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Deborah Tritt
University of South Carolina - Aiken, deboraht@usca.edu

Kaetrena Davis Kendrick
University of South Carolina - Lancaster, kaetrena@mailbox.sc.edu

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Deborah Tritt and Kaetrena Davis Kendrick

Deborah Tritt is an Instruction/Reference Librarian at the Gregg-Graniteville Library of the University of South Carolina, Aiken. She can be reached at deboraht@usca.edu. Kaetrena Davis Kendrick is an Assistant Librarian at the Medford Library of the University of South Carolina, Lancaster. She can be reached at kaetrena@mailbox.sc.edu.

Introduction

While cloud computing is not new, cloud-based services have matured and become more prevalent, thereby offering a range of new technology tools for libraries. Cloud computing technologies, and in particular those designed for end-users, present librarians with varying technology proficiencies the ability to access and use technologies - and related services - that might otherwise be beyond their reach. As cloud computing becomes more of a mainstay, many librarians are considering new ways to use these third-party tools in their work.

Cloud computing is a significant innovation for network computing. The National Institute of Standards and Technology (NIST, 2011) defines cloud computing as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction"(p. 2). In essence, cloud computing is a term referring to a network computing model that relies on distributed systems to deliver computing services on demand. Rather than requiring local infrastructure and expertise to configure and manage hardware, cloud computing facilitates remote access to robust computing power.

Cloud computing transforms how computing services are accessed and managed. This model of network computing provides a number of benefits to users and organizations, including improvements in technology accessibility, reliability, and efficiency. Cloud computing technologies can be accessed on-demand via the internet giving users greater flexibility in how and where they access computing resources, as well as increasing the variety of technology resources available from user desktops. For example, system administrators can access server space via the Internet, and end-users can access their data in remote storage tools like Dropbox from any web-connected computer. Cloud computing can also increase network reliability and efficiency. According to Breeding (2012), "Clouds, because of their massive redundancy and clustering, are very fault tolerant" (p. 3) and since cloud computing is elastic, it can expand or shrink as computing power needs increase or decrease. This model of network computing brings a number of innovations and efficiencies to organizations and users. System administrators,

developers and end users all benefit from the array of services offered under the umbrella of cloud computing.

For most librarians, *Software as a Service* (SaaS) cloud computing technologies are the most accessible and applicable form of cloud computing. SaaS is one of the three layers of the cloud computing stack and refers to software designed for end users and made available over the Internet (Luo, 2013). Common examples of SaaS include Google Docs, Evernote, and Dropbox. SaaS cloud computing technologies bring powerful options to those who may not otherwise have the expertise, staff, time or infrastructure to implement and support various computing services. Sultan (2013) notes that "cloud computing is a democratizing force" (p. 813), and to that end, access to cloud technologies helps librarians overcome limitations and utilize robust computing in their practice of librarianship.

Librarians at small or geographically isolated academic institutions are one group of LIS professionals that face challenges when accessing and leveraging technology. The Center for the Study of Rural Librarianship (CSRL, 2008) *Issues and Trends Report* identifies technology as the top concern for rural and small libraries. Technology plays a critical role in the lives of librarians at small and rural libraries, but these LIS professionals often have limited resources, including staff and funding, which make incorporating and supporting new technologies difficult, if not impossible (CSRL, 2008). For this group of LIS professionals, cloud computing provides opportunities to access and employ technologies that may benefit their practice of librarianship, library patrons, and libraries.

The present exploratory study investigates the impact of cloud computing on academic librarians at small and rural libraries. This study also examines the use of cloud computing tools by these LIS professionals and participant concerns about cloud computing.

Literature Review

Although literature addressing the technology needs of librarians at small or rural academic libraries is scarce, there is a wealth of LIS literature focusing on cloud computing in academic libraries. Mavodza (2013) examines cloud computing from an information technology and systems librarian perspective; additionally, several articles present best practices and case studies for a variety of tasks, including scholarly communication and

publishing, digital archiving, and library instruction (Greene & Ruane, 2011; Breeding, 2013; Koury & Jardine, 2013). Other relevant literature reveals how librarians use cloud computing, with a specific focus on certain groups, including distance, learning commons, and reference librarians (Scale, 2010; Ipri, 2011; Luo, 2013). Recent publications also solidify the idea that cloud computing issues and practices are being standardized and internationalized: OCLC released a short report on cloud computing in 2010 (Goldner), LITA published a general guide introducing librarians to the topic (Corrado & Moulaison, 2011), and cloud computing was heavily discussed at the Second International Conference on Academic Libraries (Sharma, 2013).

These studies and reports are useful and provide insight into how cloud computing technologies are used in libraries; however, they do not consider library size, location, or take into account the unique challenges that LIS professionals in small and rural libraries face. Issues of staffing, shrinking budget concerns, access to training or professional development, and the implementation of policies that can keep up with the ever-changing demands of technology are familiar to all librarians; and these challenges are augmented in small and rural academic library environments (Kendrick, Leaver, & Tritt, 2013).

General LIS literature focusing on small and rural libraries highlight how these organizations have limited access to technology, yet rely heavily on technologies to provide collections and services to patrons. In the Center for Rural Librarianship's 2008 survey, almost 54% of participants mentioned technology as a primary concern for rural librarians, with special focus on the necessity of wireless networks and high-speed Broadband access, and maintaining currency with software and hardware (p. 4). In their research brief, Swan, Grimes, and Owens (2013) state "Rural areas have less access to broadband services than urban areas…In order to mitigate this disparity in access, rural libraries have made additional efforts to increase their electronic resources" by adding more on-site computer terminals (p. 7). The same report notes that small and rural libraries are making concerted efforts to increase their online presence and access to digital technologies. Moreover, these technologies help patrons and communities procure needed skillsets required for modern society (e.g., information and digital literacies) (Swan et al., 2013). The following study narrows the focus to how small and rural academic libraries have used cloud computing technologies to further mitigate technology stagnation and access disparity concerns.

Methodology

Instruments and Procedure

The researchers utilized GoogleDocs, a cloud-based collaborative word processing application, to create a 26-item questionnaire (Appendix). The questionnaire was tested to gauge validity and an average length of time it took to complete the questionnaire. After testing for validity and completion time, the survey was vetted through the researchers' Institutional Review Board. Once approved, the questionnaire content was uploaded into LimeSurvey, an open source survey tool and launched for four weeks. When the survey closed, responses were checked for errors and prepared for testing within LimeSurvey.

Survey participation was requested through several national, state, and special topics listservs (e.g., ILI-L, COLLIB-L, RUSA-L, LIB-IDAHO, RURALIB-L, SCLA-L, GLA-L, GODORT-L) and via social networking sites such as LinkedIn, Google Plus, and Facebook (authors posted on their personal profiles, state library associations, and special library group social networking pages). During the active survey period, one participation reminder was sent to the same listservs and social networking sites. When the survey was closed, there were 120 responses, and after reviewing the surveys for completion, 98 were found to be viable for the study. Data from the complete, accurate responses were imported into Microsoft Excel for analysis. According to the National Center for Education Statistics' *Academic libraries: 2012 First Look* report, there are 26,606 academic librarians working full-time in the United States (U.S. Department of Education, 2014). Roughly 6,600 of these librarians work at small academic libraries (VS2, S2, VS4, and S4 Carnegie Classifications) (Carnegie Foundation for the Advancement of Teaching, 2014). Thus, the present study findings do not reflect aggregate views of cloud computing implementation or utilization by small/rural academic librarians. To provide context to the quantitative results, participant comments from open-ended survey questions are included.

Participants

Participants in this study work in a rural or small academic library and possess an ALA-accredited Master's degree (n=98). Carnegie Classifications of VS2, S2, VS4 and S4, with less than 3,000 FTE were used to define small academic libraries (Carnegie Foundation for the Advancement of Teaching, 2014). Additionally, the researchers utilized the U.S. Census rural area definition of less than 50,000 inhabitants (U.S. Census Bureau, 2013) for this study. In the respondent pool, 78% of the group was female, 20% were male, and 1% abstained from answering. One-third of respondents indicated they were between 25-35 years of age; and just under a third indicated they were between 36-44 years of age. Almost 20% of respondents were between 45-54 years old, and around 15% of the respondent group was between 55-65 years old. Only 2% indicated they were older than 65. Thirty-seven percent of respondents are at the beginning of their career, with between 0 and 4 years of credentialed librarian experience. Another 23% have between 5 and 9 years of experience; while 19% percent have between 10 and 14 years and 21% have 15 or more years of experience.

Just over half of the respondents work at a four-year private college or university, and another 20% are employed at a two-year public junior, technical, or community college. Only 16% are employed at a public four-year institution, and 4% are employed at two-year private junior, technical,

or community colleges. Statistics delineating the experience of southern libraries could not be extrapolated from survey data.

Respondents were asked about their primary duties, and to better reflect the workflow and staffing in small and rural libraries, they were able to indicate more than one choice. Almost 60% of participants indicated that their primary work was in reference or instruction, and 38% also indicated that they are involved in electronic resources. Thirty-three percent also noted their duties in technical services, and 31% also are involved in library management or administration. Solo librarians constituted 13% of the respondent group and the majority of respondents work at a library with 2-3 librarians (36%). Twenty four percent of respondents work at libraries with 4-5 librarians, 10% of respondents were that employ 6-7 librarians, and 17% of respondents reported that they work at libraries with 8 or more librarians.

Results

Cloud Computing Use

Participants in this study were asked about their familiarity with cloud computing technologies. The majority of respondents indicated that they were somewhat familiar (42%), familiar (33%) or very familiar (20%) with cloud technologies. Only 5% of respondents said that they were not familiar with cloud technologies, with 1% abstaining.

Based on the SaaS cloud computing service type framework provided by Luo (2013), participants were asked to identify the types of cloud SaaS services used and given the ability to choose more than one answer. Survey respondents cited data collection services (e.g. SurveyMonkey, Google Forms) (84%) as the most popular type of cloud computing service used, and 82% indicated that they used file sharing services (e.g. GoogleDrive, Dropbox). Participants also indicated a high use of video services (e.g. Vimeo, YouTube) (81%), online presentation services (e.g. Prezi, SlideShare) (72%), calendar services (e.g. Google Calendar, Doodle) (71%), and online document editing services (e.g. GoogleDrive, Zoho Docs) (69%). Fewer respondents cited use of information management services (e.g. Evernote, Springpad) (46%) or image editing services (e.g. PicMonkey, iPiccy) (23%). All respondents reported use of at least one type of cloud computing service (Figure 1).

Survey respondents were given the ability to identify the specific types of cloud computing tools they utilize. Sixty-seven percent of participants indicated a high use of GoogleDrive products. Dropbox, a cloud file sharing and storage site (36%) tied with the cloud-based survey tool, SurveyMonkey (36%), as the second most popular tool. Thirty-five percent of respondents listed YouTube, a video sharing service and 31% of participants mentioned their use of Prezi, an online presentation tool. While numerous other tools were listed by participants, these top five cloud computing technologies provide a picture of the kinds of

cloud computing tools in use by librarians at small and rural academic libraries.

Impact on Library Practice

Workflow

When asked if cloud computing impacted workflow, 72% of respondents indicated that cloud computing had changed their workflow, while 28% said that it had no impact on their workflow. Open-ended comments reveal that cloud computing increases mobility:

> "It makes me more flexible and able to be more productive while covering public service areas."

> "These services allow me to access information from a variety of locations and devices."

Open-ended comments also show that cloud computing improves workflow efficiency:

> "Able to deploy services and resources more quickly without purchasing equipment or software."

> "Being able to share documents has streamlined workflows and allowed for more collaboration."

Additionally, open-ended comments highlight the benefits of cloud computing for collaboration:

> "These tools have been good for sharing content with users, as well as with colleagues."

> "Easier to collaborate with librarians outside of my institution."

Library Services

Survey participants were asked to relay how often they used cloud computing to support existing library services. Thirty-five percent of respondents indicated that they often use cloud computing to support existing library services. Twenty-eight percent indicated that they always support existing services with cloud computing, while 18% sometimes, 12% rarely and 7% never use cloud computing to support existing library services. In open-ended comments, participants emphasize the benefits of information sharing, mobility and collaboration in terms of using cloud computing to support library services:

> "It's about sharing information easily, being mobile."

> "We used Google Docs and drive to work collaboratively on projects, to share resources."

> "Communication/collaboration with colleagues often happens through the cloud."

When asked whether they have been able to implement new library services because of cloud computing, most respondents communicated that they had not implemented

new services (52%), while 45% indicated they were able to implement new services. In open-ended comments, participants identified new services implemented as a result of cloud computing:

"Personal Librarian program (IL tutorial on YouTube, assessment through Google form)."

"Created interactive scavenger hunt for freshman seminar using Google Drive."

"The interactive tutorials are a new service as are the videos."

Professional Communication

Participants were asked to indicate on a Likert scale the impact of cloud computing on a number of different professional communication areas. For librarians at small and rural academic libraries, cloud computing was extremely likely (40%) to impact how they communicate with librarians at their own library. Participants also indicated that cloud computing was likely (40%) to impact how they communicate with librarians at other libraries. Survey respondents' interaction with patrons was likely impacted (43%), and communication with professional associations received a 40% likeliness of interaction impact. Teaching faculty interaction at participant institutions were least likely to be impacted by cloud computing (33%) (Table 1).

Barriers

Respondents were asked about how cloud computing affected any challenges in the workplace. Almost two-thirds (65%) of the participant group indicated that cloud computing had reduced barriers, with 34% saying that it had not, and 1% abstaining. Open-ended comments reveal how cloud computing helps librarians overcome workplace barriers, emphasizing aspects of communication, collaboration, collegiality, and mobility:

"We are very small. Only 7 staff members (5 librarians). I am the only instruction librarian. A couple librarians I only see once a week... so working in the cloud is helpful. We all have the apps on our mobile phones, so we are still in the loop, even when not on duty or in the library."

"Collaboration with colleagues in other libraries simply would not be possible without cloud [computing]."

"I can complete my tasks anywhere with internet access. Previously, it was hard to bounce between my office and the information desk."

"I am able to be productive on all five campuses of my institution without need to install specific software on specific computers."

Open-ended comments also discuss how cloud computing helps overcome workplace technology barriers:

"Allows us access to services our campus IT was unable or unwilling to provide."

"Since most of the time I don't have to download something to my work computer, I do not have to invovle [sic] my IT department in the decision about whether or not to use the product."

Respondents were also asked to reflect on barriers that prevent the use of cloud computing in their workplace. There is an even split with 49% of participants indicating they had barriers to cloud computing and 49% indicating they did not have barriers to cloud computing, with a 2% abstention. Open-ended comments discussing barriers to cloud computing included issues of time and expertise:

"Time and energy to evaluate new options is limited."

"Time to learn new things… lack of time, that is."

"Few tech-savvy colleagues onsite; miniscule budget; small IT staff has little time to focus on library needs/plans."

Open-ended comments also reveal institutional barriers to cloud computing.

"It is difficult to liaison with main campus IT."

"Our IT will not let me load Dropbox or Evernote on my work computer."

"Administrative network at my school (library computer is on this network) is blocked against streaming video, including YouTube."

Continuing Professional Development

Survey participants were asked about whether they had participated in any training on cloud computing technologies. Seventeen percent of participants indicated that they had attended professional development trainings on cloud computing, while 81% had not, with 1% abstaining.

Policies

Participants were asked about institutional policies on cloud computing and library policies that have arisen with the implementation of cloud computing. Twenty percent of participants indicated that they had updated or implemented policies as a result of cloud computing, while 76% communicated that they had not updated nor implemented policies, with 5% abstaining. Additionally, 17% said their institutions had policies regarding the use of cloud computing and 76% did not, with 6% abstaining.

Cloud Computing Concerns

Participants were provided with an open-ended opportunity to communicate their concerns about cloud computing. Concerns included reliability, privacy and security:

"I worry about the permanence (or lack of) and preservation of our work, and especially access to it. However, I think the positives definitely outweigh the negatives."

"I don't trust really sensitive, important information on the cloud yet. I prefer having that info on a hard drive that only I have access to, or something like that."

"I am hesitant to use cloud resources for library services because of privacy concerns."

Survey respondents also expressed concerns about the technology competency levels of colleagues in open comments:

"Many cloud services require all (or most) employees to use them to demonstrate their full benefits. If my entire committee is not on Google Drive, we can't collaborate on a shared document. While progress has happened, many employees are hesitant or unable to learn on their own and require technical training."

"As with any new technology, there is a learning curve for staff."

Discussion

As evidenced by the high use of cloud computing tools by survey respondents, cloud computing has found its way into the work lives of librarians at small and rural academic libraries. For those who may not have adequate staffing or other resources, SaaS cloud computing tools facilitate opportunities to access helpful technology tools. These tools generally require minimal skill and cost to implement, making them even more attractive. For LIS professionals at small and rural libraries, cloud computing positively impacts their workflow, professional communication channels, and existing library services.

Two-thirds of survey respondents indicated that cloud computing helped them overcome workplace barriers. In particular, staffing, funding, and time limitations are eased by cloud computing's efficiency, collaboration and mobility gains.

While respondents did not cite cloud computing as a major facilitator in the creation of innovative library services, they did contend that it is helping to support existing services. Primarily, respondents focused on the benefits of cloud computing to library services through improvements to collaboration and information sharing.

Survey responses on participant workflow, professional engagement, and library services highlighted collaboration as a critical benefit of cloud computing technologies. The ability to collaborate and share information with others within and outside of one's home library is essential to engaging professionally and overcoming geographic isolation. Participants stated in open-ended comments:

"So far the cloud has been great for coll[a]borating with colleagues something that was very difficult to do before for librarians in Wyoming. Not only are we rural but there are great distances between our community colleges."

"I can't imagine working without these technologies. We are both small AND rural, and could be really isolated without these cloud-based services. They are essential for collaboration!"

LIS professionals at small and rural academic libraries also encounter barriers to cloud computing. As noted in a previous study, librarians at small and rural academic libraries lack time to learn new technologies (Kendrick, Leaver &Tritt, 2012), and it bears out in the present research as well: only 17% of survey respondents have attended professional development training on cloud technologies. One respondent noted:

"My library (2 full-time, one part-time librarian, and one full-time staff person) is very small in relation to our FTE (~4600), so I know that many of the limitations I've experienced are due to lack of time for training more than not understanding the cloud's utility."

Other limitations included small staffs and the lack of technology skills in co-workers. Librarians also encounter institutional limitations in their ability to access cloud computing technologies because some academic institutions block general access to cloud computing tools.

Policies related to cloud computing are not generally being implemented by libraries or their academic institutions. This absence in policy is noteworthy when contrasted against the concerns the respondents have for privacy, security and the lack of reliability of cloud computing tools.

Conclusion

The present exploratory study investigated the impact of cloud computing technologies on librarians at small and rural academic libraries. The study also sought to examine the use of cloud computing by these LIS professionals and identify their concerns about cloud computing in libraries.

Additional research expanding upon the concerns of reliability, security, privacy and co-worker technology proficiencies would build a more complete picture of the impact of cloud computing on librarians at small and rural academic libraries. Also, further research is needed on the impact cloud computing has on professional communication and collaboration for these LIS professionals.

Librarians at small and rural academic libraries face numerous challenges. They often lack the expertise, staff,

and time to implement and support powerful computing services; however, they are actively tapping into the power of cloud computing to employ new technologies that expand and improve their practice of librarianship and serve the students, faculty and staff at their institutions.

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Appendix

Questionnaire

General Characteristics

1. Are you a credentialed librarian (you have earned an ALA-accredited Master's degree or its equivalent)?
    a. Yes
    b. No

2. Do you work in a small (FTE= <500 - 2,999 students; having between 1 to 7 librarians) or rural (area population <50,000) academic library?
    a. Yes
    b. No

3. Please select the category that best represents your age:
    a. Under 25
    b. 25-35
    c. 36-44
    d. 45-54
    e. 55-64
    f. Over 65

4. Please select your gender:
    a. Male
    b. Female

5. How long have you been a credentialed librarian (ALA-accredited MLS or equivalent)?
    a. 0-4 years
    b. 5-9 years
    c. 10 -14 years
    d. 15 years or more

6. In what type of academic library do you work?
    a. 2 year public junior, technical or community college
    b. 2 year private junior, technical or community college
    c. 4 year public college or university
    d. 4 year private college or university
    e. Other (please specify): _____

7. What is your primary work function?
    a. Administration/Management
    b. Circulation
    c. Reference/Instruction
    d. Interlibrary Loan
    e. Technical Services
    f. Acquisitions
    g. Collection Development
    h. Electronic Resources
    i. Outreach/Programs
    j. Government Documents
    k. Archives/Special Collections
    l. Systems
    m. Other (please specify): _____

8. How many professional librarians are employed in your library?
    a. Solo librarian
    b. 2-3
    c. 4-5
    d. 6-7
    e. 8 or more

9.   Do you have faculty status?
        a.   Yes
        b.   No

10.   Are you on tenure track or tenured?
        a.   tenure-track
        b.   tenured
        c.   neither

Impact of Cloud Computing

11. What does cloud computing mean to you?

12. How familiar are with cloud computing technologies?

1	2	3	4
Not familiar	Somewhat familiar	Familiar	Very familiar

13. Have you used any of the following types of cloud computing services? Please select all that apply.
        a. cloud-based video services (e.g. Vimeo, YouTube)
        b. cloud-based file sharing services (e.g. GoogleDrive, Dropbox)
        c. cloud-based information collection services (e.g. SurveyMonkey, Google Forms)
        d. cloud-based information management services (e.g. Evernote, Springpad)
        e. cloud-based calendar services (e.g. Google Calendar, Doodle)
        f. cloud-based online presentation services (e.g. Prezi, SlideShare)
        g. cloud-based online document editing services (e.g. GoogleDrive, Zoho Docs)
        h. cloud-based image editing services (e.g. PicMonkey, iPiccy)
        i. No, I have not used any of these types of cloud computing services.

14. Please list specific cloud computing tools you have used.

15. Has your workflow changed as a result of cloud computing?
        a.   Yes (please specify)
        b.   No

16. How often do you use cloud computing to support existing library services?

1	2	3	4	5
Never	Rarely	Sometimes	Often	Always

17. How do you use cloud computing to support existing library services?

18. Have you been able to implement new library services because of cloud computing?
        a.   Yes (please specify):
        b.   No

19. How likely is it that cloud computing has impacted how you engage:

	extremely unlikely	unlikely	neutral	likely	extremely likely
with library patrons					
with colleagues at your library					
with faculty at your academic institution					
with colleagues at other libraries					
with professional associations/committees					

20. Does cloud computing help you overcome barriers in your workplace?
        a.   Yes (please specify):
        b.   No

21. Are there barriers that have prevented you from using cloud computing technologies?
        a.   Yes (please specify):
        b.   No

22. Have you attended professional development training on the use of cloud computing technologies?
        a.   Yes (please specify):
        b.   No

23. Have you updated or implemented policies as a result of cloud computing?
        a.   Yes   (please specify):
        b.   No

24. Does your institution have policies guiding the use cloud computing?
        a.   Yes   (please specify):
        b.   No

25. What concerns do you have about implementing or using cloud computing? Please explain.

Conclusion:

26. You may leave general comments about this study here.

Figure 1 Use of Cloud Computing. This figure shows the use of cloud computing services by librarians at small and rural academic libraries.
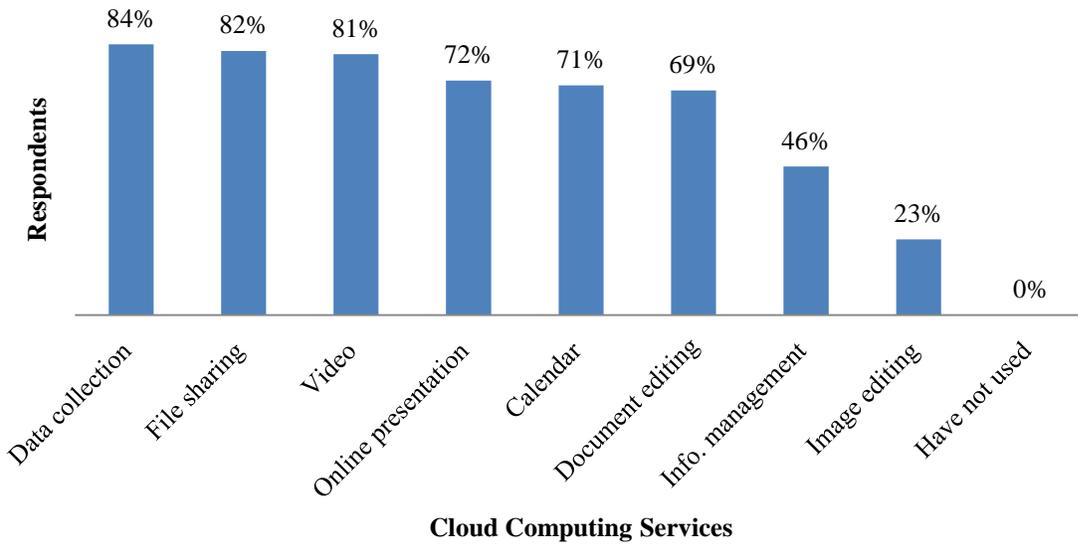

Table 1

Impact of Cloud Computing on Professional Communication.

Interaction Group	Extremely likely	Likely	Neutral	Unlikely	Extremely unlikely
With colleagues at your library	40%	34%	12%	6%	6%
With professional association/committees	25%	40%	28%	2%	4%
With colleagues at other libraries	24%	40%	25%	2%	4%
With faculty at your academic institution	21%	33%	27%	8%	9%
With library patrons	19%	43%	21%	5%	11%

Note: Table shows how likely librarians at small and rural academic libraries are to use cloud computing for communication with various groups.