

Higher Education and Emerging Technologies: Shifting Trends in Student Usage

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Abstract

This study serves as an update to a previous study by Sam Houston State University librarians about the use and preferences of Internet, communication, and educational technologies among students. Since the previous study was initiated in 2010, the iPad has made its debut and significantly altered the educational technology landscape. In this new landscape, this study investigates student usage of such technologies as instant messaging, cell phones, e-readers, social networking, RSS feeds, podcasts, and tablets. In addition, this study aims to determine which technologies students prefer the library to utilize for a variety of services, such as reference assistance or book renewals, and which technologies may not be worth the investment, such as geosocial networking. The information gained from this survey is intended to provide guidance for libraries looking to provide services utilizing the most popular technologies with the most efficient use of resources. Survey results show an increasing use and dependence on educational technologies and a desire for basic library services to be available on a variety of platforms and technologies.

Suggested Keywords: Information & communication technologies; Information technology; Information services--Use studies; Web services; Social networks; Academic libraries; College students; Higher education; iPad; Google+; Mobile phones; Mobile devices; Tablets computers; e-readers

Introduction

In 2010, Sam Houston State University (SHSU) librarians initiated a study published the following year in *Reference & User Services Quarterly* titled “Higher Education and Emerging Technologies: Student Usage, Preferences, and Lessons for Library Services” (Cassidy et al., 2011). Since the time of that study, the iPad has made its thunderous debut, significantly altering the educational technology landscape by becoming a major player in the field and opening the door for other tablet computing technologies. As a result, an updated survey was developed to more closely represent SHSU students’ usage of Internet, communication, and educational technologies in this new landscape.

In addition to exploring student’s interaction with such technologies as instant messaging, cell phones, e-readers, social networking, RSS feeds, podcasts, and tablets, educators and librarians are pressing beyond a surface exploration of digital content in order to capitalize on the idea of continuous instant access and active engagement with learning afforded through the use of mobile devices. This study is intended to provide guidance for such issues by surveying student library users’ utilization and preferences of Internet, communication, and educational technologies at SHSU. SHSU is a Carnegie Research Doctoral university located about one hour north of the Houston metropolitan area, and is made up of a large number of commuter, first-generation, or otherwise “non-traditional” students. With such a diverse student population, this survey set out to acquire as much information about SHSU students’ educational technology usage in order to provide the most efficient and highest quality library services where they are most needed and desired.

Literature Review

The idea of mobile learning, or *m-learning* (El-Hussein & Cronje, 2010; Sharples, Taylor, Vavoula, 2007, p. 222), is not necessarily new – it has been waiting in the wings since e-learning made its first stage appearance – but its pairing with the recent influx of smart technology devices has certainly fueled m-learning’s popularity. Early on, the term *smart* was often paired with devices such as phones and portable tablets that functioned “like a small, networked computer,” enabling users to access Internet browsers and email; more recently the term is paired with phones and portable tablets that provide additional software features or operating systems (OS) which enable the installation of mini-software applications, or apps (Zheng, 2006, p. 5). These apps themselves can provide a wealth of educational interaction with the target app’s subject content, including games, quizzes, audio, and visual display of malleable content. The mobility of these devices means that students are now engaging with learning content in brief spurts, on-the-go, in the hallway, during lunch, and even the classroom itself. This smart technology is “changing the ways we consume, distribute, and create information” (Little, 2011, p. 267).

In the interest of exploring how these new mobile devices are being used by the student population as a whole, several national anchor studies feature prominently in this literature review in order to give a baseline comparison for individual university study projects. The anchor studies for this review include the *NMC Horizon Report, 2013: Higher Education Edition*, the *ECAR Study of Undergraduate Students and Information Technology, 2012*, the *Pearson Education Students and Tablets Survey 2012 (Summary of Findings and the Topline Results)*, and several Pew Research Center reports, including *The Rise of E-reading* (2012), *Teens, Smartphones & Texting* (2012), and *Younger Americans’ Library Habits and Expectations* (2013).

Individual university studies relating to student technology include results from a 2011 survey at Utah State University (USU) and a 2012 survey at the University of South Carolina Columbian campus (USC). For comparison purposes, SHSU is classified by the Carnegie Foundation as a public Carnegie Doctoral Research University; it is located in semi-rural Huntsville, Texas, and offers around 136 undergraduate and graduate degrees (Sam Houston State University, 2013). USU is classified by the Carnegie Foundation as a public Research University (high research activity); it is located near mountainous Logan, Utah, and offers around 203 undergraduate and graduate degrees (Utah State University, 2013). USC Columbian is also a Carnegie-labeled public Research University (high research activity); it is located in Columbia, South Carolina, and offers a total of 324 undergraduate and graduate degrees (University of South Carolina, 2013). All three institutions are large four-year universities located in primarily nonresidential settings offering similar undergraduate instructional programs with high or very high enrollment profiles; student populations reported to Carnegie reflecting data from 2008 to 2010 show SHSU with 16,772 students, USU with 15,512 students, and USC Columbian with 28,482 students (Carnegie, 2013).

Smart Tablets

Since the publication of the original SHSU technology survey (2011), the availability of smart tablet technology has exploded onto the student stage, irrevocably changing perceptions and expectations of interactive touch-screen technology. The 2013 *New Media Consortium (NMC) Horizon Report: Higher Education Edition* also identifies smart tablets as “not a new kind of lightweight laptop, but rather a completely new technology” (Johnson et al., 2013, p. 16) and reveals that they are being used as “a portable personalized learning environment” (p. 15).

The 2012 *Pearson Foundation Survey on Students and Tablets* indicates that “[t]ablet

ownership has more than tripled among college students since March 2011, with one-quarter of students now owning a standard tablet” (p. 2). While this study was broad in scale, surveying 1,206 college students between the ages of 18 and 30 enrolled in a two-year college, four-year college, or graduate school, the popularity of smart tablet technology is difficult to argue. This same study also indicates that “tablets are just as valuable for educational purposes as they are for personal entertainment” (p. 2).

USU’s 2011 survey collected data regarding students’ use of mobile technology, specifically iPads, from 3,074 students, approximately 11.9% of the USU’s 2011 total student population of 25,767 (Dresselhaus & Shrode, 2012, p. 87). Of these 3,074 students, only 3.9% indicated daily use of an iPad (p. 88). While iPads were perhaps one of the most visible smart tablet technologies early on, iPads are not the only, and certainly not the most affordable, smart tablet technology to which students have access.

USC’s 2012 email survey collected data regarding technology brought to campus, including smart tablets known as iPads, from students living in residence halls (graduate and undergraduate), from 1124 students, or just over 16% of the total resident student population of 6,647 (University Housing, 2012, p. 1). Of these 1124 students, 18% “brought an iPad or other tablet machine to the campus” (p. 2).

Mobile Phones

Smartphones are an increasingly popular substitute for smart tablets. The Pearson Foundation’s 2012 *Survey on Students and Tablets* indicate that 65% of college students surveyed indicate that they have a smartphone (p. 5). The *ECAR Study of Undergraduate Students and Information Technology 2012*, though focused on undergraduate students, reports that 62% of undergraduates reporting owning a smartphone (Dahlstrom, 2012, p 14).

Along the same lines of popular technology adoption, USC's 2012 email survey collected data regarding technology brought to campus by undergraduate and graduate students living in resident halls. From the 1,124 students polled, approximately 79% indicate that they have a smartphone, with 21% indicating that they did not have a smartphone (University Housing, 2012, p. 3). USC's survey was specific to the campus resident population, but it does echo the high adoption rate indicated in the 2012 *ECAR* study.

USU's 2011 survey also collected data regarding students' use of mobile technology, including smartphones (Dresselhaus & Shrode, 2012). Of the 3,074 student respondents, 39.3% indicated daily use of a smartphone with Internet access (p. 88). While the overall numbers are lower than the *ECAR* study, USU focused more on the amount of daily use of the smartphone rather than simple ownership or possession.

Of interest also is the Pew Research Center's March 2012 report on *Teens, Smartphones & Texting* and its June 2013 *Younger Americans' Library Habits and Expectations*. While these Pew studies do not directly involve this project's current students, it does examine device ownership of the potential university student population at a national level: teenagers within the age range of 12 to 17. In 2012, approximately "one quarter (23%) of teens 12 to 17 indicate that their phone is a smartphone, while 54% have a regular phone (or are not sure what kind of phone they have), and another 23% of teens do not have a cell phone at all" (Lenhart, 2012, p. 7). Conversely, in 2013, approximately 93% of teens 16-17 years of age own a cell phone, with 63% reporting smartphone ownership: this same report indicates that 94% of college-age adults from 18 to 24 years old report ownership of a cell phone, while 65% indicates ownership of a smartphone (Zickuhr, Rainie, Purcell, Madden, Brenner., 2013, p. 13). This information may be

of interest in analyzing trends in smartphone ownership among current and future college students.

E-reader Devices

Another popular mobile technology option for students is the e-reader, a device specifically dedicated to the reading of e-books. Common options of e-readers include early generations of Amazon Kindle and Barnes & Noble NOOK, as well as the Sony Reader. In examining technology trends for students, some distinction is necessary to differentiate e-reader devices from smart tablets. Early distinctions typically included the limitation of a black and white display such as those found in the early Kindle and NOOK, as well as screen size, with tablets having larger displays than e-readers. However, with a continually evolving line of e-book technologies, smart tablet and e-reader hybrids are becoming more widely available (Tablets & e-book readers, 2011); distinctions become even more unclear as smart tablet display screens shrink for better mobility while e-readers and smartphones enlarge their screens for better visibility (Kim, 2012).

According to Pew's 2012 *The Rise of E-reading* report, approximately 19% of adults age 18 and older own an e-book reader (Rainie, Zickuhr, Purcell, Madden, & Brenner, 2012, p. 32). Interestingly, this is the same percentage of adults age 18 and older who own a tablet computer. The report also shares an additional correlation that may interest technology researchers: "tablet users and e-reader users are more likely to own cell phones, desktops, tablets, and e-reading devices" (p. 32). An alternate interpretation of this statement is that individuals who own a smart tablet or e-reader device are more likely than those who do not own a smart tablet or e-reader device to own some of the other technologies included in this project.

USU's 2011 survey collected data regarding students' use of mobile technology, including e-book readers (Dresselhaus & Shrode, 2012). Of the 3,074 student respondents, only 5.4% indicated daily use of e-book readers (p. 88). While this number is significantly lower than Pew Research indicates in its report, one point of contention may be that recently blurred line between smart tablets and e-reader devices.

Social Networking Sites (SNS)

Another technology from the original SHSU 2010 study that warrants further research is that of social networking sites (SNS). The popularity of student use of SNS is difficult to contest, as examined in the original 2010 SHSU technology study, but one burning question exists throughout much of the literature and is still up for debate: since SNS is popular with students for social interaction, should its use be incorporated into the academic arena?

One definitive answer is in the 2012 *ECAR* study, which identifies one of the "primary objectives of this year's study" as "to create a profile of undergraduate students' ownership and use of technology for academics" (Dahlstrom, 2012, p 6). The 2012 *ECAR* also indicates that although students prefer multiple options for the purposes of communication, "students use social networks for interacting with friends more than for academic communication" (Dahlstrom, p. 5).

Echoing the *ECAR 2012* findings is USC's 2012 email survey, which included the use of cell phones to access online social networks (University Housing, 2012). Of the 1124 student respondents, approximately 74% indicated that they use a cell phone for online social network activity (p. 3). Regarding the incorporation of SNS into the academic arena, however, only 3% of surveyed students responded that they preferred online social networking sites to communicate with fellow students: of specific interest for this study is that only 0.1% (.001) indicated that they

preferred the university to contact them using SNS (p. 4). These numbers give clear indication that, at least within existing literature, there seems to have been little demand for integrating SNS use into student's academic arena.

Methodology

A 53-item online survey was developed to assess students' perception and preferences for current and emerging information technologies at SHSU. The survey questionnaire was adopted from the previous SHSU student technology study (Cassidy et al., 2011). Questions from the original study regarding common technologies, such as laptops, Facebook, and mobile phones, were kept the same for comparison with the current study findings, and new questions regarding technologies that emerged since the last study, including tablet computers and Google+, were added.

To ensure participants would clearly distinguish between e-reader and tablet devices, the researchers defined tablet as all devices supporting the download and use of apps and e-readers as handheld devices primarily used for e-book reading. The survey also listed Apple iPad, Samsung Galaxy, Kindle Fire, Nook HD, and Nook Color as examples of tablets, and Nook Touch and Kindle E-reader as examples of e-readers.

The first section of the survey evaluated students' access to computers, laptops and the Internet at home. This assessment of student home computing pattern was followed by questions regarding their access and usage of mobile devices, including tablets, e-readers, and mobile phones. The third section of the survey focused on student's perception and usage of popular and emerging technologies, such as Twitter, podcasts, and instant messaging (IM). Throughout the survey, students were also asked to indicate their level of interests in receiving library services

through each technology platform. Lastly, students were asked to provide general demographics information, such as gender, age, and areas of study.

The entire survey took between 10 and 20 minutes to complete. Although most respondents were not asked to answer all the questions, since some were conditional upon a respondent's usage and awareness of certain technologies. If a respondent was unfamiliar with a particular technology, he or she would not be asked to answer questions regarding its usage. The survey was open via the Survey Monkey platform from January 29 to March 2, 2013. A survey invitation was sent to all SHSU students' official school email address on January 29, followed by a reminder email on February 22. The study was also advertised through SHSU Library's social media outlets. As an incentive for participation, a Nook HD tablet was offered as drawing prize for respondents who completed the survey and provided an email address for the draw. Participants' emails were saved securely and separately from the survey results and deleted after the prize drawing to ensure respondent anonymity.

Results

Overall, 987 individuals responded to the survey. Forty-two responses (4.3%) were incomplete and therefore eliminated from the final results set. In addition, since the survey invitation was posted on the library website and social media pages, four SHSU alumni and staff members had responded to the survey despite the invitation's emphasis on student participants. These responses were also removed because the participants did not belong to the study's population of interest.

Of the 941 remaining respondents, most (76.1%) were undergraduates, followed by masters (19.0%) and doctoral (3.3%) students. There were also 15 (0.4%) non-degree seeking

students. The majority of respondents (67.7%) were taking courses that met face to face at one of the three SHSU campuses. The rest were either taking online courses (26.1%) or courses with extensive online components (4.9%).

The average age of respondents was 25.5 years, although 69.1% of the respondents were under 25 years of age. Similar to the 2010 study, students who chose to participate in the survey were predominantly female (70.1%). Six respondents chose not to indicate their gender, and 13 chose not to disclose their birth year.

Internet, Computer, and Common Technology Use

Almost all the respondents (99%) had Internet access at home, although 11.5% did not know what type of internet—DSL, satellite, or dial-up—they had. Correspondingly, a great majority of respondents (98.7%) had access to a laptop or desktop at home, with 45.1% using both.

Compared to the 2010 survey results, the number of students who used laptops increased from 91.8% to 95.9%, whereas those who used desktops decreased from 55.6% to 47.4%. Moreover, 81.5% of desktop users had machines that were more than one year old. The survey saw an increase in the use of both laptops and desktops made by Apple. Almost 19% of all laptop users had an Apple product, a 69% increase from the 2010 survey; the proportion of Apple desktop users rose as well, from 6.9% to 9.7%.

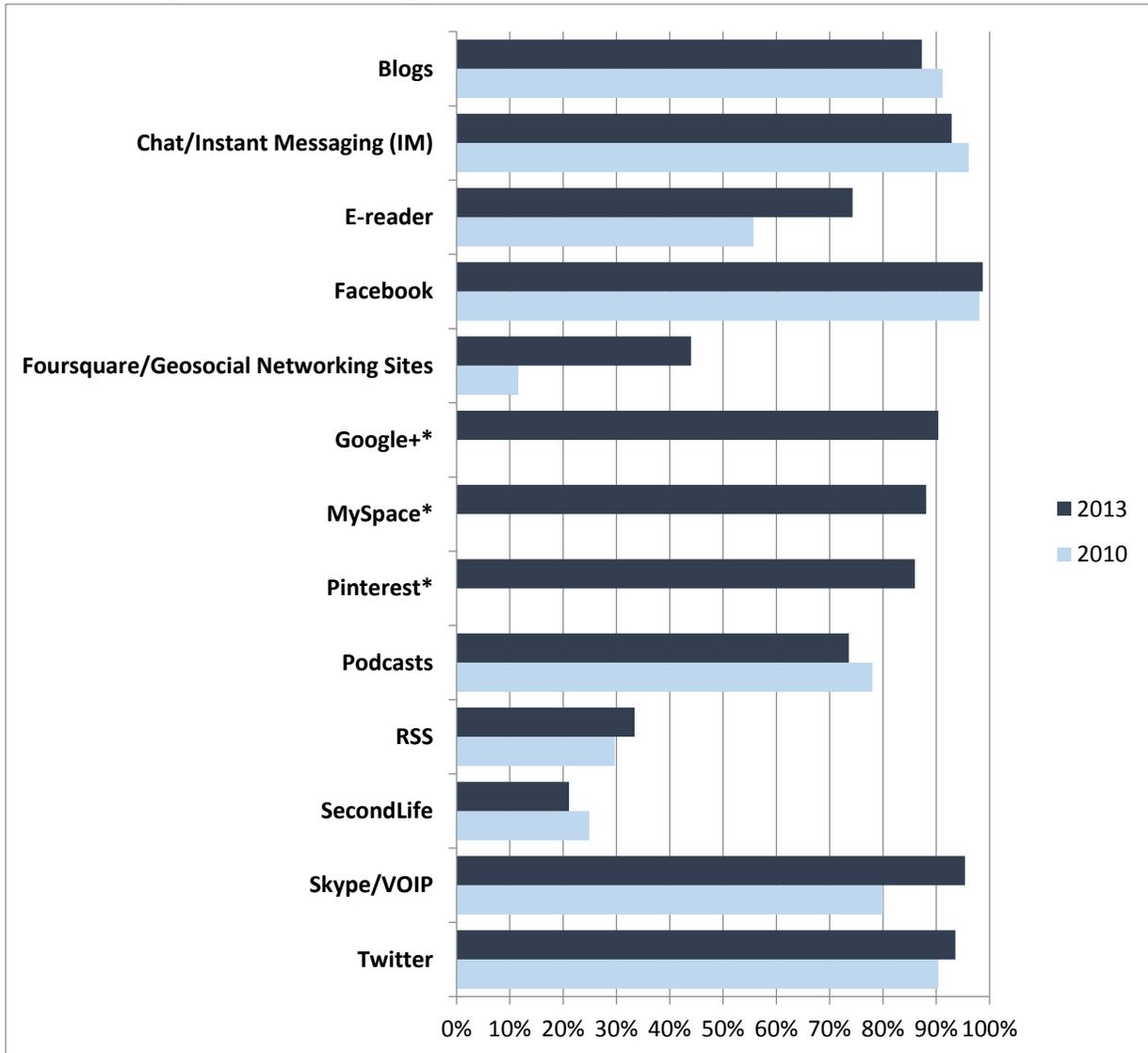
Concerning students' familiarity with popular technologies, most of those surveyed unsurprisingly recognized YouTube (98.8%) and Facebook (98.7%), although their familiarity with other SNS varied (Figure 1). For instance, many respondents did not recognize Second Life (21.1% recognition), Foursquare (44.0% recognition), or the term *geosocial networking site*. Delicious and Goodreads, two popular technologies in the field of library and information

studies, likewise had low name recognition (5.9% and 21.9% respectively) with respondents.

Lastly, 75.3% of all smartphone users surveyed did not use QR code readers.

Figure 1

Student Recognition of Technology Names



* Technologies not surveyed in the 2010 study

Tablets and E-Readers

Almost half of the survey respondents (456 of 941) used tablets or e-readers. E-reader usage had more than doubled since the 2010 study, growing from 10.5% of students surveyed to

26.0%. Even more impressively, the proportion of respondents who used a tablet, include the iPad, a device that was not yet available at the time of the original study, was 33.6%.

Furthermore, most students who were not using tablets or e-readers indicated interest in owning one (87.5% and 70.0% of non-tablet or non-e-reader users, respectively).

However, despite growing interests and ownership, only 5 respondents solely relied on tablets for their computing needs. Students appeared to use these tablets and e-readers in addition to, not as replacements for, laptops and desktops. In fact, over 11% of respondents used an e-reader, a tablet, plus a laptop or desktop.

Similar to the 2010 findings, the majority of e-reader users owned Amazon Kindles, although the proportion of e-reader users with Kindles decreased from 69.9% to 52.7%, while the proportion of e-reader users with Barnes & Noble NOOKs increased from 8.2% to 25.3%. Among tablet users, the Apple iPad was the most popular tablet (58.2%), followed by the Kindle Fire (10.8%).

Overall, respondents showed more interest toward tablets: the majority of tablet users (72.3%) used their devices daily. In contrast, just 28.4% of e-reader users reported the same usage frequency. Moreover, 61.9% of the tablet users purchased their devices within the past year. Only 37.7% of e-reader users had devices that were less than a year old, a sharp decrease from the 2010 survey figure of 82.1%.

More importantly, 86% of tablet users reported using their devices for education, compared to just half (52.9%) of e-reader users. Tablet users also showed more interest in getting library services through their devices (94.2%) than e-reader users (84.4%).

Of possible library services for tablets, students were most interested in wireless printing (82.9%), followed by checking out/downloading digital books and other contents (82.6%),

although those who already used tablets were most interested in downloading library content (88.6%). The ability to download library content (84.5% of all e-reader users) and borrow devices pre-loaded with textbooks (72.5% of all respondents) were the possible library services respondents showed most interests in.

Mobile Phones

All but 1.6% of the respondents owned a mobile phone; iPhone (44.3%) and Android (37.2%) were the most popular. Also, more students were using their mobile phones for texting (98.5%) than for making phone calls (96.9%). In fact, almost all of students surveyed (95.5%) texted daily, an 11.4% increase since the 2010 study.

Likewise, compared to the 2010 survey results, more students are using their phones for traditionally computer-based tasks, including sending and receiving emails (from 45.5% in 2010 to 83.9% in 2012), web browsing (from 47.4% to 82.9%), downloading and using apps (from 36.6% to 78.5%), and instant messaging (from 29.4% to 46.7%).

Students' increased reliance on mobile phones translated into higher reported demand for mobile library services. Compared to the last survey, respondents showed more interest in every suggested mobile library service options, such as renewing books online (from 64.8% to 79.0%) and asking questions through text messages (from 56.3% to 72.3%). Correspondingly, the number of students who indicated no interest in mobile library services decreased from 24.4% in 2010 to 9.6%

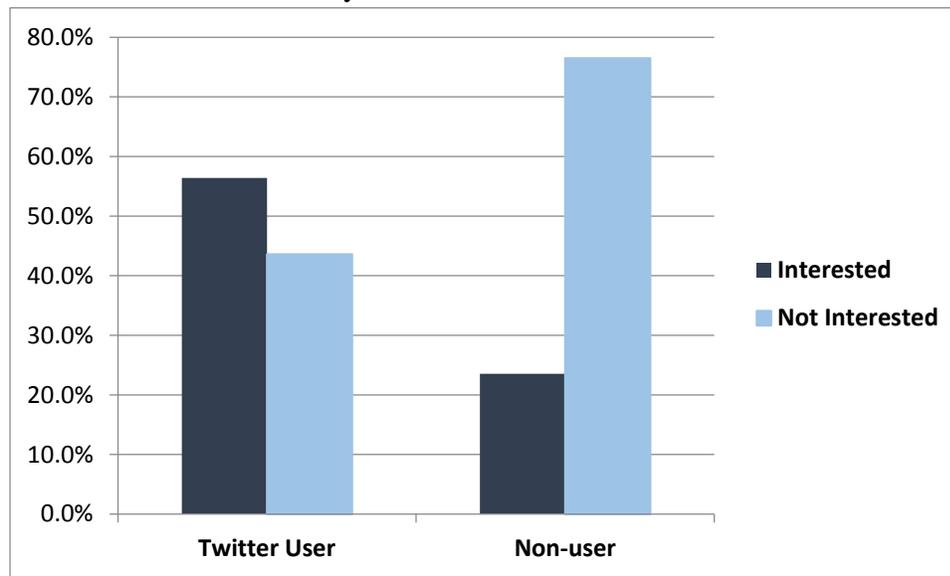
Twitter and RSS Feed

Less than half (33.4%) of the respondents recognized the term *RSS feeds*, and even fewer (20.2%) subscribed to any feeds. Even so, RSS usage had improved since the previous study, in which only 29.7% of respondents recognized the term and 16.4% subscribed to feeds. In contrast

with RSS feeds, Twitter had much greater name recognition amongst respondents (93.6%) and a higher adoption rate; students' use of Twitter almost doubled since the 2010 survey, from 21.2% to 41.4%. Nonetheless, 50.2% of those surveyed still indicated no interest in using Twitter, and 60.4% indicated no interest in library services using Twitter.

However, majority of those who have used Twitter did respond positively to library services offered through this technology (Figure 2). Over two-thirds of the respondents who have used either Twitter (67.5%) or RSS feeds (67.7%) expressed interest in selected library services using them. The services that received the most interest were reading library updates on Twitter (59.3% of Twitter users) and receiving notices of new books and resources through RSS feeds (42.3% of RSS users).

Figure 2
Student Interests in Library Services via Twitter



Chat/IM

Over 63% of respondents used chat/IM services, and an additional 10.4% were interested in using them in future. Facebook Chat was the most popular service amongst chat/IM users at

54.9%; Yahoo! Messenger was a distant second at 9.6%. More importantly, compared to Twitter and RSS feeds, more respondents (62.6% of all students surveyed) were interested in asking questions through chat/IM, including 81.2% of current chat/IM users.

Podcasts

Forty-three percent of those surveyed listened to or watched podcasts, a 7.0% increase from the 2010 survey. Compared to the last survey, in which most respondents used podcasts only occasionally (48.0%), the current survey showed an increase in students' podcast usage. Thirty-one percent of respondents reported weekly use of podcasts (versus 20.9% in 2010), while those who used podcasts occasionally dropped to 28.8%.

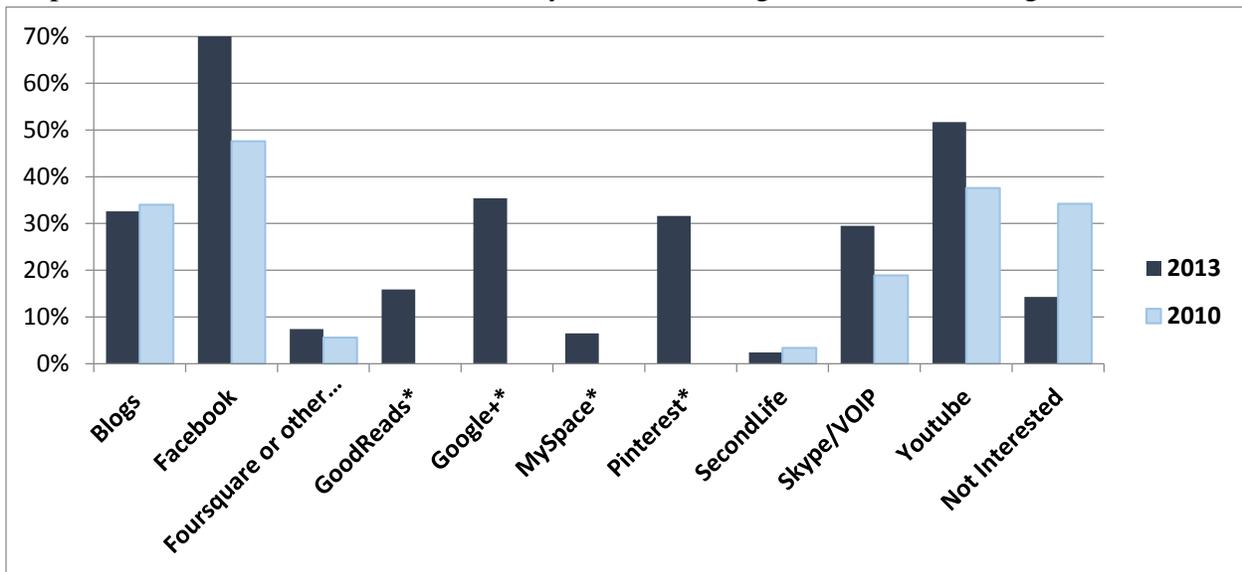
Respondents primarily used podcasts for education (75.7%) and recreation (73.2%), which was congruent with previous survey results. As for library services using podcasts, students preferred podcasts on topics in their areas of study (62.7%) as opposed to podcasts on using the library (37.4%) or local history (35.8%). Approximately one-third of respondents were not interested in using podcasts (32.2%) or library services involving podcasts (33.4%).

Other Notable Findings

Since the last survey, students' overall interest in library services through popular technologies has increased (Figure 3). The percentage of students who were not interested in library services via any survey-specified technologies declined from 34.2% to 14.3%. When asked to select a number of popular technologies through which they would like to receive library services, most students preferred Facebook (70.6%), followed by YouTube (51.7%) and Google+ (35.4%).

Figure 3

Proportion of Students Interested in Library Services through Various Technologies



* Technologies not surveyed in the 2010 study

In addition, familiarity of a technology alone does not always translate into interests in library services using that technology. In particular, 90.4% of students recognized Google+, but only 7.3% of those students were interested in library services using it; similar findings also applied to MySpace (88.1% familiarity, 6.5% interest) and Pinterest (86.0% familiarity, 31.6% interest).

On the other hand, when given concrete examples of a technology application for library services, some respondents who did not recognize a particular technology at the beginning of survey showed interest in adopting the technology in later questions. For instance, 68.4% (173 of 253) of those who indicated interest in specific, concrete library services provided via RSS feeds had not recognized RSS technology by name at the beginning of the survey.

Discussion

The shift in survey responses from 2010 to 2013 demonstrates an overall increased student interest in accessing library services via popular technologies. This increased interest

carries implications for continuing and enhanced library services, which will be investigated in more detail throughout the individual sections of this discussion. However, as in 2010, the 2013 study saw a high quantity of write-in comments requesting services that are already available, including Twitter, laptop checkout, wireless printing from laptops, wireless device chargers, and instant messaging (IM). Although some of these services, such as wireless device chargers, are relatively new, others are not: the SHSU library has offered IM-based services since approximately 2004, for example. The apparent lack of student awareness concerning existing services suggests that the library's marketing techniques may not be achieving maximum penetration into the student population. A follow-up study may be warranted concerning this issue.

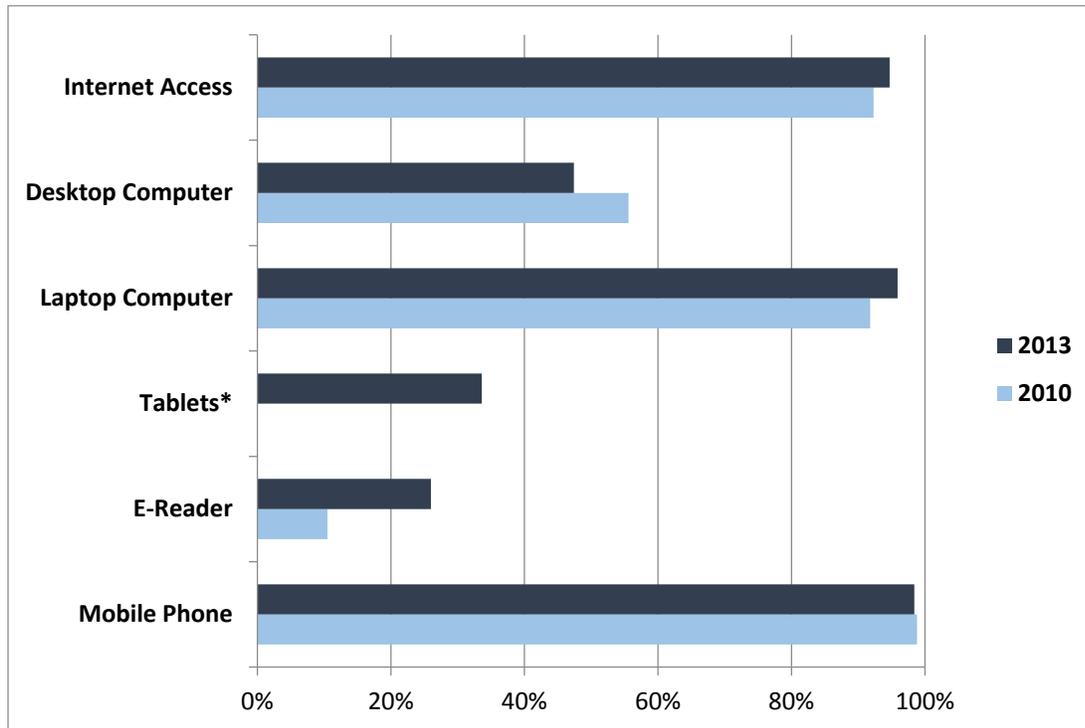
Another general observation the researchers made was that the framing of technology-related questions—for instance, simply referring to a technology's technical name versus providing concrete, familiar examples of the technology's use—has a distinct impact on how users respond. In this study, for example, the terms *RSS* and *RSS feed* had very low name recognition and received low reports of student usage; however, when specific library services were described that would be facilitated by RSS technology, users reported high interest in those services. Many users may actually be familiar with what RSS technology does but not know it by name. This suggests a need for careful selection of terminology in all similar library studies, depending on whether the focus is to determine name recognition alone or to determine a familiarity with practical applications. Furthermore, with clear communication and concrete service examples, students may be persuaded to engage with library services based in technologies with which they might be unfamiliar. This observation has significant implications for the ways in which library services are described and marketed, suggesting that a clear,

concrete description of the service's function and purpose should be heavily emphasized over the technical nature of the underlying technology.

Device Usage

The study revealed several insights into students' usage of various computing devices, including desktop computers, laptop computers, e-readers, and mobile tablet devices (Figure 4). The high percentage of desktop computers aged over one year suggests that fewer students have been purchasing new desktops, and the overall reliance on desktops does seem to have declined slightly since 2010. However, the researchers were surprised to learn that 64% of students who own a desktop computer still use it on a daily basis. Despite evidence of diminished PC sales—in April 2013, “the research firm IDC reported...the most severe decline in the PC market since IDC began tracking the business almost two decades ago”—and the popular idea (heralded by Steve Jobs) that we are moving into a “post-PC era,” desktop workstations clearly still occupy an important place in the daily routine of many SHSU students (Wingfield, 2013, B5).

Figure 4
Students' Usage of Devices and Technologies



* Technologies not surveyed in the 2010 study

Among desktop computers, the ratio of PC to Mac usage has not changed significantly since 2010; however, among student laptops, Mac usage has nearly doubled. This raises questions concerning library services, since campus computing is substantially weighted towards PCs. Cross-platform support should be emphasized with respect to services such as software for wireless printing, hardware for device charging, and library tutorials or instructions for tasks that may differ between operating systems, such as accessing Remote Desktop or changing cookie and pop-up settings in a browser.

This study further inquired into student usage of e-readers. Although the Amazon Kindle still led device popularity, the number of students with Barnes and Noble NOOKs increased significantly from 2010 to 2013. This shift in brand preference may be related to the active

marketing of NOOK Study, NOOK e-textbooks, and similar by the campus' Barnes and Noble bookstore or student desire for compatibility with those NOOK-based services and features. Interestingly, the average age of student e-readers increased since 2010, suggesting more existing ownership and fewer new purchases.

The developments in tablet usage were even more interesting, considering that the first-generation Apple iPad was only just released near the completion of the 2010 study; student ownership increased from none to about one-third of the student population in just three years. This was a higher rate of ownership than the researchers had expected when taking into account the average SHSU student's socioeconomic demographics and background. Apple iPads were the most numerous brand of tablet, which is unsurprising since this particular device was the leader in the explosion of tablets onto the computing market. Amazon's Kindle Fire—essentially a tablet in its own rights, despite being the descendant of a simple e-reader—was the second most common tablet, and this too is not surprising, given the Kindle's existing position of strength in the e-reader market which preceded the emergence of tablets. However, the researchers wonder how long the iPad may be able to sustain its dominance, as new sales of the device have dropped off during 2013 while competitors such as Samsung and ASUS have seen significant growth, creating a possibility that Android-based tablets may outpace iPads in the future (Nagel, 2013).

While 93% of students reported recreational use of tablets, 86% also reported educational use. This was somewhat more than the researchers expected, but high educational use of tablets is a positive indicator that academic library services do have a place in the tablet world. Compared to tablets, the split in e-reader usage is more pronounced, with recreational use significantly outpacing educational use. Furthermore, the educational use of e-readers has

dropped since 2010; the researchers speculate that the emergence of the tablet may have provided students with a more ideal device for educational needs, thus reducing this type of use with e-readers, which nevertheless may have remained preferable to some students for recreational reading activities. In any case, comparison of daily use between tablets and e-readers indicates that the tablet is, by far, students' daily go-to device.

Mobile Phones

This study's results showed that mobile phone adoption was nearly universal for students surveyed, with a majority of students using smartphones. The results reflected the high adoption rates found in the Pearson and ECAR reports, though SHSU adoption was actually higher than both reports (Pearson, 2012; Dahlstrom, 2012). This indicates an overall trend towards universal adoption of mobile phones. The research suggests that mobile phones, particularly smartphones, are an ongoing and important technology for establishing contact with the library, both in pushing content and in providing services. Smartphones provide a means for students to initiate contact and transact with the library for services such as reference, research, or receiving general information about both the library and the university at large.

Survey responses from the 2010 and 2013 studies showed that communication remains of central importance in mobile phone use, with students using their phones predominantly for texting, phone calls, and email. Web browsing and the use of apps are also popular among students, with use increasing significantly from the 2010 study. For the library this suggests a need for a mobile-friendly website and apps that will promote library services such as student research and resource access; any online library services that are incompatible with mobile devices will only discourage use of the library.

As recognized elsewhere in the study, students tended to show interest in library services while at the same time remaining unaware of their availability; targeting students with mobile library-service apps might broaden student awareness of how the library can meet their needs. In particular, the researchers noted a discrepancy between the high use of mobile phones for texting and the low use, perhaps even low awareness, of text-based reference services from the library; this discrepancy may warrant further study.

Wireless Printing

Student responses indicated a demand for wireless printing. Although this service is already available for laptops on campus—including in the library—it is not yet available for other kinds of mobile devices such as tablets. Demand for such a capability is only likely to increase as students' mobile-device usage continues to increase; demand is further increased by faculty use of tablets, especially since campus IT offers iPads for long-term faculty use. The researchers understand that the campus IT department is working towards new initiatives which may in the future address the need for mobile-device printing. In the meantime, however, the library could consider providing AirPrint wireless printers for iPad users, thereby serving its patrons while simultaneously demonstrating its “cutting-edge” thinking.

Quick-Response (QR) Codes

The researchers noted a lack of continuity between student familiarity with Quick-Response (QR) codes and the hype surrounding this technology in the library science field. Students at SHSU have an extremely low familiarity with QR codes, and those who are familiar with it use it infrequently at best. However, many librarians have touted this technology at professional conferences as a valuable marketing and information-sharing tool. The SHSU population may simply lag behind other student bodies in their interaction with QR technology.

However, this leads to a question of how librarians should proceed: should the use of QR codes be delayed until the student population's awareness and use of this technology has increased by natural means, or should librarians take a proactive role in educating students about QR codes and marketing the technology's use? The answer is not clear-cut and may depend on various factors in a given library. As for SHSU, the researchers intend to develop instructional workshops on QR codes; a precedent exists for training students, faculty, and staff in the use of technologies such as RSS feeds, so this course of action will fit a pattern of past behavior while also fulfilling an apparent user need.

Podcasts

This study observed an increase in the use of podcasts, not so much a significant increase in new adopters of podcast technology, but more an increase in frequency of use. Nevertheless, the majority of students responding expressed no interest in the library doing more with podcast services. Over the past few years the library has contributed to creating podcasts on subjects related to library and university life. Students in this study, however, responded that their interest was in podcasts that supported subject studies and recreational interests. In response to the survey data collected, the library could play a role in improving findability of existing podcasts, although to avoid duplicated efforts already done well by others on the Internet, the library may want to limit such recommendations to highlighting university-related content. In some cases, LibGuides or other resources might be needed to recommend and instruct users on the variety of podcatcher apps and RSS services available. This is a suggested area for future study.

Geosocial Networking

Foursquare or other geosocial networking sites continued to show a poor response from students as a technology desired for distributing library services. Geosocial networking lacks

familiarity in comparison to the name recognition of other social networking sites such as Facebook. This lack of familiarity corresponds with the collected data showing low student adoption rates for geosocial networking. This observation is made in contrast to library literature's promotion of this technology and other libraries' experience of using this technology in marketing and encouraging user engagement (Cuddy & Glassman, 2010; Ekart, 2010). At this time, the researchers' library has not made use of any geosocial networking technologies for library services, and despite some increase in name recognition for this technology in comparison to the 2010 study, the results of this survey support the library's continued non-adoption of this technology.

Twitter

Twitter remains a highly-recognizable social media technology, and this study observed some increase in adopters from the 2010 study. Nonetheless, the majority of students expressed no interest in library services via Twitter. The library, however, does have a history of using Twitter and in 2012 decided to promote this service by distinguishing the use of Twitter from that of Facebook. Rather than syndicating identical posts to both services as had been done in the past, the library now uses Twitter primarily as a venue for immediate library announcements regarding resources and services, including building closures, resource outages, and new subscriptions, whereas Facebook is used for more engaging general interest stories. Despite the high percentage of patrons not using Twitter, the library will continue to use this service for microblogging library news and other important notifications. This decision is supported by the data, which shows that users who are interested in using Twitter for library services concurrently have a higher interest in using Twitter for getting library news.

Google+

Google+ remains one of the few social technologies with name recognition and popular interest which the library has not adopted. Since Google released Google+ in the summer of 2011, adoption has been rampant, with over 250 million users at the time of this study. On a daily basis, the statistics show 75 million users with activity of at least 60 minutes a day across all Google products and an average of 12 minutes per day in Google+. This totals 360 minutes per month, only 81 minutes less than the 441 minutes of usage per month for Facebook (Bullas, 2012, June 28). Although only 35% of SHSU users currently express any interest in library services using Google+, in light of its global adoption rate and high name recognition at SHSU, Google+ may be underused in the library's social media planning.

Google+ provides some distinct differences to Facebook that could be useful to library services. One of the strengths of Google+ is the use of *circles* for organizing how users interact socially online and govern privacy. Additionally, Google+ Communities would enable the library to create a community page where library users could interact with each other. Google+ Communities could also be a good way to promote LibGuides and other online resources for library users and the university community at large. Google+ Hangouts could be explored for a variety of services including online training and instruction, book reading groups, and more. For some libraries, these Google+ services might work well for a point of reference. At the researchers' library, other services are currently being used for email, SMS/text, and chat/IM reference, but the researchers recognize that adopting such specialized software creates a barrier for users who already use other chat services like Facebook and Google+.

Instant Messaging / Live Chat

Despite the fact that the SHSU library has provided an instant-messaging service for nearly ten years, numerous write-in comments demonstrated ignorance that this service existed.

This suggests that new promotional approaches may be needed to facilitate student awareness. During the semester before this study was conducted, the launch of a new embedded librarian program resulted in chat widgets being placed prominently on all users' dashboards in the Blackboard course management system. The researchers hope that this, along with the ever-increasing presence of embedded librarians and chat widgets in individual class spaces in Blackboard, will be one step towards increasing student awareness of the library's live chat service. Additionally, the August 2013 launch of an updated website introduced a "pop-out" tab on the edge of every page to further increase the visibility of and ease of access to the instant-messaging service.

On the more positive side, the number of write-in comments demonstrating ignorance of this service was actually exceeded by the number of comments which actively praised the existence of and the library's performance in live chat. This finding is encouraging and validates current library services.

Although the library tends to consider the concept of *live chat* as being synonymous with *instant messaging*, students who request an IM service may actually see a difference, in the sense that the library is not present in the popular IM world which the students already occupy. For instance, the library does not have usernames in AOL Instant Messenger, Yahoo! Messenger, or other popular IM tools that students use recreationally. Therefore student requests for IM may just be signaling ignorance of the existing service, but they may also be communicating that a presence in those popular realms of IM would provide a different level of service than an anonymous web-based chat which they must access through our website (or via embedded widgets in other university-related pages).

If this popular IM presence is what students were requesting, then, ironically, the SHSU library's recent transition to a new chat service platform may have cost it the ability to fulfill this need. The library's former subscription to the LibraryH3lp chat service provided the capability to appear present in numerous IM tools—including Facebook Chat, the most popular tool among students surveyed—while actually monitoring only the LibraryH3lp interface, to which messages from all other systems were funneled. However, with the more recently adopted chat platform, such a capability is not present: maintaining a presence in numerous tools would actually require numerous simultaneous logins and the monitoring of numerous interfaces for incoming messages, and this would be an undesirable burden on reference personnel. With chat services, as with many technologies where choices must be made regarding a brand or version, some features must often be sacrificed in exchange for different features, cost savings, or similar: librarians should research carefully and prioritize the features that will be most important to a given user population in order to select the most appropriate tool.

Ideas for Future Services

In addition to sharing their thoughts on technologies specifically mentioned in the survey, respondents also shared write-in suggestions for numerous other technologies that they would like to see the SHSU library leveraging. For instance, they suggested self-checkout machines; Mac Books for checkout; online thesis and dissertation submissions; Apple's Facetime; and even the use of main university logins by the ILLiad interlibrary loan service, removing the need to create and remember yet another username and password. Some suggestions, such as self-checkout machines, may be too costly for the library to consider at this time; others, such as the ILLiad suggestion, may face insurmountable technical complications. Nevertheless, the researchers sincerely appreciate the student body's creative thinking, and hope that such

innovative suggestions will continue to push the library to the limits of its ability to provide valuable technology-based services at the point of need.

Study Limitations

Participant self-selection, a common concern with any survey, was also a challenge for this study. The most notable issue was the predominance of female respondents: at 70%, it was well above the actual gender ratio of the student population. Even though no significant differences in responses were found based on participants' gender, such disparity nonetheless reduces the strength of survey findings to represent the entire SHSU student population.

In addition, the survey format limits researchers to gauge students' interests, not actual use, of library services through various technology platforms. Therefore, whether students' self-declared preferences for certain technologies would translate into actual usage of library services through them remains uncertain.

Lastly, despite attempts to clearly define e-readers and tablets and explain examples of both, the researchers acknowledge that some respondents may have experienced confusion between devices and apps: for example, someone may not own an actual NOOK e-reader device, but may use the NOOK app on a tablet, and thus may have mistakenly given a positive response to a question about owning and using a NOOK. It is possible that such confusion may have in some ways skewed the data concerning e-reader use.

Conclusions

As compared to the 2010 study, the researchers found that students increased their use of laptops and e-readers, began using tablets, and showed more interest in mobile library services. The immediacy of mobile devices and their rising popularity are providing academics' with

opportunities to advance learning and provide services, while also presenting challenges to ensure students are both informed and trained. Mobile-device training for SHSU students, particularly with regard to accessing library resources, is a future possibility. Although the researchers acknowledge that the most successful mobile apps require no training, we also recognize that vendor-provided library resources such as mobile databases and downloadable DRM-protected e-books tend to be less user-friendly than most popular apps. The average undergraduate student or the less tech-savvy faculty member may benefit from demonstrations and/or training. Another future possibility involves improving the marketing of technology-based library services, as the current study re-emphasized an existing discontinuity between the services the library offers and the services that many students are, or are not, aware of. Furthermore, the researchers reaffirmed their belief that library offerings should not be based on what staff believe to be frontline or stellar technology but rather on evidence of students' interest in and use of devices, features, and services.

Further Research

A general increase, since the 2010 study, in SHSU-student interest in technology-based library services is a positive finding. This finding may foster further research, especially regarding the use of social networking services for library-related interaction with SHSU students, given the interest indicated by adopters of Twitter and Facebook Chat.

However, as has been noted, although students positively responded to receiving library services via various technologies, many remain unaware of some services their library already provides—for example, text-based reference services. Further exploration is warranted to determine the cause(s) for this dilemma and to study, analyze, and discuss resolutions. Two suggestions would be the following: research what determines a successful strategy of educating

students about the text-based reference services, including what those services can provide for students and effective ways to get students to engage with the service. A possible strategy may be encouraging students to use the service sometime in the week following orientation and measuring whether this increases usage overall. The second area for further study would be looking at how effectively the text-based reference service meets a student's needs and how that relates to a student's continuing participation in the service.

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