherwise unavailable, and thus does not provide a comprehensive list of physical books.**

Students are familiar with a wide variety of online interfaces and have become accustomed to common practices in navigation and design. For this study, our comparison group was usability studies which examined Primo desktop since there is a lack of published studies surrounding Primo mobile usability. Another comparison group could include commercial websites which students use on a regular basis. Beyond the library's resources, Amazon and Google Scholar are two widely used platforms that students use to find textbooks, research articles, or other items. **A comparison of elements of the mobile interfaces of these sites might offer additional context for the search landscape that students are familiar with.** Providing a consistent experience might help students complete their research tasks more easily.

Regarding search limits, on the mobile websites (not apps) of both Amazon and Google Scholar, filter options appear after conducting a search. Filters are available from the top-right corner under the search box for both mobile platforms. **At the time of our testing, Primo mobile's search filters were at the bottom of the screen, which rendered them invisible to several test participants.** We are relieved that the search filters have moved since our testing to the top right, consistent with other interfaces.

When saving items to access later on Amazon's mobile website, users can save items to a shopping cart without logging in. Items are saved even after the mobile browser window is closed through the use of cookies, which is a common practice that users have come to expect and may explain why our study participants expected their pinned items to be saved without further action. We do not recommend the use of cookies out of concern for patron privacy. On Google Scholar mobile, users can click the star button (similar to Primo's pin) to save items to "My Library" within a Google account. Once a user clicks the star button, the screen is filled with a prompt to log in. By contrast, Primo mobile allows users to add items to a list via pinning directly from the result list or within an item record, but it is not clear to users that their pinned lists are temporary and will be lost without logging into their library account.

Recommendations

Based on our findings we offer the following recommendations for usability design changes. **The first three recommendations below would have to be implemented by Ex Libris, and the final recommendation is for implementation at the consortial level:**

Recommendation 1

We recommend that the **mobile interface have only one place to apply search limits.** Most mobile users recognized and expanded the slider icon, which indicated the Advanced Search area in the top right corner, so we suggest that all mobile search limits be included under that area. Search limits are available in two locations, which have different and overlapping limits: Advanced Search and the filters area.

Rationale

Mobile users were confused by these two locations and did not see search limits they were actively seeking. Although Ex Libris has updated the locations of these two limits since our testing, the search limits are still

separated into two areas and the Advanced Search is now more difficult to find.

Recommendation 2

We recommend making it obvious that users need to take an additional step to save items for later. This could take the form of a prompt to log in or email records after pinning items.

Rationale

Participants assumed simply pinning items would save them for later.

Recommendation 3

We recommend the addition of a single filter to provide a comprehensive list of print books or ebooks.

Rationale

Students often have a format preference for books. Giving them an easy way to filter for physical books or ebooks would be useful. Four mobile users expressed surprise that they could not limit to books on the shelf using Advanced Search. They failed to figure out the combination of material type (books) and physical location (“Available in the Library”) filters, which is currently the only way to limit to physical books, even though it is not comprehensive, as checked out books are not included.

Recommendation 4

We recommend using consistent language at the consortial level for record-level access labels that appear in the results list brief display.

Rationale

Since filters are hidden in the mobile interface, mobile users rely heavily on the information visible from the results list. Two mobile users were confused that some records indicated “online access” and others indicated “full text available” and incorrectly assumed that “full text” must refer to physical books.

Limitations

In keeping with usability test practice, our test participant group was small. This allowed us to identify key usability issues among our campus user groups, but they are not necessarily generalizable. With our limited budget

for participant incentives, we focused testing on mobile users, leading to an uneven distribution between mobile and desktop user groups, which complicates any comparisons between the two user groups.

Technical issues caused one desktop participant's test to be unusable, reducing the desktop user sample size. Zoom was used to record audio and screen capture, but the recording was corrupted. Additionally, some participants used their own devices and some used library devices, which might have contributed to unfamiliarity with a device or browser.

Conclusion

Our findings indicate there are some usability issues with Primo mobile that could be addressed. Often, in usability studies, researchers are able to make updates to a website interface that they can evaluate again to continue the assessment cycle. Although individual libraries in the CSU system can make minor customizations, the Primo interface is controlled centrally by Ex Libris and libraries are not able to make major revisions on a large scale. Instead, research, such as the current study, can be provided to Ex Libris as evidence for suggested improvements. We plan to share our recommendations with Ex Libris through channels available through the CSU system and the Ex Libris Idea Exchange forum.

The overall number of search sessions on mobile devices at our two campuses has increased since Primo's implementation in 2017. However, as a percentage of total search sessions, mobile devices consistently remain around the 5% mark over the past two years. We designed this study to identify usability problems specific to the mobile interface, and we assume that an improvement in user experience could increase mobile usage.

The question remains: Why do such a small percentage of Primo search sessions originate on mobile devices when mobile devices are such a ubiquitous tool for college students? Usability is one aspect of usage decisions by students, but there are other possible factors that could lead to the low mobile usage of Primo. Further study is warranted into alternative considerations, such as student research practices and preferences.

The current study provides a snapshot in time, and so there is a need for continuous usability testing as interfaces and user expectations change. Although our small sample size does not lead to generalizable results, this study sets the groundwork for future research into the usability of mobile library discovery search interfaces. We recommend further research in Primo usability, especially as Ex Libris implements updates. We look forward to reading further studies on Primo that address this question and continue to study future iterations of the mobile interface.

Notes on contributors

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Appendix 1. Pre-survey

Campus

1. What is your current class standing?

- First-year
- Sophomore
- Junior
- Senior

2. How much library instruction have you had in college?

- Full-term course for credit
- 1–2 class visits by a librarian
- 3 or more class visits by a librarian
- Drop-in library workshop
- None

How often do you use OneSearch on a computer? [campus-specific screenshot]

- Every day
- 2–5 times per week
- 2–5 times per month
- Once a month or less, but at least once before
- Never

How often do you use OneSearch on your phone? [campus-specific mobile screenshot]

- Every day
- 2–5 times per week
- 2–5 times per month
- Once a month or less, but at least once before
- Never

What browser do you use most frequently?

- Chrome
- Safari
- Firefox
- Internet Explorer / Edge
- Other _____

What type of operating system do you use on your phone?

- Android
- iOS
- Other _____

Appendix 2. Script for usability tests

As you carry out these tasks, please explain out loud the actions you're taking and why. [The researcher may prompt for more explanation if the participant stops narrating their choices or actions.]

Use a web browser to go to [campus library URL]. On that page, use OneSearch to search for [Climate change]

Select 3 relevant Peer-reviewed Journal Articles on climate change. Identify them out loud by title or author to the librarian.

Explain out loud why you picked those three.

Save the articles to easily access the full text to read later, explaining your process out loud.

Search OneSearch again for the topic [terrorism].

Find a print/hard copy book (not ebook) on terrorism available on the shelf published within the past five years. Explain your actions as you go.

During any of those tasks, was there something that happened that you didn't expect?