Student Perceptions and Use of Mobile Devices for LIS Coursework: Implications for Educators

Michael Stephens, Nikki Rudiger, and Debbie Faires

This study offers insights regarding the use of mobile devices by students to help educators in Library and Information Science (LIS) and across disciplines better understand their current and potential use. Using a web survey and descriptive content analysis methods, this article reports student perceptions of the role mobile devices play in LIS coursework, identifying areas where the technology is effective, providing recommendations regarding creative enhancements to course delivery, and offering insights for instructors into mobile-friendly course design and pedagogy. The data in this study indicate that current LIS students take their courses "on the go," moving easily between a formal learning setting to an informal one, and provide instructors with considerations for the multiple ways in which students may access course content and engage with others in their classes using mobile devices.

Keywords: higher education, LIS education, mLearning, mobile devices, online learning, pedagogy

In 2012, The New Media Consortium and EDUCAUSE published their annual *Horizon Report* (Johnson, Adams, & Cummins, 2012). The report identified mobile apps and tablet computing as key emerging technologies predicted to make an impact on higher education teaching and learning in the coming years, noting that "people expect to be able to work, learn, and study whenever and wherever they want to." Many people have now incorporated mobile devices fully into their lives. Educators should be curious, then, as to how students in the university setting might be using their devices to access course materials, collaborate with peers, and complete coursework.

This article offers insights regarding the use of mobile devices by students to help educators in Library and Information Science (LIS) and across disciplines better understand their current and potential use. It evaluates student perceptions of the role that mobile devices play in LIS coursework, identifying areas where the technology is effective, providing recommendations regarding creative enhancements to course delivery, and offering insights for instructors into mobile-friendly course design and pedagogy.

About the School of Information

This exploratory study surveyed current MLIS students at San José State University (SJSU) School of Information. The Master's

KEY POINTS:

- A study of student perceptions of using mobile devices in LIS coursework illustrates various ways in which instructors might enhance courses for mobile access.

- Current LIS students take their courses "on the go," moving easily between a formal learning setting and an informal one—learning everywhere—and incorporating learning into real life.

- Mobile devices and applications in the cloud can be useful for giving students practical and creative experience across multiple channels throughout their LIS coursework.

program has been 100% online since 2009. Every student begins the program with a required course, "Online Learning: Tools and Strategies for Success." In this course, students are introduced to many of the technologies they will use in their studies. Students continue with a few other required courses as well as several electives.

Literature review

A review of applicable research concerning mobile devices, the concept of mLearning, and student use of those devices helps to set the stage. A theoretical framework, the Technology Acceptance Model, provides a lens to understand perceptions and uses of mobile devices in LIS education.

Mobile devices and use

The popularity of mobile devices as information and communication tools has grown exponentially in recent years. Pew Research Center (2019a, 2019b) reported that the vast majority of Americans (96%) now own a cellphone of some kind and 37% of US adults say they mostly use a smartphone when accessing the internet. Many are connected often: "Among mobile internet users—the 86% of Americans who use the internet at least occasionally using a smartphone, tablet or other mobile device—92% go online daily and 32% go online almost constantly" (Pew Research Center, 2019c, para. 2).

Defining mobile devices

For the purposes of this study, we define mobile devices as smartphones or tablets. In their research on digital mobile devices in higher education, Sevillano-García and Vázquez-Cano (2015) specify inclusion of tablets and smartphones (but not laptops). Crompton and Burke (2018) specifically excluded laptops from their definition of mobile devices. The more recent report by Clinefelter, Aslanian, and Magda (2019) includes tablets and phones as part of the study's definition of mobile devices.

Mobile devices in higher education

In higher education, mobile devices are often noted as having an impact on teaching and learning. Historically, the NMC Horizon Report, from EDUCAUSE Learning Initiative and The New Media Consortium, ranked mobile technologies as leading-edge tools for 2010, 2011, and 2012 (Johnson, Levine, Smith, & Stone, 2010; Johnson, Smith, Willis, Levine, & Haywood, 2011; Johnson et al., 2012). Gikas and Grant (2013) noted that mobile device use in higher education was in its infancy at that time, while a more recent study by Educause (Brooks & Pomerantz, 2017) found that "at least 19 of 20 students own a laptop or a smartphone, and 3 in 10 students own a laptop, a smartphone, and a tablet" (p. 5.).

mLearning

Definitions of mLearning typically combine the concepts of the use of mobile devices with the activity of learning (Crompton & Burke, 2018; Pedro, de Oliveira Barbosa, & das Neves Santos, 2018; Sharma & Madhusudhan, 2017). Miraz, Ali, and Excell (2018) posit that mLearning "may simply be defined as facilitating E-Learning through the use of any mobile

or handheld devices" (p. 47). Some researchers specifically incorporate the elements of "any-time, anywhere ubiquitous learning" (Hung & Zhang, 2011, p. 3) as part of the definition, while Crompton (2013) includes additional facets of "social and content interactions" (p. 4.).

Earlier research studies on mLearning focused largely on studying its effect on student achievement and impact on student attitudes (Chee, Yahaya, Ibrahim, & Noor Hasan, 2017; Crompton & Burke, 2018). Pedro et al. (2018) agree with Gikas and Grant (2013) that "much of the literature has been focusing on the affordances of mobile devices to replicate old methods, strategies, and practices that are mainly teacher-centered and trans-mission-oriented" (p. 4). There is a need for further research on pedagogical issues and mLearning design (Crompton & Burke, 2018; Pedro et al., 2018).

mLearning supports both formal and informal learning by going beyond the classroom or desktop/laptop computers, creating the opportunity for students to access and apply content while "on the go" as well as develop technology skills. Gikas and Grant (2013) examined "authentic learning on the move" (p. 20), which enables what Brown and Mbati (2015) described as opportunities for "small components, activities or events within any mode of delivery" (p. 118). Utilizing mobile devices also encourages the "transferability of skills to personal, social, academic, and professional contexts and, thus, being able to create an effective foundation for life-long learning" (Sevillano-García & Vázquez-Cano, 2015, p. 106). This integration helps to "tear apart the existing barrier" between real life and formal learning (Pedro et al., 2018, p. 5).

mLearning and collaboration

Mobile devices support communication and collaboration among learners (Gikas & Grant, 2013). Students use mobile devices to organize and share information to complete group projects (Wai, Ng, Chiu, Ho, & Lo, 2018). Based on these facts, Pedro et al. (2018) recom-mend a shift from data-driven use of mLearning to collaborative-driven practices.

Researchers have identified the need for instruction on educational uses of mobile devices for students and for faculty (Pedro et al., 2018; Sung, Chang, & Liu, 2016). mLearning is particularly well suited for a variety of pedagogies such as social constructiv-ism (Brown & Mbati, 2015). However, challenges such as distraction and multitasking need to be addressed in mobile learning strategies (Pedro et al., 2018).

Student use of mobile devices

Through focus-group interviews, Gikas and Grant (2013) found that undergraduate and graduate students using mobile devices for their studies were able to access information quickly and communicate and collaborate effectively on coursework with their peers, while the mobility of their mobile devices allowed them to personalize the way in which they interacted with course material, such as recording videos or voice memos or participating in polls (p. 22). The students in their study also noted that there were technical challenges to using mobile devices for their studies, including "fear of the technology not working prop-erly" (p. 25), and they were sometimes "frustrated" by the small keyboard and screen (p. 23).

Seilhamer, Chen, Bauer, Salter, and Bennett (2018) surveyed higher education students in 2014 and 2016 regarding their beliefs about mobile usage and found that there was an

increase in the number of students who felt that mobile devices made it easier to complete various tasks. Student beliefs increased by 1–5% from 2014 to 2016 in these subcategories concerning mobile technology:

- gave them better access to coursework;
- provided opportunities for increased communication with other students;
- helped increase their knowledge of the course's target field of study;
- helped increase their communications with the instructor;
- helped increase their motivation to complete coursework; and
- helped them improve their quality of work. (p. 7)

A 2019 study by Clinefelter et al. focused on prospective, current, and recently graduated fully online college students and found the following:

- 56% of online students use a smartphone or tablet to complete at least some of their online course-related activities.
- Students 45 and older are significantly less likely to use or want to use a mobile device for coursework, highlighting a generational difference.
- Graduate students (63%) are significantly more likely than undergraduates (52%) to use a mobile device in conjunction with online courses.
- Checking grades, due dates, and schedules is the top reason current and past students (68%) use their mobile device for online courses.
- Other top reasons that current and past students used mobile devices include completing course-related readings (44%) and watching videos (36%). (Clinefelter et al., 2019, pp. 32–34)

Magda, Capranos, and Aslanian (2020) conducted a similar survey of online college students and found that "seventy-four percent of online college students want to use their mobile devices . . . to help them progress through their courses no matter where they are" and that these "on-the-go students" (p. 9) use their devices for reading course materials or consuming other media. Participants in their study also reported using mobile devices to communicate with their instructors or peers (p. 33).

Studies of the use of mobile devices by LIS scholars in India (Sharma & Madhusudhan, 2017) and Greece (Vassilakaki, Moniarou-Papaconstantinou, & Garoufallou, 2016) found that LIS students used their mobile devices daily for entertainment and communicating with friends and sometimes used the devices for accessing educational resources and academic collaboration. A survey of SJSU students in the fall semester of 2019 indicated that more than 40% of the technology equipment used to access Canvas consisted of mobile devices (34.5% mobile phone and 6.6% tablet) (San José State University eCampus, 2019).

Technology Acceptance Model

The Technology Acceptance Model (TAM) (Davis, 1989) is a theoretical framework that describes how people approach using new technologies. Key factors of adopting a technology, according to the model, include perceived usefulness (PU) and perceived ease

of use (PEOU). TAM is often utilized as a means to understand the motivations of those who adopt various technologies and is useful in exploring student use of mobile devices. A study by Wai et al. (2018) confirmed that young people "nowadays have a positive attitude towards using mobile apps in daily life as well as for learning . . . a consistent pattern of using apps for communication and interaction purposes, searching and checking for learning and reference materials, and information sharing." (p. 44). Their research indicated that PU is more significant than PEOU in determining overall attitude. Iqbal and Bhatti (2015) applied the model to mLearning and higher education students' PU and PEOU of mobile devices. In their discussion, they cite PU as an important factor in the adoption of a new system because it "mainly depends upon the perception that this system will result in enhanced performance" (p. 95). Their study also supported the concept of PEOU as a factor contributing to students' adoption of mLearning as part of academic workflows. The authors noted that the increase in smartphone ownership contributed to their findings.

Research questions

This study offers a better understanding of how students use mobile devices and apps for coursework and will provide recommendations on how LIS educators can enhance course materials, learning objects, and other pedagogical interactions. The questions guiding the research were the following:

RQ1: How do students utilize mobile devices in their coursework?
RQ2: How do students perceive the effectiveness and usefulness of mobile devices for their coursework?
RQ3: How can instructors enhance online courses to enable mobile device access?

Methodology

A web-based survey tool, designed to address the research questions, included Likert scale or yes/no questions and open-ended questions, reflecting a research design that was both quantitative and qualitative. The Institutional Review Board of SJSU approved the survey questions in the spring of 2020.

Sample

The target population for the survey was determined to be students in the MLIS graduate program at the School of Information at SJSU. The survey was announced on April 6, 2020, via email alert to a list with 2,674 recipients. A total of 195 valid responses were collected from an initial pool of 221 respondents.

Content analysis methodology

Open-ended survey question responses were coded using descriptive content analysis (Neuendorf, 2002), with emphasis on exploring recurring themes that occurred within responses to individual questions as well as throughout the data as a whole. The responses were coded in online spreadsheets by hand. We initially coded the qualitative survey responses separately, developing our own codebooks. Subsequently, we reviewed, edited,

and merged the preliminary codebooks into a master codebook. We shared coding duties to ensure inter-coder agreement. The investigators exchanged ideas and conferred about the salient thematic areas shared in the findings and discussion below.

Findings

The findings are presented here in two parts: (a) quantitative data regarding device and application use, including the Canvas Learning Management System and use of library resources, and (b) coded responses to open-ended questions.

Quantitative analysis

The quantitative data analysis of Likert scale and yes/no questions in the survey indicate how SJSU School of Education students use mobile devices for LIS coursework.

Devices in use. Laptops, iPhones and desktop computers were the top three technologies used by survey respondents. See Table 1 for a full breakdown of this question of the survey.

Applications used. Table 2 presents a full breakdown of this question of the survey. Overall, students used a mail client and the Canvas app most often, followed by a mobile web browser such as Safari or Chrome. Other answers included Evernote, course website, Zotero, Audible, various Google products, Panopto, and Mendeley.

Table 3 details how students use the Canvas app on their mobile devices. These answers align with qualitative data presented in the second section of findings.

Library use. SJSU School of Information students prefer to access King Library resources via other platforms instead of mobile devices. This may indicate that laptop and desktop computers are more conducive to utilizing library resources.

Qualitative analysis

The qualitative data analysis of open-ended questions in the survey reveals further insights concerning student perceptions and use of mobile devices for LIS coursework.

Table 1: Which of these devices do you utilize for School of Information coursework? (*n* = 194)

Answers	Responses	Percentage
Laptop	185	95%
iPhone	110	57%
Desktop	73	38%
Other smartphone	61	31%
iPad	40	21%
Other tablet	15	8%

Student use of mobile devices. For the question "How are you using your mobile device(s) in your coursework?," student respondents detailed tasks accomplished with mobile devices that were coded into the following thematic areas: communicating, checking, consuming, and creating, many with an emphasis on using the technology for "on the go" or "quick and easy tasks." The various tasks are detailed under each thematic area in Table 5.

Table 2: Which of these applications do you utilize on a mobile device for School of Information coursework? (*n* = 194)

Answers	Responses	Percentage
Gmail or other mail client	158	81%
Canvas app	154	79%
Mobile web browser	125	64%
Google Drive	119	61%
Google Docs	114	59%
Zoom	95	49%
PDF readers	89	46%
E-Book app or PDF viewer	70	36%
Social media for assignments and coursework	46	24%
Other	9	5%
None	6	3%

Table 3: How do you use the Canvas app on your mobile device? (*n* = 153)

Answers	Responses	Percentage
Check grades	147	96%
Read announcements	142	93%
Access modules	123	80%
Send or receive messages	112	73%
View calendar	98	64%
Watch lectures	66	43%
Download PDFs and other materials	55	36%
Participate in discussions	54	35%
Submit assignments	17	11%

Table 4: Do you access the King Library and its resources from your mobile device? (*n* = 194)

Answers	Responses	Percentage
No	137	70.6%
Yes	57	29.4%

Table 5: How are you using your mobile device(s) in your coursework? (*n* = 175)

Answers	Responses	Percentage
Checking[a]	171	98%
Communicating[b]	134	77%
Consuming[c]	80	46%
"On the go"[d]	36	21%
Creating[e]	22	13%
Everything	5	3%
N/A	6	3%
Technology[f]	4	2%

[a]*Checking* includes notifications (incl. grades & deadlines), Canvas (incl. modules & checking discussion boards), and checking assignments.
[b]*Communicating* includes email, communication, interaction (incl. posting on discussion boards), Zoom, Twitter/social media, and group work.
[c]*Consuming* includes reading, watching videos/lectures, and library/research.
[d]*"On the go"* includes out and about/away and small, "quick and easy" tasks.
[e]*Creating* includes using Google Drive, submitting assignments, and taking notes/photos.
[f]*Technology* includes mobile hotspot and "second screen."

Many respondents described the specifics of how mobile devices keep them connected to classes, for example: "I use my smartphone to do on the fly research, read through course materials, check updates, communicate with group members; especially during breaks at work or when I have some casual down time."

 "On the Go" and "Everything." It is also notable that 21% of respondents specified that mobile devices allowed them to be "on the go" and still be connected to their courses, instructors, and the flow of classes. A few shared they could do "everything" on their device. This response is indicative of that sentiment:

> I receive notifications from canvas on my phone, I do pretty much everything on my phone from time to time, as I am a mom and I work full time so using my phone helps me to fit

Table 6: What activities can you not use your mobile device(s) for? (*n* = 168)

Answers	Responses	Percentage
Knowledge creation[a]	74	44%
Device incompatible with software/programs/manipulation[b]	57	34%
Reading[c]	50	30%
Canvas[d]	38	23%
Video consumption[e]	24	14%
N/A	23	14%
No response	23	14%
Not sure	6	4%
School/personal life division	3	2%
Collaboration	2	1%
Anything	1	1%

[a]*Knowledge creation* includes long-form writing, taking notes, annotating, and blogging.
[b]*Device incompatible with software/programs/manipulation* includes Google Drive, MS docs, PeopleSoft, desktop required, switching between apps, downloading files, submitting assignments, printing, and quizzes.
[c]*Reading* includes ProQuest eBooks and library or scholarly research.
[d]*Canvas* includes course discussions and viewing rubrics.
[e]*Video consumption* includes Zoom, watching lectures/video, and Panopto.

doing my coursework into my life wherever I am and whatever I am doing—from reading an assignment in the grocery checkout line to writing a discussion post while out with my family at a brewery listening to live music during the summer months.

Incompatible tasks. For the question "What activities can you not use your mobile device(s) for?," student respondents detailed tasks related to coursework that could not be done on mobile devices. These were coded into the following thematic areas: knowledge creation, video consumption, use of Canvas, device incompatibility with software for required activities, and general reading activities. The various tasks are detailed under each thematic area in Table 6.

Perceptions of instructors' course design. For the question "How have your instructors made the information accessible to use from your mobile device(s)?," student respondents detailed what aspects of instruction/technology their instructors had provided, offering mobile device accessibility. These were coded into the following aspects of instruction, presented in Table 7.

When students were asked about mobile-friendly tools and practices already available in their courses, 70% commented favorably about the Canvas app. Content posted in Canvas was described as being easily accessible, with the exception of lengthy discussion boards.

Table 7: How have your instructors made the information accessible to use from your mobile device(s)? (*n* = 163)

Answers	Responses	Percentage
Used Canvas	77	47%
No response or n/a	56	34%
Don't know or instructors have not	31	19%
Offered links	14	9%
Most everything works	13	8%
Videos	13	8%
Email	11	7%
PDFs	10	6%
Other	5	3%
Zoom	4	2%
Google Drive/apps	4	2%

Table 8: How can instructors make it easier for you to use your mobile device(s) for your studies? (*n* = 147)

Answers	Responses	Percentage
No suggestions[a]	82	56%
Course site organization and formatting[b]	21	14%
Documents/readings[c]	18	12%
Video/recordings[d]	16	11%
Confirm viewability on mobile	14	10%
Provide instruction[e]	6	4%

[a]*No suggestions* includes unsure, no suggestions offered, and not much that instructors can do.
[b]*Course site organization and formatting* includes putting assignments in the Canvas assignment page, using short links, ensuring deadlines are in Canvas calendar, format links to open in new tabs, using less text, using more media and graphics, using links, marking which items are mobile friendly, keeping content within Canvas (rather than linking out to it), linking to syllabus, improving the Canvas discussion interface, and using Google Drive to organize files.
[c]*Documents/readings* includes using PDFs, mobile-friendly apps, open platforms for readings, providing links to articles, providing multiple formats, and providing linked lists of PDF readings.
[d]*Video/recordings* includes mobile-friendly recordings and players via links, mobile-friendly video (shorter lectures), using Panopto, listing of all recordings, not embedding lecture videos, and providing multiple formats.
[e]*Provide instruction* includes providing instruction, perhaps in INFO 203, providing a user guide, recommending helpful apps (e.g., Feedly, Canvas), and providing more library access/services info.

Many students specifically mentioned the Canvas mobile app, while a few said they access the Canvas course site through a browser. Students like the notifications they receive when new content (particularly grade information) is posted in the site. These automated alerts usually come through email or screen notifications, a very convenient form of communication on mobile devices. Students cited instructor use of email as a mobile-friendly practice.

Suggestions for improvement. For the question "How can instructors make it easier for you to use your mobile device(s) for your studies?," student respondents detailed what aspects of instruction could be improved for mobile device accessibility. The most popular response was "No suggestion" or, in the words of one respondent, "everything works." The rest of the responses were coded into the following thematic areas: course site organization and formatting, video/recordings, documents/reading, confirmed accessibility of documents, and provide instruction on how to access coursework via mobile devices.

Other qualitative responses. An open-ended question rounded out the survey: "Do you have any other comments about your use of mobile devices in your school-related activities?" Respondents shared general thoughts about the survey, mobile devices, and their coursework. Responses included a preference for laptop/desktop over mobile devices as the most popular response, followed by appreciation of the usability of mobile devices, the benefits of "on the go" access and overall convenience, and praise for the Canvas app.

Discussion

From the quantitative data and analysis of the qualitative responses, we have identified a clear picture of how our students use mobile devices for their coursework and how they perceive the usefulness of those devices. We have also identified suggestions for LIS instructors to optimize their materials for access via mobile devices.

Student use and perceptions

The first two research questions for this exploratory study were

RQ1: How do students utilize mobile devices in their coursework?

RQ2: How do students perceive the effectiveness and usefulness of mobile devices for their coursework?

For RQ1 and RQ2, LIS students at the School of Information utilize mobile devices in their coursework to accomplish many tasks related mainly to communication activities and checking in on grades, notifications from instructors, and other interactions. Our students perceive the devices to be useful overall for the tasks described in the findings above. Many have found the "sweet spot" of utilizing mobile devices for the tasks they are most comfortable accomplishing in smaller amounts of time and "on the go." Students did note that writing papers or submitting assignments is best done with a laptop or desktop computer. This also includes utilizing SJSU King Library resources.

The findings point to previous research highlighted in the literature review regarding mLearning, collaboration, and "anytime, anywhere ubiquitous learning" (Hung & Zhang, 2011, p. 3). This leads us to consider two ideas LIS educators should consider going forward: the possibilities and potential for "learning everywhere" and the rise of the "student power user."

Learning everywhere

From the student completing tasks while listening to live music, to those who consume lectures while performing household tasks, this concept is now even more solidified in LIS and higher education in general. The notion of learning everywhere supports the almost decade-old Horizon Report idea that "people expect to be able to work, learn, and study whenever and wherever they want to" (Johnson et al., 2012). A respondent's thoughts about "on the go" learning echo this: they are "mostly checking emails, reading discussion posts, and reading class readings on my bus commute." Another noted the ease of use of mobile devices for this style of learning:

> I have a Samsung tablet that I use about 50% of the time to do all types of coursework. I have access to a laptop that meets university requirements, but I find it easier to carry my tablet with me when I am not at my primary residence as my laptop is large and difficult to move. I have not experienced any difficulty this semester. I mainly use the Canvas app on my phone to check messages and the calendar quickly.

Students also listed the Zoom mobile app as a valuable tool providing additional access. One student noted they "have attended meetings from my phone if I am traveling without my laptop." Students also mentioned that videos worked well on their phones. They were easily able to access lecture content that was provided in this format. Additional formats such as audio only and captioning were also mentioned as being helpful. One student wrote, "recorded lectures . . . made available in several formats . . . make it possible to listen to or watch a lecture on a mobile device, which is helpful."

The student power user

Five of the respondents included detailed descriptions of how they use mobile devices to complete many aspects of LIS coursework. The lengthy explorations included a high degree of specificity about work flows and suggestions for streamlining processes. Other respondents may not have been as specific, but they shared their own workflows and shortcuts to get coursework done. This response is indicative of what we have dubbed the "student power user":

I often put course readings in PDF version into folders on my Google Drive account so that I can read them on my iPad. When traveling, I sometimes watch course lectures on my iPad and access course readings or videos.

I also sometimes create a working doc for assignments on my iPad saved to my Google Drive that I then finalize on a laptop or desktop computer for final submission. I also use Google Drive as a complete backup of my school files that I have on my computer.

I tend to search the library on a computer, but if I'm interested in an ebook, I will redo my search on my iPad so that I can download it. It would be nice if there were a way that I could send an ebook to my device somehow without needing to redo the search on the device.

I get Canvas notifications on my phone and when I get a message that an assignment's been graded, I usually check Canvas on my phone and read any related comments. I usually leave downloading the feedback until I'm on a computer and can better control where

I'm saving to. Saving a file to Drive from other apps is sometimes buggy on mobile and has to be done multiple times.

I have also participated in Zoom conferences via the phone app often dialing in when I had a poor internet connection. I also use my phone to take pictures for assignments that involve library visits.

Understanding the student power user's workflows can inform course design and instruction. Academic librarians may also find inspiration for services as well.

Implications for LIS instructors

The final research question for this exploratory study was

RQ3: How can instructors enhance online courses to enable mobile device access?

For RQ3, LIS students at the School of Information suggested enhancements that instructors might add to their course design to enable access and interaction via mobile devices. Many students stated that instructors were already doing enough to support mobile access to course materials. Some stated that they felt that challenges were inherent to the use of mobile devices and that there is little instructors can do to improve the issues. As one student wrote, "I don't think this one is on them."

Students frequently mentioned course site organization as an important aspect of access. Courses organized with weekly modules that include the associated assignments are easier to navigate whether students are on mobile devices or on larger computers. Other suggestions covered a wide range of pedagogical practices with a focus on delivering multi-channel opportunities for consuming and creating around course content. These are included in the following section.

Suggestions for faculty

Culled from the qualitative responses and analysis of the overall survey data, here is a checklist of practical enhancements to the online delivery of courses for consideration by faculty in LIS. The suggestions presented here are intended to be thought starters for LIS professors to add more mobile components to their courses. The specific technologies depend on what a respective university uses or has approved. It also seems anecdotally that Google Drive is probably a mainstay for students and instructors across LIS.

- For readings and documents, the clear recommendation is to use PDF. This facilitates ease of access due to the friendliness of the file format. Proprietary formats and sources (such as some library databases) can be problematic. Providing access to the PDF files via clear links is very helpful.
- Instructors who provide links to content such as readings or recorded lectures make it much more convenient for mobile users to access content. Links to video sites, database permalinks, and direct, authenticated links to e-books enable ease of access.
- When recorded content is being provided, students recommend using tools and formats that are mobile friendly (e.g., YouTube and Panopto videos). Students appreciate

having access to playback speed controls. Providing multiple formats including captions, audio-only, and presentation slides is a practice that students appreciate.
- Using the Canvas mail to communicate with students is highly recommended so that notifications can be pushed to students with information about class assignments, module updates, and other content.

Creative enhancements to course delivery

What have these findings regarding student mobile device use taught us about the creative enhancements that instructors might add to course creation and design? We would argue for an increased emphasis on utilizing the cloud for student projects, encouraging student interaction across various social media platforms, and increased sharing of video and images from students and instructors. Long-form writing and reading articles and monographs may happen more often on larger devices and desktop computers, but we would suggest the following ideas for creative enhancements via mobile.

In the cloud. Instructors might consider using cloud-based applications such as Google Drive, Adobe Cloud, and various social media sites for individual assignments and group projects. Not only would this allow access from the desktop *and* mobile devices for students and instructors, but it would also give LIS students a chance to utilize applications they may soon be using in professional positions. Understanding project management or the creation of media-enhanced reports by a group, for example, might pave the way for a future librarian performing similar tasks as part of a regional, national, or international workgroup.

Communication everywhere. Instructors might look for ways to encourage students to communicate and collaborate with each other via mobile devices and apps beyond the regular channels built into our learning management systems. Imagine assigning a Twitter-based chat or establishing a course hashtag on various platforms. Our data pointed to students appreciating the ease and convenience of being able to check in and talk to others in classes. Other strategies might include giving students the opportunity to ask instructors questions via text, or using apps that send texts or push notifications so that students can participate in group projects anywhere, even when they are away from their desktop or laptop computer.

Images and video. We would also argue for creative uses of creating and sharing images and video. Assignments might include creating infographics on a community's information-seeking behaviors, an Instagram-based assignment developing and promoting a new information service for users, or videos created on the go with mobile devices. Instructors can do this as well. Imagine out-and-about lectures and course content presented from an outdoor setting, in a library, or in similar sites. An effective and engaging video doesn't have to be recorded sitting in an office or study space. Sharing information can happen anywhere.

Broader considerations

Other suggestions included broader ideas focused on awareness of how mobile access works and providing instruction and information on utilizing mobile devices in coursework. Some students recommend that instructors "be mindful of mobile interfaces and how they are different from a normal browser."

A few students suggested that it would be helpful to have some instruction on strategies to use with mobile devices and coursework. Information about available mobile apps and recommendations about which course-related tasks and content are best suited for mobile use would be valuable. This instruction could be incorporated into an early course in the program or provided in a guide, such as the INFO 203 course at SJSU. Perhaps a course module or instructional video might focus on "Becoming a Student Power User."

Research limitations and future research

This exploratory study focuses on the students of one program: the SJSU School of Information. Replicating the study at other institutions would further enhance the insights gleaned from this exploratory study. To address the limitations of using the survey method, future studies could use methodologies such as narrative inquiry or phenomenology to better understand student workflows with mobile devices. This might further inform a formal model of the student power user. Another approach would be to investigate faculty adoption of mobile-friendly practices for course design.

Another avenue for future research might involve other issues related to mobile devices, including ethics, privacy, and data security. These issues would further inform who might utilize mobile devices in LIS. This exploratory study was intended to focus solely on student perceptions of using mobile devices for LIS coursework.

Conclusion

The primary purpose of this study was to investigate the preferences and perceptions of students' mobile device use for LIS coursework. We have identified areas where mobile technology is effective, provided recommendations regarding mobile-device–friendly enhancements to courses, and given insights into mobile friendly course design and pedagogy. We believe that mobile devices and applications in the cloud can be useful for giving students practical and creative experience across multiple channels.

Further, the data in this study indicate that current LIS students take their courses "on the go," moving easily between a formal learning setting to an informal one—learning everywhere—breaking through the barrier described by Pedro et al. (2018) and incorporating learning into real life. This echoes what Gikas and Grant (2013, p. 20) have called "authentic learning on the move." We believe this is a holistic approach to online learning for 2021 and beyond. We encourage instructors to consider the multiple ways in which students may access course content and engage with others in their classes, keeping the ideas presented here in mind. What benefits the mobile user benefits all.

Michael Stephens*, School of Information, San José State University*, is associate professor at the School of Information at San José State University. His research focuses on enhancing learning with technology and professional learning experiences for librarians. Email: mstephens7@mac.com

Nikki Rudiger is a recent graduate from the iSchool at San José State University and lives in Portland, Oregon. Her interests include learning new technologies and how to make information more accessible and inclusive. Email: nicole.rudiger@sjsu.edu

Debbie Faires is lecturer emerita at San José State University. Email: debbie.faires@sjsu.edu

References

Brooks, D. C., & Pomerantz, J. (2017). *ECAR study of undergraduate students and information technology, 2017* [Research report]. Boulder, CO: ECAR.

Brown, T. H., & Mbati, L. S. (2015). Mobile learning: Moving past the myths and embracing the opportunities. *International Review of Research in Open and Distributed Learning*, *16*(2), 115–135. https://doi.org/10.19173/irrodl.v16i2.2071

Chee, N., Yahaya, N., Ibrahim, N. H., & Noor Hasan, M. (2017). Review of mobile learning trends 2010-2015: A meta-analysis. *Educational Technology & Society*, *20*(2), 113–126.

Clinefelter, D. L., Aslanian, C. B., & Magda, A. J. (2019). *Online college students 2019: Comprehensive data on demands and preferences*. Louisville, KY: Wiley Education Services.

Crompton, H. (2013). A historical overview of m-learning: Toward learner-centered education. In Z. L. Berge & L. Y. Muilenburg (Eds.), *Handbook of mobile learning* (pp. 3–14). New York, NY: Routledge.

Crompton, H., & Burke, D. (2018). The use of mobile learning in higher education: A systematic review. *Computers & Education*, *123*, 53–64. https://doi.org/10.1016/j.compedu.2018.04.007

Davis, F. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340. https://doi.org/10.2307/249008

Gikas, J., & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *The Internet and Higher Education*, *19*, 18–26. https://doi.org/10.1016/j.iheduc.2013.06.002

Hung, J.-L., & Zhang, K. (2011). Examining mobile learning trends 2003–2008: A categorical meta-trend analysis using text mining techniques. *Journal of Computing in Higher Education*, *24*(1), 1–17. https://doi.org/10.1007/s12528-011-9044-9

Iqbal, S., & Bhatti, Z. A. (2015). An investigation of university student readiness towards m-learning using Technology Acceptance Model. *International Review of Research in Open and Distributed Learning*, *16*(4), 83–103. https://doi.org/10.19173/irrodl.v16i4.2351

Johnson, L., Adams, S., & Cummins, M. (2012). *NMC Horizon Report: 2012 higher education edition*. Retrieved from https://library.educause.edu/resources/2012/2/2012-horizon-report

Johnson, L., Levine, A., Smith, R., & Stone, S. (2010). *NMC Horizon Report: 2010 Higher education edition*. Retrieved from https://library.educause.edu/resources/2010/1/2010-horizon-report

Johnson, L., Smith, R., Willis, H., Levine, A., & Haywood, K. (2011). *NMC Horizon Report: 2011 Higher education edition*. Retrieved from https://library.educause.edu/resources/2011/2/2011-horizon-report

Magda, A. J., Capranos, D., & Aslanian, C. B., (2020). *Online college students 2020: Comprehensive data on demands and preferences*. Louisville, KY: Wiley Education Services.

Miraz, M. H., Ali, M., & Excell, P. S. (2018). Cross-cultural usability issues in e/m-learning. *Annals of Emerging Technologies in Computing*, *2*(2), 46–55. https://doi.org/10.33166/AETiC.2018.02.005

Neuendorf, K. A. (2002). *The content analysis guidebook*. Thousand Oaks, CA: Sage.

Pedro, L. F. M. G., de Oliveira Barbosa, C. M. M., & das Neves Santos, C. M. (2018). A critical review of mobile learning integration in formal educational contexts. *International Journal of Educational Technology in Higher Education*, *15*(1), 10. https://doi.org/10.1186/s41239-018-0091-4

Pew Research Center. (2019a). *Mobile fact sheet*. Retrieved from https://www.pewresearch.org/internet/fact-sheet/mobile/

Pew Research Center. (2019b). *Mobile technology and home broadband 2019*. Retrieved from https://www.pewresearch.org/internet/2019/06/13/mobile-technology-and-home-broadband-2019/

Pew Research Center. (2019c). *About three-in-ten U.S. adults say they are 'almost constantly' online*. Retrieved from https://www.pewresearch.org/fact-tank/2019/07/25/americans-going-online-almost-constantly/

San José State University eCampus. (2019). Fall 2019: Canvas user satisfaction. Retrieved from https://www.sjsu.edu/ecampus/teaching-tools/canvas/canvas-statistics/canvas-user-satisfaction/fall-2019/index.html

Seilhamer, R., Chen, B., Bauer, S., Salter, A., & Bennett, L. (2018). Changing mobile learning practices: A multiyear study 2012–2016. *EDUCAUSE Review*. Retrieved from https://er.educause.edu/articles/2018/4/changing-mobile-learning-practices-a-multiyear-study-2012-2016

Sevillano-García, M. L., & Vázquez-Cano, E. (2015). The impact of digital mobile devices in higher education. *Journal of Educational Technology & Society*, *18*(1), 106–118.

Sharma, R., & Madhusudhan, M. (2017). Use of mobile devices by library and information science students in central universities of Uttar Pradesh. *DESIDOC Journal of Library and Information Technology*, *37*(4), 293–302. https://doi.org/10.14429/djlit.37.4.11505

Sung, Y.-T., Chang, K.-E., Liu, T.-C. (2016). The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis. *Computers & Education*, *94*, 252–275. https://doi.org/10.1016/j.compedu.2015.11.008

Vassilakaki, E., Moniarou-Papaconstantinou, V., & Garoufallou, E. (2016). Identifying the uses of mobile technology among library and information science undergraduate students. *Program: Electronic Library and Information Systems*, *50*(4), 417–430. http://doi.org/10.1108/PROG-10-2015-0069

Wai, I. S. H., Ng, S. S. Y., Chiu, D. K. W., Ho, K. K. W., & Lo, P. (2018). Exploring undergraduate students' usage pattern of mobile apps for education. *Journal of Librarianship and Information Science*, *50*(1), 34–47. http://doi.org/10.1177/0961000616662699