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Implementation of web 2.0 services in academic, medical and research libraries. A scoping review

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Conflicts of interest

The authors have no financial relationships relevant to this article to disclose.

Key messages

Implications for practice

Some of the web 2.0 services most frequently implemented by academic, medical and research libraries over the past five years include conferencing/chat/instant messaging, blogs, social networking, wikis, podcasts and aggregators.
For academic, medical and research libraries aiming at implementing such services, a clear and rigorous evaluation strategy is advisable, in order to obtain reliable data about the effectiveness of library 2.0 services for final users.

Implications for policy

Most identified studies lack rigorous research designs and outcome measures. Further primary research should be undertaken about the effectiveness of implementation of web 2.0 services in academic, research and health libraries, using appropriate research designs and clearly specified outcome measures.

A systematic review of of the relevant literature is recommended, in order to evaluate the effectiveness of these services, and to identify gaps in the evidence base.

Structured abstract

Background
Academic, medical and research libraries frequently implement web 2.0 services for users. Several reports notwithstanding, characteristics and effectiveness of services are unclear.

Objectives

To find out: the web 2.0 services implemented by medical, academic and research libraries; study designs, measures and types of data used in included articles to evaluate effectiveness; whether the identified body of literature is amenable to a systematic review of results.

Methods
Scoping review mapping the literature on the topic. Searches were performed in 19 databases. Inclusion criteria: research articles in English, Italian, German, French, and Spanish (publication date >= 2006) about web 2.0 services for final users implemented by academic, medical and research libraries. Reviewers' agreement was measured by Cohen's Kappa. From a dataset of 6461 articles, 255 (4%) were coded and analysed.

Results

Conferencing/chat/instant messaging, blogging, podcasts, social networking, wikis and aggregators were frequently examined. Services were mainly targeted at general academic users of English-speaking countries.

Conclusions
Data prohibit reliable estimate of the relative frequency of implemented web 2.0 services. Case studies were the prevalent design. Most articles evaluated different outcomes using diverse assessment methodologies. A systematic review is recommended to assess the effectiveness of such services.

Background

Web 2.0
In 2005, web 2.0 was defined by O'Reilly[1] as the second wave of Internet technologies: interconnected and converging on a unified platform, with services continually updated in a "perpetual beta" and remixed even by final users, open to social use and reuse of information in an "architecture of participation" and promising "rich user experiences" well beyond the reach of the limited 1.0 web pages. This seminal and widely cited paper envisaged not just specific technological advances, but a revolution in the use of the World Wide Web, which would empower final users, augment and qualitatively improve interactions between people and enhance collaboration in generating knowledge through the "wisdom of the crowds".[2]
This definition and subsequent developments were met with a degree of criticism and scepticism, particularly because of its alleged lack of clarity and techno-utopian, pro-business slant;[3,4] also the possibility was outlined that web 2.0 services would bring about "a set of unintended consequences, including the increased flow of personal information across networks, (…) the emergence of powerful tools for peer surveillance, the exploitation of free labor for commercial gain".[5]
Furthermore, several web 2.0 services proved short-lived and very few of them survived long enough to really make a difference for users.
It is, however, a fact that social media such as Facebook, Wikipedia, Twitter and blogs, often built according to web 2.0 conceptual tenets, now play a vital role in Internet use.[6]

Social media and the medical/academic domain
In the medical and academic research domains, the possible impact of web 2.0 services received early acknowledgement in terms of increasing user participation, implications of user-generated content for academic practices and intellectual property issues.[7]
According to Giustini,[8] social media have the potential to "change medicine", improving information access and sharing, while enhancing clinical practice; Metzger and Flanagin[9] stress "the utility of Web 2.0 technologies for engaging stakeholders with evidence-based medical information". The interest of the medical world in social media is also witnessed by a recent *JAMA* article about "Physicians on Twitter",[10] describing how "the existence of social media is transforming the way physicians communicate with the public" (p. 566).
Furthermore, the use of social media by researchers of all academic areas raised considerable interest recently. A report by Research Information Network (RIN)[11] has studied the impact of social media on scholarly information dissemination, concluding that "there is little evidence at present to suggest that web 2.0 will prompt in the short or medium term the kinds of radical changes

in scholarly communications advocated by the open research community. Web 2.0 services are currently being used as supplements to established channels rather than displacing them. A 'web 2.0 revolution' is not imminent". On a similar tune, a recent *Nature* article pointed out that "there are myriad social and professional networking options for scientists. But, so far, none has proved infectious enough to go viral".[12] In an attempt to answer these challenges, RIN recently published an online guide [13] to provide an introduction for researchers on the use of social media for acquiring, creating and sharing knowledge.

Library 2.0: conceptualizing and providing social media services for medical and academic users

On one hand, it would be easy to think that web 2.0 and the social media would increase the disintermediated use of online resources by final users. On the other hand, however, academic and medical librarians and library and information science (LIS) researchers were quick both to elaborate theoretical models and to experiment with social media services for final users.
The term "library 2.0"[14–17] summarizes the efforts of librarians to envisage and adopt the necessary changes in technology and attitudes to effectively engage with social media users: delivering services through the use of social media, encouraging the diffusion of high quality content through web 2.0 channels and supporting interaction and participation of users in online library services. Even more importantly, very soon academic and medical libraries started to offer guidance and advice to their patrons for the use of social media, and to deliver library services through web 2.0 channels (i.e. blogs, online social networks, wikis, etc.).
This active involvement was quickly reflected in a large number of librarians' contributions to academic journals, conferences and websites, with the intent of describing and marketing social media to librarians and to promote reflection on the challenges and opportunities for academic libraries that the new web 2.0 era was to bring.
However, in some of these contributions, the need was pointed out to build an evidence base to measure the success of library 2.0 initiatives. For example, Boxen[16] notices "an obvious absence of library literature that would convey the qualitative data necessary for more skeptical individuals to consider implementing Library 2.0 technologies".
In the past few years, several articles tried to estimate prevalence and impact of web 2.0 services implemented by academic, medical and research libraries, in different countries, for different target users and in varying service contexts.[18–37] However, no robust evidence of effectiveness emerges from this body of literature.
Besides, about 5 years have now passed since the first implementations of library 2.0 services. In the light of the concerns about the effective adoption of web 2.0 tools by the academic community, and the more general challenges concerning social media outlined above, it seems important to study which web 2.0 services academic libraries offer and their effectiveness for the research and medical community.

Objectives

The present review attempts to answer the following research questions:

1. What web 2.0 services were implemented by medical, academic and research libraries?
2. What study designs, measures and type of data were used in the included articles to evaluate effectiveness? Is the identified body of literature amenable to a systematic review and/or meta-analysis of results?

Methods

The present study was, to our knowledge, the first attempt to systematically map the published literature about the use and effectiveness of the widest possible range of web 2.0 software and services in academic, medical and research libraries. Therefore a scoping review seemed the most appropriate research design. In fact, this type of review "aims to identify the nature and extent of research evidence", by providing "a preliminary assessment of the potential size and scope of available research literature"[38].
The scoping review methodology[39,40] was consequently adopted, adapting it to the purposes of the present research.
The research team comprised four academic medical librarians with ≥10 years of experience.

Identification of web 2.0 services

As outlined in the introduction, web 2.0 is characterised by a broad and quite blurred definition, thus making a complete categorisation of social tools in the academic field impossible. For this reason, the authors decided to focus on the most common categories of 2.0 services, using an adaptation of the RIN's social media guide for researchers[13].
For the purposes of the present study, web 2.0 software and services were classified into 4 main categories: a) communication; b) collaboration; c) multimedia /content; d) uncategorised. Each of them included several specific sub-categories. Details are given in Table 1, with examples of corresponding commonly-used tools.

Search strategy, databases, temporal limits and initial data collection

The 4 authors collectively developed a search meta-string on the basis of both the 2.0 categories reported in Table 1 and some exploratory searches performed in several databases.
The meta-string was aimed at reaching the maximum sensitivity/recall, and it was composed of two main concepts: a) service provider, that is libraries or comparable services; b) web 2.0, expressed by general concepts, typologies or specific names of 2.0 services. Meta-string details are shown in Table 2.

Thematic areas of interest were library information science, medical sciences, information technology and education as related to the research questions, and more likely to contain relevant literature. Consequently, the authors collectively produced a list of 19 databases covering these disciplines, in order to perform literature searches. Table 3 shows the details of the selected databases.

The search meta-string was adapted to match the specific characteristics of each database for the use of thesauri, wildcards, search syntax for plural nouns, capital letters, and any other specific search features.
The 4 investigators performed the searches from 1/3/2011 to 10/3/2011. Whereas no limits were used for publication types, a publication date limit from 2001 onwards was initially set wherever permitted by the database search options. As most of the today's popular web 2.0 tools (e.g. blogs) began to massively spread nearly 10 years ago, this temporal limit was chosen as no or just irrelevant results were presumably to be found by searching the pre-2001 literature with the search

terms contained in the meta-string. Retrieved references were managed using Endnote X2 (Thomson Reuters, New York, NY, USA) .
The initial dataset, containing the results obtained by the searches performed in all the 19 databases, included 18,952 records. A number of such records were duplicates. Prior to de-duplication, the following categories of references could be identified:
a) published before 2006 = 4,301;
b) published from 2006 onwards = 13,672;
c) with no date = 877;
d) with wrong date = 102.
After an initial review of the dataset, all 4,301pre-2006 references were discarded because of their scarce relevance to the aims of the study. A total of 14,651 references from the other 3 categories, were de-duplicated. Then, references published from 2006 onwards were included, while the correct publication date was checked for the remaining references. The number of references included at this stage was reduced to 6,461.

Inclusion/exclusion criteria for study selection

The inclusion/exclusion criteria for study selection were collectively discussed and adopted by the 4 investigators, according to the research questions:
a) *Reference type*: only journal articles were included. This allowed inclusion of the majority of peer reviewed items, while also helping to maintain methodological rigour, as journal articles were the only publication type covered by all the databases.
b) *Languages*: articles written in English, Italian, German, French, and Spanish were included. Non-English papers were taken into account because of the well-known existence of relevant results published also in other languages. The selection was limited to Italian, German, French and Spanish, as these were the additional languages known by the authors.
c) *Research design*: case study/reports or any other primary or secondary research studies were included. News, commercial publications, general presentations or papers lacking sufficient details were excluded.
d) *Library type*: authors decided to include results related to single academic, health, research or special libraries (including national or state libraries), consortia or groups of academic, health or research libraries, and mixed consortia including a considerable number of academic, health or research libraries. Public or school libraries were excluded.
e) *Study contents*: articles containing relevant experimental or primary data about the implementation of any of the web 2.0 services listed in Table 1 in the context of health academic or other higher research institutions (post-secondary school) were included. Analyses about users' interactions, preferences, etc. were included only if based on data collected on implemented services reported in the same article. Pilot tests and detailed implementation plans were also included, if conforming to other inclusion criteria. Studies or preliminary surveys about users' preferences or needs were excluded.
f) *Target users*: only studies about library final users (e.g. students, health professionals, researchers, academic teachers, etc.) were included. Services aimed only at library staff were excluded. For studies including both web 2.0 services for staff and for users, only the part relating to the latter was considered and analysed.

Reviewers' agreement and article selection

Retrieved references were blindly reviewed for inclusion by pairs of investigators, on the basis of the article title and abstract. In case of disagreement, the final decision about inclusion was made by the lead investigator.
As a first step, two pilot tests were performed, in order to improve inter-rater agreement of the reviewers and refine the application of the inclusion criteria. Two subsets of the initial dataset were blindly reviewed by pairs of investigators on the basis of the title and abstract. The reviewers' inter-rater reliability was measured by Cohen's Kappa[41] with SPSS 19 (SPSS Inc., Chicago, IL, USA). In both cases, the initial result was < 0.60, a value that most statisticians consider as the minimum threshold to claim for a good level of agreement[42]. After collective discussion on disagreements, these articles were reviewed again in pairs by the same investigators. The Kappa coefficient was recalculated, and the result was > 0.60 for both pilot tests.
The final selection round was then performed. The remaining studies were blindly reviewed for inclusion by 3 investigators in pairs on the basis of the title and abstract. The lead investigator made the final decision in case of disagreements or doubts expressed by either of the reviewers.
One author also reviewed by title all the articles judged as either relevant or not relevant by both members of all reviewer pairs, to ensure that no studies were included or discarded due to wrong concordant judgments by both reviewers.
At this stage, the total number of references judged as relevant was 588.
The full-text was then retrieved for 586 articles. It was not possible to obtain the full text for 2 references. More articles were discarded as not relevant by the investigators by taking into account the full-text, and the lead investigator reviewed the final choices for all the 586 articles. After this phase, 255 articles (4% of the initial dataset) met the inclusion criteria and were consequently coded.
All the steps of the selection process are summarised in an adapted version of the PRISMA flow diagram[43] in Figure 1 and depicted in detail in Appendix 1.

The coding process

A coding sheet was developed for the content analysis of the selected articles[44]. Coding categories were initially extracted by the lead investigator after in-depth reading of a number of relevant dataset results, and then integrated by other categories pertaining to the specific research questions of the study.
During the first test on inter-rater agreement, a pilot test was also performed by the 4 investigators to assess the suitability of the coding sheet for an initial subset of 89 selected articles. Based on the collective analysis and discussion of the pilot test outcomes, some coding categories were discarded and some were partially modified, while others remained unchanged.
The complete final coding sheet with categories and specific coding values is given in Appendix 2.
The frequency analysis of coded data was calculated using Microsoft Excel 2010 (Microsoft, Redmond, WA, USA) and SPSS 19.

Results

Description of web 2.0 services implemented by academic, research and health libraries

Table 4 shows the breakdown of implemented services studied in the included articles according to the 15 main categories of web 2.0 services. A single article might be coded according to a maximum of 3 specific categories.

The landscape of implemented web 2.0 services is quite varied, with no prevalent typologies in absolute terms. Nearly one quarter of articles (N = 70, 24.7%) was about the use of conferencing, chat and instant messaging tools, almost always in the context of virtual reference services. Blogging (N = 38, 13.4%) and podcasts/screencasts (N = 29, 10.2%) also proved quite popular in the included articles. Social networking (N = 24, 8.5%) and wikis (N = 23, 8.1%) seemed slightly less used. Tools and services which may seem more specific to libraries and more attuned to librarians attitudes and skills, such as aggregators, social bookmarking and social bibliography were relatively less reported.

Appendix 3 shows the complete list of software and services used in the implementation of web 2.0 services. A certain number of articles did not make explicit which software or service was used (N = 35, 12.4%), and many articles reported on the use of multiple software and services (N = 49, 17.4%). There was a clear prevalence of ready-to-use software and services, although requiring a varying degree of personalization. Only 8 articles (2.8%) described the implementation of software by programmers and developers.
No single service clearly stands out among others. The most cited service was Facebook (N = 18, 6.4%), and only 11 other services were cited more than 5 times: Second life, Flickr, Trillian, Meebo, Delicious, AOL Instant Messenger, Wordpress, Blogger, QuestionPoint, LibGuides, Twitter.

Web 2.0 services cited in more than a half of the articles (N = 130, 51%) were targeted at both students and faculty 52 (20.4%) were aimed at an even wider public including both students and faculty, but often potentially reaching out to every Internet user. Sixty (23.5%) were instead specifically designed for students. The complete analysis of target users is displayed in Table 5.

As showed in Table 6, the majority of web 2.0 services were implemented by academic and research libraries in the context of the whole university, college, or research institution (N = 157, 60.9%); as for the services implemented in specific academic sectors, there is a clear prevalence of Health and Medicine (N = 43, 16.7%), followed by Arts and Humanities (N = 24, 9.3%, including LIS schools).

As for the specific context of library services in which web 2.0 tools were used, about one quarter of articles (N = 62, 24.3%) described multiple contexts. The single prevalent context service was general reference (N = 74, 29%), followed by user education and information literacy (N = 46, 18%), public catalogues (N = 21, 8.2%), and news/awareness/outreach (N = 20, 7.8%). The complete list is shown in Table 7.

Characteristics of coded articles

Included articles were firstly analysed according to their bibliographic characteristics.
The distribution of the included articles according to publication year is shown in Figure 2.

For publications between 2006 and 2010, the mean was 49.4 (Median = 55, Standard deviation = 14.519, Range = 32, Min = 33, Max = 65). Although the number of articles published in 2010 was clearly higher than in 2006, no significant trends can be detected from the data. In other words, there is no evidence that the increased perceived importance of web 2.0 tools in academic libraries has translated into a growth of good quality articles on these topics over the last 5 years.

The complete list of journals in which the included articles were published is displayed in Appendix 4. All included articles were published in library and information science (LIS) journals. No articles were therefore published with the aim of reaching a wider public than LIS professionals. Included articles were published in 102 different journals (Mean = 2.50, Median = 1.00, Standard deviation = 2.639, Range = 14, Min = 1, Max = 15). However, the first 16 journals for number of published articles accounted for 47.5 of the total included articles. In addition, a relatively small number of journals (30), with 3 or more published articles, accounted for 63.9% of total included articles.

Although articles published in five different languages were taken into account, the overwhelming majority was published in English (N = 239, 93.7%); 8 articles in Spanish (3.1%), 6 in German (2.4%) and 2 in Italian (0.8%) were also included.

The countries to which the service(s) studied in the article referred to are listed in Table 8.
The vast majority of articles were about services implemented in the United States (N = 159, 62.4%). North America accounted for 174 articles (68.2%), Europe for 55 articles (21.6%), while all other continents accounted for 26 articles (10.2%).
The first two states (United States and United Kingdom) accounted for more than three quarters of the included articles (N = 196, 76.9%). Additionally, 218 articles (85.5%) concerned services implemented in English-speaking countries.

Finally, Table 9 shows the breakdown of included articles by study type.
The design of more than three quarters of articles (N = 196, 76.9%) was the case study or case report. Surveys (N = 30) accounted for another 11.8% of included articles. Other research studies (N = 16, 6.3%) included mainly studies whose primary focus was different from the description and assessment of web 2.0 services in academic library environments, but were nonetheless included because they offered data and insights in our topic of interest. Mixed methods studies (N = 9, 3.5%) and qualitative research (N = 1, 0.4%) accounted for the remaining primary research designs. Narrative review was the only secondary research design in the included articles (N = 3, 1.2%). Most articles were descriptive, many did not employ formal methods and almost all were non-experimental.

Assessment and evaluation

Articles were coded for the presence of evaluation whenever their authors used data to support a-claim of effectiveness, impact or success. No assumptions about or checks of methodological rigour were made by the reviewers, who aimed at being as inclusive as possible.
Despite these very broad criteria used to look for evaluations or assessment of services in the articles, only 122 (47.8%) were found evaluating the success of implemented services.
Out of these 122 articles, the single most frequent service category was conferencing, chat and instant messaging tools, almost always in the context of virtual reference services (52 articles, 42,6%); all other categories are the topic of a relatively low number of articles (0 to 14).

As for the 122 articles containing an evaluation, the latter was performed using mainly quantitative methods (N = 102, 83.6%). Mixed methods (N= 18, 14.8%) and qualitative methods (N = 2, 1.6%) were used in a minority of cases.
Most articles presented preliminary usage data for services, collected within a relatively short time, or brief user satisfaction surveys (N = 102, 83.6%). As per mixed methods or qualitative methods of evaluation, they were mentioned in only 20 articles (N = 20, 16.4%).
Finally, effectiveness was reported in 69 out 122 articles (56.6%), while partial effectiveness was reported in 40 articles (32.8%). The remaining 13 articles (10.7%) did not find evidence of effectiveness.
In total, only 69 out of 255 articles (27.1%) reported effectiveness, and 40 (15.7%) partial effectiveness. The services described in the remaining 146 articles (57.3%) were either not evaluated, or did not report any evidence of effectiveness.
Figures 3 and 4 summarise the aforementioned findings.

Exploratory analyses

Exploratory analyses were conducted in order to identify possible correlations between the values of different variables. The Kendall Tau correlation coefficient was calculated using SPSS 19. However, the correlations found were either statistically non-significant, or so weak that it was very likely that they had arisen merely by chance. Therefore, no hypothesis could be made on possible relationships between variables.

Discussion

Principal results

Our first research question concerned the categories of web 2.0 services implemented by academic, medical and research libraries.

Twenty-eight of the 255 articles included in our review (11%) described multiple services; therefore, the remaining 227 articles represent at least 14 different categories of web 2.0 services implemented by libraries. Instant messaging, chat and conferencing services appeared to be the most implemented,; this seems consistent with the fact that such services have been generally implemented for a longer time than most other web 2.0 services. However, due to these small numbers, no reliable inference can be drawn with respect to the relative prevalence of specific web 2.0 service categories in academic and medical libraries.
The same holds true for the service contexts. Since we were not able to find any standard, universally agreed categorisation of library services, both devising and applying specific codes for different service contexts proved challenging; this might also partly explain the relatively high number of articles assigned to “multiple” service categories. Finally, due to the small number of articles included, it is wise not to draw inferences concerning the prevalence of implementations of these categories in the real world.
Furthermore, no one-to-one correspondence between single articles and single libraries exists in our dataset. There are a number of case reports concerning single libraries, but several studies synthesize data from different libraries: in our review, no different weight was assigned to studies conveying data from more than one library, so it may well be that, in principle, a relatively under-represented service category conveys data about a bigger number of libraries than a more represented category.

Based on our data and the related limitations of collection and analysis methods, we can conclude that academic, medical and research libraries in the past 5 years have used all of the main web 2.0 tools to deliver services to final users in different service contexts (see Tables 4 and 7). A "universalistic" approach to service seems to prevail in the included articles, as web 2.0 services tend to be offered to all members of a research/medical institution, in all topic areas of research. A more sectorial approach, aimed at specific categories of users or specialist areas, seems to be an exception.
However, no further inference about the relative prevalence of some service categories or contexts can be based on these data.

The second research question concerned the identification of study designs, measures and type of data used in the included articles to evaluate effectiveness, and also asked whether the identified body of literature was amenable to a systematic review and/or meta-analysis of results.
Before answering this question, some preliminary considerations seem necessary.
Although the clear prevalence of articles published in English is to be reasonably expected, our finding that certain countries and cultural-linguistic traditions appear to be over-represented raises concerns. Data emerging from this review primarily concern the English-speaking geographical and cultural area. What about the under-representation of nearly all developing, but also most other developed countries? How generalizable are these findings in geographical areas beyond the Anglo-Saxon world?
Moreover, all articles were published in LIS journals, and were therefore aimed at librarians and information professionals. While this is understandable, it might be worth exploring different dissemination channels for LIS literature on web 2.0 service, which should be of potential interest for a variety of academic audience.
Almost all databases not primarily containing LIS literature were of little or no use for identifying articles to be included in the present review.

As for the study designs, data types and measures, it clearly emerged that, although mainly quantitative in design, very few articles used structured evaluation methods, in order to compare a baseline situation with expected results and verify if users' expectations had been met. This is also clearly reflected in the absolute prevalence of the case study design in the set of included articles. In most cases, evaluation and assessment tools had not been validated.. Evaluation data in the included studies were therefore obtained on the basis of a heterogeneous range of assessment methodologies, and the types of outcomes or endpoints evaluated varies almost from article to article, even for the same typology of services.

However, evaluating "new" services is typically difficult, since both providers' and users' expectations tend to be unclear, both from a qualitative and from a quantitative point of view.[45] In our opinion, more rigorous study designs and projects with clearer hypotheses to be tested with regard to users' needs and expectations, together with more precise baseline assessments, would greatly enhance the quality of the evidence base concerning the effectiveness of such services.
Secondly, the limitations of the current study have an impact both on the estimate of the prevalent web 2.0 services implemented by libraries, and on the evidence of effectiveness which can be drawn from the literature. For example, both books and conference proceedings contain relevant data to answer our research question. We opted for articles published in journals to try to obtain the best possible quality from the included literature, given the time and resources available. However, it cannot be excluded that conference proceedings can produce results of comparable quality, as research in a related field show.[46] Ideally, an integration of the results of the present review with conference proceedings would allow to retrieve more relevant results.
As articles usually need to undergo a peer review process during at least some months before being published in journals,[47] data from the included articles are, at best, updated at the end of 2010 –

which can make a significant difference when studying services which are expected to have, at least in some cases, a rapidly increasing rate of adoption. However, contrary to what we expected, we did not find an increasing trend in the number of publications meeting our inclusion criteria on this topic from 2006 to 2011 (see Figure 2).
After that, it emerged from the data that most of the web 2.0 services were either free, or not so expensive to set up and run. This surely had an impact on the ease of adoption, and might have put less pressure to evaluate such services, than, for example, other pieces of library automation software or other library services which have considerable costs which constantly need to be justified.[48]

Finally, despite the heterogeneity of service categories, evaluation methods and outcomes, the authors recommend that a systematic review of this literature be undertaken. This seems an urgent task, since a considerable number of articles evaluating the implementation of web 2.0 services in academic, research and health libraries has been identified, but no thorough and systematic assessment of this body of literature has been conducted so far.
Moreover, a systematic review would allow assessment of the effectiveness of such services for final users and identification of gaps in the available evidence.
This applies to our whole dataset, although a specific subgroup of articles (referring to conferencing, chat and instant messaging) might represent an even more homogeneous target for a systematic review.

Conclusions

Data from the studies included in the present review suggest that academic, medical and research libraries actively experimented with web 2.0 services targeted at their final users. The prevalent service category in our dataset seems to be "conferencing, chat and instant messaging", while blogging, podcasts, social networking, wikis and aggregators implementation were also described in a small number of articles. However, the available data do not allow reliable estimate of the relative frequency of the most important web 2.0 services implemented. Such services were mainly targeted at a general academic audience, and the results are mostly related to libraries located in English-speaking countries.
Very few included articles used structured evaluation methods, in order to compare a baseline situation with expected results and verify users' satisfaction; in most cases, evaluation and assessment tools had not been validated. Assessment methodologies were very heterogeneous, and assessed outcomes varied widely, even within the same typology of services.
However, given the considerable number of identified articles, it is recommended that a systematic review of this literature be undertaken to assess the effectiveness of such services for final users and to identify gaps in the available evidence for effectiveness.

Our conclusions are influenced by the limitations of the approach to the present study. To obtain more accurate results, it is suggested that further research be undertaken. Future reviews on this topicwould benefit from the inclusion of results published in books and conference proceedings to improve the accuracy of results. As for primary studies, more rigorous research design and a clear evaluation strategy prior to implementing the services would be advisable, in order to obtain reliable and generalizable data about the effectiveness of library 2.0 services for final users.

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Table 1. Categorisation of Web 2.0 services

General category	Specific sub-category	Examples	Notes for coding / search strategy
Communication	*Blogging*	Technorati, Google blog search	
	Microblogging	Twitter, Yammer, Google Buzz	
	Social networking	Facebook, Cyworld, LinkedIn, MySpace, Friendster	It includes location services (e.g.: Gowalla, Foursquare)
	Aggregators	Google Reader, Netvibes, Pageflakes, iGoogle	It includes "RSS" (as an aggregator technology)
Collaboration	*Conferencing / Chat / Instant Messaging*	Skype, Google Chat	
	Wikis	Wetpaint	
	Social bookmarking	Delicious, Diigo, BibSonomy	
	Social bibliography	CiteULike, Mendeley, Zotero, Connotea, Librarything, Anobii	
	Social documents / Collaborative writing tools	Google Docs, Dropbox, Zoho	
Multimedia / Content	*Photographs*	Flickr, Picasa	
	Video	YouTube	
	Presentation sharing	Scribd, SlideShare, Sliderocket	
	Virtual worlds	Second Life	
Uncategorised	*Podcast / Screencast*	Podscope	
	Web browser toolbars / tools		
	Mind mapping tools		
	Web 2.0 / Social web		

Table 2. Search meta-string

Service provider		Web 2.0
library OR librarian OR information centres OR information centers OR information services OR informationist* OR information profession* OR library science	**AND**	*[General concepts]:* web2 OR web 2.0 OR web 2 OR social web OR social media OR social software **OR** *[Typologies of web 2.0 services]:* blogging OR microblogging OR social networking OR rss OR aggregators OR conferencing OR chat OR instant messaging OR wikis OR social bookmarking OR social bibliography OR social documents OR photographs sharing OR video sharing OR presentation sharing OR virtual worlds OR podcast OR screencast OR web browser toolbars OR mind mapping tools OR collaborative writing tools OR collaboration tools **OR** *[Names of web 2.0 services]:* Technorati OR Google blog search OR Twitter OR Yammer OR Google Buzz OR Facebook OR Cyworld OR LinkedIn OR MySpace OR Friendster OR Google Reader OR Netvibes OR Pageflakes OR iGoogle OR Skype OR Google Chat OR Delicious OR Diigo OR BibSonomy OR CiteULike OR Mendeley OR Zotero OR Connotea OR Librarything OR Anobii OR Google Docs OR Dropbox OR Zoho OR Flickr OR Picasa OR YouTube OR Scribd OR SlideShare OR Sliderocket OR Second Life OR Podscope

Table 3. Searched databases

	Database name	Platform
1	ACM Digital Library / Association for Computing Machinery	Acm.org
2	ANTE: Abstracts in New Technologies and Engineering	CSA ProQuest
3	ASSIA: Applied Social Sciences Index and Abstracts	CSA ProQuest
4	CINAHL: Cumulative Index to Nursing and Allied Health Literature	EBSCOhost
5	Computer and Information Systems Abstracts	CSA ProQuest
6	Conference Papers Index	CSA ProQuest
7	Conference Proceedings Citation Index	ISI Web of Knowledge
8	E-LIS: E-prints in Library and Information Science	Eprints.rclis.org
9	Embase	Embase.com
10	ERIC: Education Resources Information Center	CSA ProQuest
11	IBSS: International Bibliography of the Social Sciences	CSA ProQuest
12	Library Literature & Information Science Full Text	WilsonWeb EBSCOhost
13	LISA: Library and Information Science Abstracts	CSA ProQuest
14	LISTA: Library, Information Science & Technology Abstracts	EBSCOhost
15	MEDLINE	PubMed
16	PsycInfo	Ovid
17	Scopus	SciVerse
18	Sociological Abstracts	CSA ProQuest
19	Web of Science	ISI Web of Knowledge

Table 4. Services studied in included articles according to specific web 2.0 categories

Specific category	N. of articles	Percentage	Cumulative percentage
Collab - Conferencing / chat / IM	70	24.7%	24.7%
Comm - Blogging	38	13.4%	38.2%
Uncat - Podcast/Screencast	29	10.2%	48.4%
Multiple	28	9.9%	58.3%
Comm - Social networking	24	8.5%	66.8%
Collab - Wikis	23	8.1%	74.9%
Comm - Aggregators	21	7.4%	82.3%
Other	13	4.6%	86.9%
Multi - Virtual worlds	11	3.9%	90.8%
Collab - Social bookmarking	8	2.8%	93.6%
Multi - Photographs	7	2.5%	96.1%
Comm - Microblogging	6	2.1%	98.2%
Multi - Video	3	1.1%	99.3%
Collab - Social bibliography	1	0.4%	99.6%
Collab - Social docs/collab writing tools	1	0.4%	100.0%
Total Number	**283***		

* It was possible to assign more than one service category to a single article; therefore, the number of total service categories exceeds the number of articles included in the review (N = 255).

Table 5. Target users for the web 2.0 services described in included articles

Target users	N. of articles	Percentage
Faculty + Students	130	51.0%
Students	59	23.1%
Multiple	52	20.4%
Health professionals	9	3.5%
Faculty	4	1.6%
Others	1	0.4%
Total Number	**255**	

Table 6. Breakdown of included articles by academic sector in which web 2.0 services were implemented

Academic sector	N. of articles	Percentage	Cumulative percentage
Generic - Academic	157	60.9%	60.9%
Health and medicine	43	16.7%	77.5%
Arts & Humanities	24	9.3%	86.8%
Economics & Business	8	3.1%	89.9%
Law	6	2.3%	92.2%
Natural sciences	6	2.3%	94.6%
Social & Psychological Sciences	5	1.9%	96.5%
Engineering and Architecture	5	1.9%	98.4%
Multiple (more than 2)	3	1.2%	99.6%
Agriculture & Veterinary Sciences	1	0.4%	100.0%
Total Number	**258***		

* It was possible to assign more than one service category to a single article; therefore, the number of total service categories exceeds the number of articles included in the review (N = 255).

Table 7. Breakdown of included articles by library service context in which web 2.0 services were implemented

Service context	N. of articles	Percentage	Cumulative percentage
General Reference service	74	29.0%	29.0%
Multiple	62	24.3%	53.3%
User education & information literacy	46	18.0%	71.4%
Public catalogs	21	8.2%	79.6%
News, awareness, outreach	20	7.8%	87.5%
Information retrieval	10	3.9%	91.4%
Basic library information	7	2.7%	94.1%
Other	6	2.4%	96.5%
Electronic resources	5	2.0%	98.4%
Library marketing / Branding	4	1.6%	100.0%
Total Number	**255**		

Table 8. Location of the service(s) described in the article

Countries	N. of articles	Percentage	Cumulative percentage
United States	159	62.4%	62.4%
United Kingdom	37	14.5%	76.9%
Canada	13	5.1%	82.0%
Spain	8	3.1%	85.1%
Multiple continents	7	2.7%	87.8%
Germany	4	1.6%	89.4%
Australia	3	1.2%	90.6%
New Zealand	3	1.2%	91.8%
Austria	3	1.2%	92.9%
Asia - Multiple states	2	0.8%	93.7%
China	2	0.8%	94.5%
North America - Multiple states	2	0.8%	95.3%
Italy	1	0.4%	95.7%
India	1	0.4%	96.1%
South Africa	1	0.4%	96.5%
Egypt	1	0.4%	96.9%
Israel	1	0.4%	97.3%
Oceania - Multiple states	1	0.4%	97.6%
Singapore	1	0.4%	98.0%
Estonia	1	0.4%	98.4%
Hong Kong	1	0.4%	98.8%
Argentina	1	0.4%	99.2%
Chile	1	0.4%	99.6%
France	1	0.4%	100.0%
Total Number	**255**		

Table 9. Articles by study type

Study type	N. of articles	Percentage	Cumulative percentage
Case study/report	196	76.9%	76.9%
Survey	30	11.8%	88.6%
Other research study	16	6.3%	94.9%
Mixed methods	9	3.5%	98.4%
Review - Narrative	3	1.2%	99.6%
Qualitative research	1	0.4%	100.0%
Randomized controlled trial	0	0%	100.0%
Systematic review	0	0%	100.0%
Total Number	**255**		

Figure 1. Flow diagram of the process of study selection

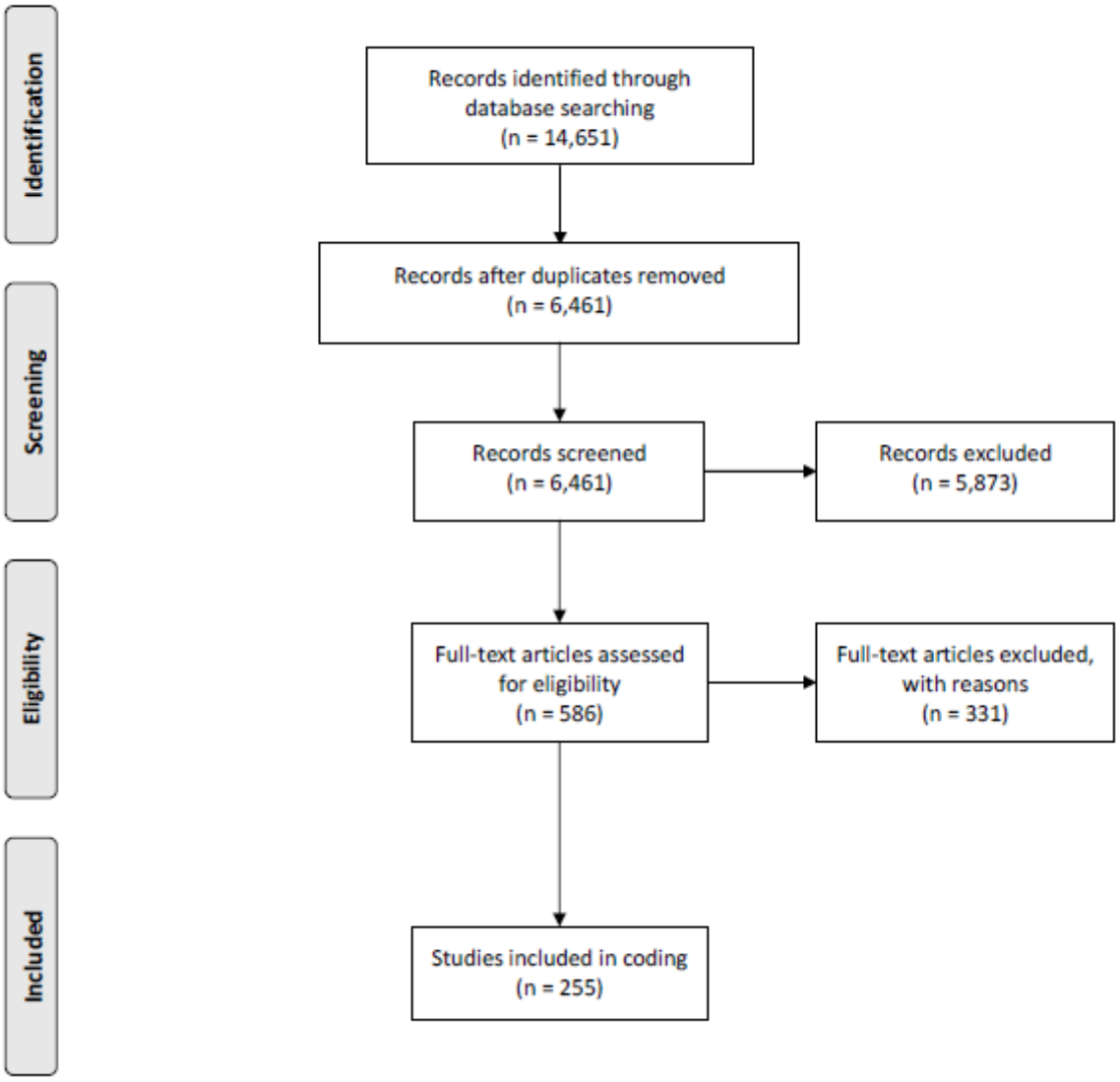


Figure 2. Distribution of included articles per year of publication

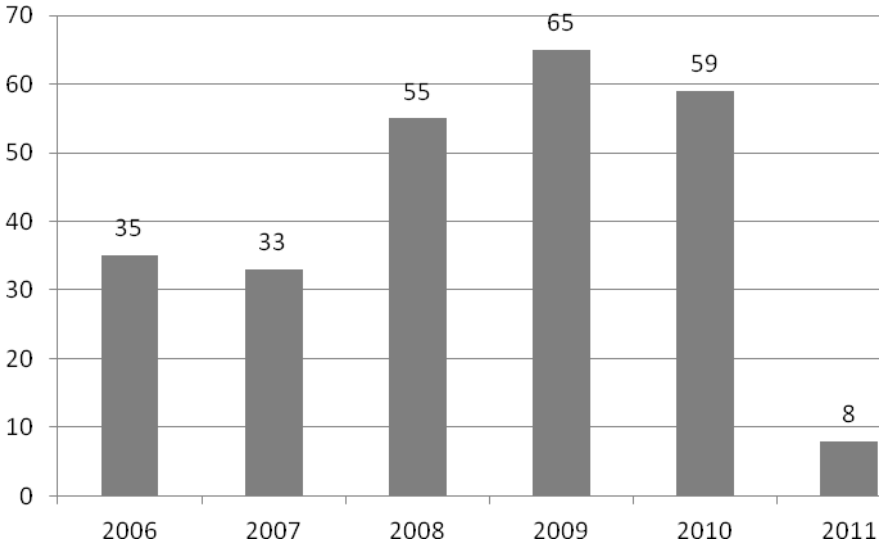


Figure 3: Articles with evaluation

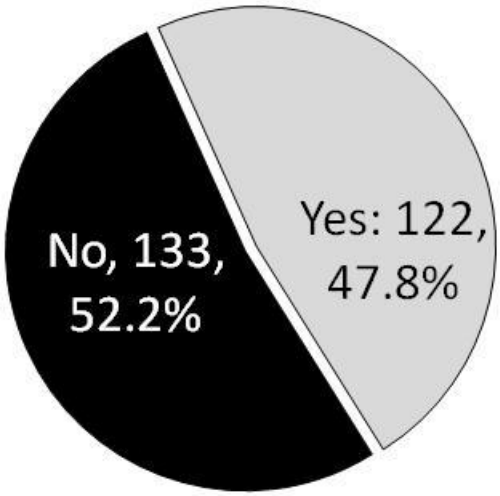
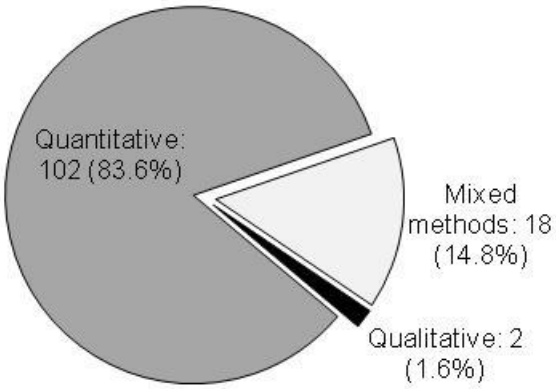
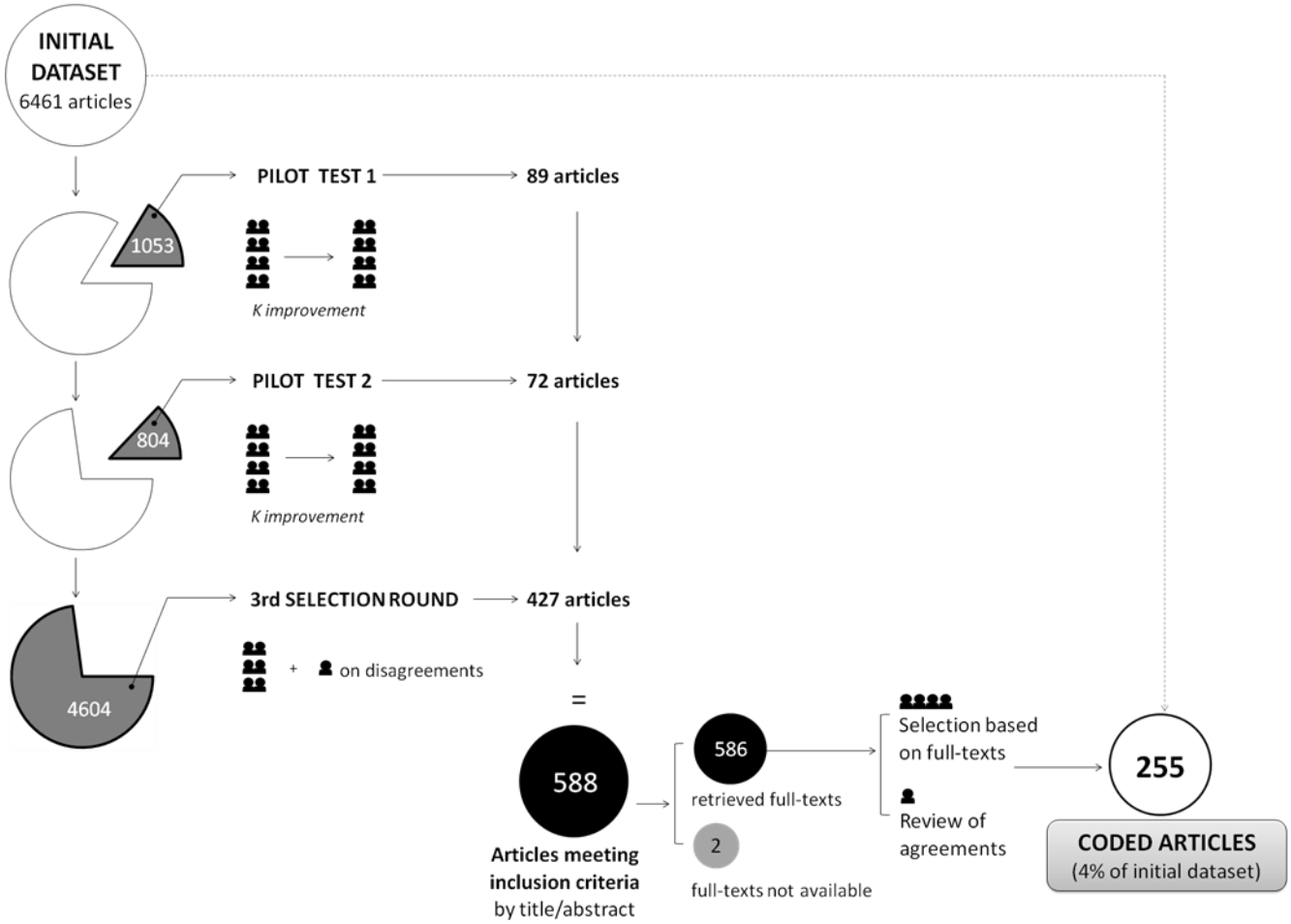


Figure 4: Evaluation method



Appendix 1. The article selection process



Appendix 2. The coding sheet

Coding category	Coding values
A1-A3: Specific category	Collab – Conferencing / chat /IM Collab – Social bibliography Collab – Social bookmarking Collab – Social docs / collab writing tools Collab – Wikis Comm – Aggregators Comm – Blogging Comm – Microblogging Comm – Social networking Multi – Photographs Multi – Presentation sharing Multi – Video Multi – Virtual worlds Uncat – Mind mapping tools Uncat – Podcast / screencast Uncat – Web browser toolbars / tools Multiple *(if more than 3)* Other
B1-B3: Service name	Library implementation of software Anobii BibSonomy CiteULike Connotea Cyworld Delicious Diigo Dropbox Facebook Flickr Friendster Google blog search Google Buzz Google Chat Google Docs Google Reader iGoogle Librarything LinkedIn Mendeley MySpace Netvibes Pageflakes Picasa Podscope Scribd

	Second Life Skype Sliderocket SlideShare Technorati Twitter Yammer YouTube Zoho Zotero Multiple *(if more than 3)* Other (*to be specified*) N/A
C1: Countries	Complete alphabetical list of world countries Africa – Multiple states Asia – Multiple states Europe – Multiple states North America – Multiple states Oceania – Multiple states South/Central America – Multiple states Multiple continents N/A
D: Article language	English French German Italian Spanish
E: Study type	Case study / report Mixed methods Other research study Qualitative research RCT Review – Narrative Survey Systematic review N/A
F1-F2: Target users	Health professionals Faculty Students Faculty + Students Multiple *(if more than 2*) Other (*to be specified*) N/A
G1-G2: Academic sector	Generic – Academic Agriculture & Veterinary Sciences

	Arts & Humanities Economics & Business Engineering & Architecture Health & Medicine Law Natural Sciences Social & Psychological Sciences Multiple *(if more than 2*) N/A
H1-H2: Service context	Basic library information Bibliometrics Copyright, privacy, legal issues Document lending / supply Electronic resources General reference service Information retrieval Library marketing / branding LIS academic research News, awareness, outreach Public catalogs Publishing advice Security User education & information literacy Multiple (*if more than 2*)) Other (to be specified)
I1: Evaluation	Yes No
I2: Evaluation methods	Quantitative Qualitative Mixed methods
J: Effectiveness	Yes No Partially
K: Notes	(*Open field*)

Appendix 3 Complete list of software and services used in the implementation of web 2.0 services

Service name	N. of articles	Percentage	Cumulative percentage
Multiple	49	17.4%	17.4%
N/A	35	12.4%	29.8%
Facebook	18	6.4%	36.2%
Second life	9	3.2%	39.4%
Library implementation of software	8	2.8%	42.2%
Trillian	8	2.8%	45.0%
Meebo	8	2.8%	47.9%
Flickr	7	2.5%	50.4%
Delicious	7	2.5%	52.8%
AOL Instant Messenger	7	2.5%	55.3%
Wordpress	7	2.5%	57.8%
Blogger	7	2.5%	60.3%
QuestionPoint	6	2.1%	62.4%
LibGuides	6	2.1%	64.5%
Twitter	5	1.8%	66.3%
Docutek	4	1.4%	67.7%
Wimba	4	1.4%	69.1%
Adobe Captivate	4	1.4%	70.6%
LibraryH3lp	4	1.4%	72.0%

MySpace	3	1.1%	73.0%
Skype	3	1.1%	74.1%
PBWiki	3	1.1%	75.2%
MediaWiki	3	1.1%	76.2%
Audacity	3	1.1%	77.3%
Dokuwiki	3	1.1%	78.4%
Camtasia	3	1.1%	79.4%
Librarything for libraries	2	0.7%	80.1%
Netvibes	2	0.7%	80.9%
MSN	2	0.7%	81.6%
Pidgin	2	0.7%	82.3%
Blackboard	2	0.7%	83.0%
Wikipedia	2	0.7%	83.7%
Blogspot	2	0.7%	84.4%
Bloglines	2	0.7%	85.1%
Movable Type	2	0.7%	85.8%
Apple iTunes	2	0.7%	86.5%
ticTOCs	2	0.7%	87.2%
Google Docs	1	0.4%	87.6%
Google Reader	1	0.4%	87.9%
YouTube	1	0.4%	88.3%
Zotero	1	0.4%	88.7%
Apple Garage Band	1	0.4%	89.0%

Wimzi widget	1	0.4%	89.4%
GAIM	1	0.4%	89.7%
Tocross	1	0.4%	90.1%
Yahoo Messenger	1	0.4%	90.4%
Confluence	1	0.4%	90.8%
NetAgent	1	0.4%	91.1%
Magpie RSS	1	0.4%	91.5%
Nucleus	1	0.4%	91.8%
Wordpress	1	0.4%	92.2%
SeedWiki	1	0.4%	92.6%
Tutor.com	1	0.4%	92.9%
Polycom PVX	1	0.4%	93.3%
Wetpaint	1	0.4%	93.6%
FeedBurner	1	0.4%	94.0%
Reddot	1	0.4%	94.3%
FeedBurner	1	0.4%	94.7%
Adobe Acrobat Connect	1	0.4%	95.0%
Dspace	1	0.4%	95.4%
Google Maps API	1	0.4%	95.7%
PmWiki	1	0.4%	96.1%
iTunes University	1	0.4%	96.5%
Timpani	1	0.4%	96.8%
Ning	1	0.4%	97.2%

24/7 Reference	1	0.4%	97.5%
Wikidot	1	0.4%	97.9%
LivePerson	1	0.4%	98.2%
Wetpaint	1	0.4%	98.6%
VRLPlus	1	0.4%	98.9%
Jing	1	0.4%	99.3%
Gregarius	1	0.4%	99.6%
iMovie	1	0.4%	100.0%
Total number	**282**		

N.B.: A single article might be coded according to a maximum of 5 service names.

Appendix 4 Complete list of journals featuring included articles

Journal	N. of articles	Percentage	Cumulative percentage
Medical Reference Services Quarterly	15	5.9%	5.9%
College & Undergraduate Libraries	12	4.7%	10.6%
Reference Services Review	12	4.7%	15.3%
Internet Reference Services Quarterly	11	4.3%	19.6%
ALISS Quarterly	8	3.1%	22.8%
Journal of Web Librarianship	8	3.1%	25.9%
SCONUL Focus	8	3.1%	29.0%
Journal of Library Administration	7	2.7%	31.8%
Public Services Quarterly	7	2.7%	34.5%
Library Hi Tech	6	2.4%	36.9%
Electronic Library	5	2.0%	38.8%
Journal of Hospital Librarianship	5	2.0%	40.8%
Reference & User Services Quarterly	5	2.0%	42.8%
Computers in Libraries	4	1.6%	44.3%
Journal of Library & Information Services in Distance Learning	4	1.6%	45.9%
Tennessee Libraries	4	1.6%	47.5%
AALL Spectrum	3	1.2%	48.6%
College & Research Libraries	3	1.2%	49.8%
College & Research Libraries News	3	1.2%	51.0%
Evidence Based Library & Information Practice	3	1.2%	52.2%
GMS Medizin - Bibliothek - Information	3	1.2%	53.4%
Journal of Electronic Resources in Medical Libraries	3	1.2%	54.5%
Journal of Information Literacy	3	1.2%	55.7%
Journal of the Medical Library Association	3	1.2%	56.9%
Library & Information Science Research	3	1.2%	58.1%
New Library World	3	1.2%	59.2%
Partnership: the Canadian Journal of Library and Information Practice and Research	3	1.2%	60.4%
Portal: Libraries & the Academy	3	1.2%	61.6%
Program: Electronic Library and Information Systems	3	1.2%	62.8%
The Journal of Academic Librarianship	3	1.2%	63.9%

Art Documentation: Bulletin of the Art Libraries Society of North America	2	0.8%	64.7%
Biblioteche oggi	2	0.8%	65.5%
Bibliothek Forschung und Praxis	2	0.8%	66.3%
D-Lib Magazine	2	0.8%	67.1%
Educacion y Biblioteca	2	0.8%	67.9%
El Profesional de la Informacion	2	0.8%	68.6%
Health Information and Libraries Journal	2	0.8%	69.4%
Indiana Libraries	2	0.8%	70.2%
Issues in Science & Technology Librarianship	2	0.8%	71.0%
Journal of Business & Finance Librarianship	2	0.8%	71.8%
Library & Information Update	2	0.8%	72.6%
Library Review	2	0.8%	73.4%
Louisiana Libraries	2	0.8%	74.1%
Multimedia Information & Technology	2	0.8%	74.9%
New Review of Academic Librarianship	2	0.8%	75.7%
New Review of Information Networking	2	0.8%	76.5%
Profesional de la Informacion	2	0.8%	77.3%
Technical Services Quarterly	2	0.8%	78.1%
The International Information & Library Review	2	0.8%	78.8%
The Serials Librarian	2	0.8%	79.6%
Against the Grain	1	0.4%	80.0%
Agricultural Information Worldwide	1	0.4%	80.4%
Annals of Library & Information Studies	1	0.4%	80.8%
Archival Science	1	0.4%	81.2%
Ariadne	1	0.4%	81.6%
Australian Academic & Research Libraries	1	0.4%	82.0%
Bibliotheksdienst	1	0.4%	82.4%
BuB Forum Bibliothek und Information	1	0.4%	82.8%
Bulletin of the American Society for Information Science & Technology	1	0.4%	83.2%
CILIP Health Libraries Group Newsletter	1	0.4%	83.5%
Collection Building	1	0.4%	83.9%
Colorado Council of Medical Librarians Council Quotes	1	0.4%	84.3%
Communications in Information Literacy	1	0.4%	84.7%

DESIDOC Bulletin of Information Technology	1	0.4%	85.1%
DttP: Documents to the People	1	0.4%	85.5%
Education Libraries	1	0.4%	85.9%
E-JASL: The Electronic Journal of Academic and Special Librarianship	1	0.4%	86.3%
Electronic Journal of Academic & Special Librarianship	1	0.4%	86.7%
Feliciter	1	0.4%	87.1%
Fontes Artis Musicae	1	0.4%	87.5%
Georgia Library Quarterly	1	0.4%	87.9%
Health Information on the Internet	1	0.4%	88.3%
inCite	1	0.4%	88.6%
Innovation	1	0.4%	89.0%
International Journal of Information Management	1	0.4%	89.4%
International Preservation News	1	0.4%	89.8%
Journal of Access Services	1	0.4%	90.2%
Journal of Consumer Health on the Internet	1	0.4%	90.6%
Journal of Education for Library & Information Science	1	0.4%	91.0%
Journal of Electronic Resources Librarianship	1	0.4%	91.4%
Journal of Map & Geography Libraries	1	0.4%	91.8%
Kentucky Libraries	1	0.4%	92.2%
Law Library Journal	1	0.4%	92.6%
Legal Reference Services	1	0.4%	93.0%
Library and Information Science Research	1	0.4%	93.4%
Library Hi Tech News	1	0.4%	93.7%
Library Journal, suppl. Net Connect	1	0.4%	94.1%
Library Management	1	0.4%	94.5%
Microform & Imaging Review	1	0.4%	94.9%
Mississippi Libraries	1	0.4%	95.3%
North Carolina Libraries	1	0.4%	95.7%
OLA Quarterly	1	0.4%	96.1%
Online	1	0.4%	96.5%
Reference Librarian	1	0.4%	96.9%
Revista española de Documentacion Cientifica	1	0.4%	97.3%
School Libraries Worldwide	1	0.4%	97.7%

Science & Technology Libraries	1	0.4%	98.1%
Serials	1	0.4%	98.4%
Serie Bibliotecologia y Gestion de Informacion	1	0.4%	98.8%
Southeastern Librarian	1	0.4%	99.2%
SRELS Journal of Information Management	1	0.4%	99.6%
Studies in Health Technology and Informatics	1	0.4%	100.0%
Total number of articles	**255**		
Number of journals	**102**		

Supplementary material

List of articles included in the scoping review: "Implementation of web 2.0 software and services in academic, medical and research libraries. A scoping review".

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