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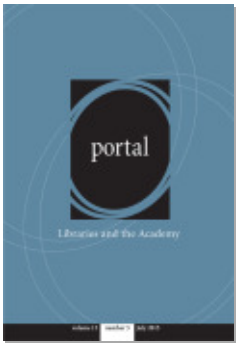

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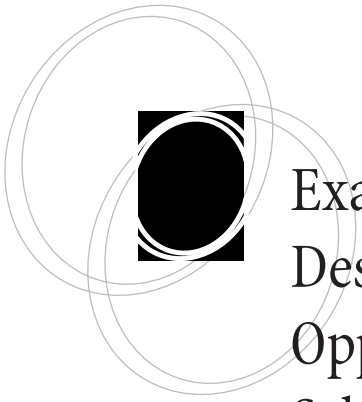
portal: Libraries and the Academy, Volume 15, Number 3, July 2015, pp. 531-549 (Article)

Published by Johns Hopkins University Press
DOI: 10.1353/pla.2015.0035



Examining Mendeley: Designing Learning Opportunities for Digital Scholarship

Alison Hicks and Caroline Sinkinson

abstract: Researchers have widely adopted computer programs for reference management, such as Mendeley, due to their ability to support a variety of research practices, including organization and storage of pdfs. These programs also afford participation and networking within new scholarly information landscapes. This paper uses a survey and semi-structured interviews to explore use of Mendeley at the University of Colorado and to provide an initial snapshot of scholars' adoption of new digital practices. Because these new practices call for different capacities, the authors then used the results to design meaningful learning opportunities for scholars and students.

Introduction

An increasing number of scholars worldwide use Mendeley, an advanced reference management system and academic social network, to support their research process. Designed by scientists to meet the demands of scholarship conducted within dynamic information landscapes, Mendeley is now endorsed by over one hundred universities due to its perceived ability to support shifts in scholarship and evolving research needs.[1] Recognizing the value of this tool, many librarians offer Mendeley training as a natural extension to traditional instructional services. Evolving technologies and changes in scholarly practices call for a reconceptualization of how librarians design and implement advanced education for researchers.

The primary aim of this paper is to understand how scholars use Mendeley at the University of Colorado, Boulder (UCB). Accordingly, the authors use a survey and semi-structured interviews to gain a snapshot of how scholars employ Mendeley within their

portal: Libraries and the Academy, Vol. 15, No. 3 (2015), pp. 531–549.

current research practices. In turn, these understandings lead to the secondary aim of this paper, which is to measure scholars' adoption of digital scholarship practices more generally, including their gaps and capacities within such new environments. Together, these understandings will guide the design of more responsive, meaningful learning and support opportunities. The paper will start by defining and describing Mendeley and its unique features. Next, the authors will provide an overview of current discussions surrounding scholarly practices and literacies within digital environments as well as examine how library structures currently support these needs. The paper will present findings from a campus survey and six semi-structured interviews that explored local Mendeley usage. Analysis of these findings will provide concluding recommendations and direction for learning and support services.

Background

Established in 2008, Mendeley is a Web, desktop, and mobile application that, at its most basic level, is a reference manager that allows the user to store citations and create bibliographies. On another level, it builds upon the features of traditional reference management tools to help users discover and organize papers as well as to collaborate with groups and networks of scholars. Accordingly, Mendeley combines characteristics of productivity tools, such as Evernote, with elements of social networking tools, such as Academia.edu, and resource discovery tools, such as databases, to enable users to collaborate, share, and manage their entire scholarly research process. With nearly 2.5 million users and a catalog of 420 million documents, the tool has become most popular among biological and medical researchers, whose practices and funding demand open and collaborative work.[2]

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Mendeley currently offers its users individual packages—called Basic, Plus, Pro, and Max—as well as team and institutional plans. All plans provide the ability to store, organize, read, annotate, and cite documents in a personal account both on- and offline. In addition, researchers can create and join public or private groups as well as participate in social networking activities through the establishment of a public profile. Basic accounts on Mendeley are free, offering up to 2 gigabytes (GB) of storage and the ability to create one private group. Storage capacity gradually increases across the Plus, Pro, and Max accounts upon payment of a fee. Within the group plans, the Team account offers unlimited storage and private groups for up to fifty researchers, while the institutional version includes statistical analysis and usage of library holdings. Elsevier, a mammoth academic publishing company, acquired Mendeley in the spring of 2013. To date, the user experience of Mendeley has not significantly shifted since this acquisition.[3]

Literature Review

In this literature review, the authors summarize and connect three strands of discussion around modern scholarly practices to frame this study. These strands include research into the effect of technology on scholarship, benchmarking studies into the literacies or capacities needed to act within this new arena, and ethnographic studies of the scholarly research process, or the skills and procedures that characterize scholarly actions.

Digital and Open Scholarship

Mendeley's functionality offers support for a wide range of research practices, from traditional needs such as reference management, to newer processes of scholarship, such as networked collaboration and sharing. In recent years, scholars have started to discuss these changes to the research process, which include collaborative, open, and transparent practices. It is not yet clear whether these transformations represent latent impulses that were previously logistically difficult or whether they form evidence of the change technology has wrought on academic practice. Nevertheless, this digital scholarship exerts significant impact on both individuals and academic communities.[4] Although definitions remain fluid and evolving, Nick Pearce and his coauthors define digital scholarship as "information and communication technologies to research, teach and collaborate."[5] However, as the authors go on to point out, digital scholarship is not just defined by technology usage. Instead, changes to scholarly practice are accompanied by a commitment to "the open values, ideology and potential of technologies" in support of making meaning and generating knowledge.[6] George Veletsianos and Royce Kimmons see these evolving scholarly practices as taking place in three major areas: open access and publishing, open education, and networked participation.[7] Mendeley provides significant support for two of these areas: open access and publishing, and networked participation.

Mendeley's functionality offers support for a wide range of research practices, from traditional needs such as reference management, to newer processes of scholarship, such as networked collaboration and sharing.

Open access is defined as the "free, immediate, online availability of research articles, coupled with the rights to use these articles fully in the digital environment."[8] Mendeley's crowdsourced and shared research catalog "supports the aims of transparency embodied in the open-access movement by contributing to a more open sharing of resources."[9] In addition, Mendeley provides an application program interface (API), allowing its users to employ standard commands and functions to develop software, instead of writing the software from scratch. Mendeley data have contributed significantly to the altmetrics movement, an initiative that measures the impact of work by nontraditional means, beyond citation counts and journal impact factors. Notwithstanding, the purchase of Mendeley by Elsevier, a company often perceived to work in opposition to the open-access movement, has brought this commitment into question.[10]

Networked participation refers to "scholars' uses of online social networks to share, critique, improve, validate, and enhance their scholarship."[11] Mendeley enables researchers to create a more substantial online presence by establishing a personal profile. Group functionality also enables wider participation in professional practices. Private groups facilitate collaborative scholarship practices, while public groups enable the development of broader public intellectual spaces, all of which are core aspects of networked participation. As researchers' work and workflows migrate online and encompass wider open and networked practices, Mendeley can facilitate key aspects of these changes, as well as, potentially, provide a space in which scholars can experiment.

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While transformations to scholarly practice may offer new opportunity for openness and collaboration, tensions between new and established methods of research or traditional means of academic evaluation remain. As Cristóbal Cobo and Concepción Naval observe, "It is not easy to determine how and to what extent the traditional and the new practices . . . of scholarship will coexist."[12] However, as scholars continue to explore and engage with new practices, they begin to require previously uncultivated skills. An example is information management, which has transitioned from "institutional stewardship" to the responsibility of individual scholars.[13] The technological and cultural changes at play not only require the learning of new skills and the acquisition of new technical proficiencies, but also must shift scholars' dispositions toward new values of openness and collaboration. Given these demands on scholars, educators and librarians are compelled to explore and gain greater insight into these evolving literacies.

Digital Literacy Approaches

Though an inventory of literacies for digital scholars has not yet been widely adopted or established, it is not uncommon for definitions of digital or academic literacies to incorporate skills and competencies that align with digital scholarship. A joint project by the Research Information Network (RIN) and the Society of College, National and University Libraries (SCONUL), for example, sponsored institutions to explore the creation of digital literacy frameworks, which include digital scholarship and related competencies.[14] Several universities in the United Kingdom (UK) have taken part in this project. The program Information Skills for Research Postgraduates at the University of Bath, for example, highlights digital skills such as managing references and evaluating digital research outputs as well as attributes that support ethical research practices.[15] This program recognizes the value-based changes in scholarship that embrace openness, while it also identifies new practices such as reference management that are facilitated by emerging technologies. The Digidol program at Cardiff University takes this one step further by matching conceptual maps to the scholarly research process, which it defines as finding, managing, manipulating, producing, and sharing information.[16] Postgraduate Researcher Digital Skills at Plymouth University, on the other hand, specifically outlines

skills for digital scholars, such as developing a digital profile, communicating about research, and writing as a digital researcher.[17]

Perhaps, however, the framework that is most clearly aligned with digital scholarship is the Digital and Information Literacy Framework of the UK's Open University, which includes five central competencies mapped across five stages of development.[18] The final development stage, *professional and digital practice*, describes an individual who understands digital scholarship and is able to productively use digital tools as well as adopt an open approach to research development. The variety of approaches and frameworks that are being built around the theme of digital scholarship testify to the novelty of the concept and emerging thinking in the area.

Research Process

Even as librarians work to develop new digital scholarship frameworks, studies of the scholarly research process provide a foundation for understanding scholars' activities. This insight is especially important given the tension between traditional and evolving notions of scholarship. The research process, or research cycle, can be defined as the steps a researcher takes from an initial idea through and beyond publication, whether the researcher is a novice or an experienced scholar. This definition breaks scholarly activity into smaller steps, thereby helping librarians to identify the gaps and barriers that a researcher may encounter at any given stage. For Alison Head, who studied the research process of recent college graduates, these steps center around four nonsequential activities: "identifying a topic, searching for information about it, evaluating the information, and then applying it."[19] Nancy Fried Foster and Susan Gibbons break down this process further in their study of expert scholars, finding that research faculty employ several core activities and habits to meet academic work demands.[20] These demands include reading and writing about research interests, sharing research and outputs with others, staying abreast of literature in the field, organizing and storing research materials, as well as collaborating with colleagues and other researchers.[21] Tools like Mendeley support each of these activities.

In a later study, Foster analyzes scholars' confidence in their ability to engage in these practices, an aspect of the research process that is often overlooked.[22] Scholars perceive that they are successful at activities such as reading and staying current; finding books and articles; using a variety of media and sources; annotating and organizing sources; conducting field research; and presenting and publishing, as well as teaching.[23] Foster's findings show that while scholars feel able to complete these foundational aspects of the research process, they are less confident in facets of research that involve new information streams and technologies. For example, scholars see themselves as less able to manage information overload, leverage interdisciplinary crossovers, keep track of bibliographies, maintain time for colleague dialog, and master library tool idiosyncrasies.[24] This knowledge of scholars' abilities helps to identify the prime areas for learning opportunities and training interventions, both in terms of conventional and emerging research practices.

Research Support

Traditionally, academia has recognized the need to train novice scholars in the competencies needed to be both a content expert and a proficient researcher, with training commonly offered in doctoral programs or informally through peer-to-peer communities.[25] Yet, as Cobo and Naval observe, many of the competencies inherent in digital scholarship are skill sets that "lie outside the traditional knowledge-based research practices."[26] This development presents an opportunity to revise research training to include a focus on the individual scholar's identity, process, and dispositions as well as disciplinary norms.

. . . many of the competencies inherent in digital scholarship are skill sets that "lie outside the traditional knowledge-based research practices."

Some educators have responded to this opportunity by developing digital scholar centers on college and university campuses, including the University of Virginia's Scholars' Lab in Charlottesville; the Scholarly Communication Symposia of Georgetown University Libraries in Washington, D.C.; and the City University of New York's Digital Fellows Program, to name only a few. It is common for such centers to offer funding, trainings, and symposia on topics relevant to digital scholarship. For other institutions, such as the Emory Center for Digital Scholarship in Atlanta or the Digital Scholarship Lab at the University of Richmond in Virginia, digital scholarship is inextricably bound up with digital humanities projects. While these initiatives and programs have met with success, they appear to place greater focus on skill-based training rather than on the development of scholars' open and networked dispositions. However, this may change in the near future as research groups study these centers in more depth and develop a set of best practices.[27]

University libraries are other stakeholders who are invested in supporting digital scholarship. Librarians build upon existing instructional service models, such as individual research consultations and group and class workshops, to support these needs. They also create dedicated spaces equipped with research-relevant tools.[28] However, workshops that approach emerging digital practices tend to focus on promoting services such as the institutional repository or publishing services, on scholarly communication advocacy, or on understanding author publication agreements.[29] In this way, these initiatives, too, focus on technological changes rather than helping scholars develop the capacities needed to work within changing models of scholarship. If digital literacy workshops exist, they are predominantly directed to an undergraduate audience rather than experienced scholars. The London School of Economics, which has an extensive personalized training system for researchers, may be one of the few exceptions.[30]

Summary

In sum, this literature review demonstrates that there is considerable interest in the development of digital scholarship practices and the design of effective support structures for scholars. However, as Katy Jordan points out, the potential benefits of these services have "received greater focus in the academic literature than the ways that such services

are being used in practice."[31] Similarly, few studies have examined digital literacy and the research process together to look holistically at what it will mean to be a digital scholar. In addition, the literature shows that support models tend to focus on the technological skills that digital scholars require without enough attention to the fundamental shift in scholarly culture and values. These findings illustrate the gap between scholars' needs and current support models, providing a further impetus for this paper.

Methods

The authors used a survey and focused interviews to elicit broader understanding and feedback about local Mendeley usage and the scholarly research process at UCB. These findings provided a glimpse of local scholars' attitudes toward digital scholarship, as well as their support needs.

Survey

A survey was the first method of data collection. Designed to provide an initial understanding of Mendeley usage as well as user habits and needs on the UCB campus, the survey consisted of twenty questions. These items covered basic demographics, as well as more detailed inquiries about respondent usage of Mendeley in the research process, including discovery, access, use, and support. Questions were designed to fulfill three major purposes: to understand local details of Mendeley usage; to gather information about individual Mendeley usage and habits, including details of how Mendeley fits into individual workflow and scholarly activity; and to uncover user needs. This survey would help the authors decide where to target future training and outreach support. Answers from these questions also served to inform the design of the focused interviews.

Interviews

The authors then conducted semi-structured interviews several weeks after the survey went out. Questions followed up and expanded on survey responses to gain a clearer picture of Mendeley usage and the role of this tool in the scholarly workflow. Interview questions were split into three sections focused around common aspects of the research process: managing information, writing, and publishing. Questions about managing information covered searching for articles or citations and keeping up in the field, as well as reading, annotating, and organizing Mendeley articles. Inquiries about writing focused on participant use of Mendeley for reference management, while questions about dissemination looked at how participants utilized Mendeley both before and after publication, for example, tracking statistics or archiving personal copies of articles. Nonetheless, the semi-structured nature of the interviews meant that each interview had a unique focus. Interviews took place in the library or at a location of the participant's choosing, for example a lab. The sessions lasted around forty-five minutes and were audio recorded. The investigators asked participants to bring any device that they use to access Mendeley to the interview for clarification purposes. Interviewees received a $15 Amazon gift card for their time.

Recruitment

The investigators recruited participants for the survey through communication systems at the Boulder campus of the University of Colorado. While it is impossible to ascertain that responses did not come from outside the Boulder campus, the authors emphasized the local nature of the study, both in question design and recruitment communications. Mendeley employees also sent an e-mail with details of the survey to users who had registered for a Mendeley account with a University of Colorado e-mail address. The final question of the survey allowed respondents to register their e-mail address if they were interested in participating in a semi-structured interview. The authors subsequently recruited interview participants who represented a broad cross section of the local community from these survey respondents.

Respondents

Sixty-eight respondents completed the survey. While the total number of Mendeley users on campus is unknown, Mendeley records indicate that 874 people registered for an account with a university e-mail address. However, this is likely not the total number of campus users due to the possibility of registering with a personal e-mail address or due to accounts being inactive. The largest number of survey respondents were PhD graduate students (50 percent) and faculty (28 percent), although all academic ranks were represented. The popularity of Mendeley among PhD students was also found in other studies (see Table 1).[32]

Table 1.
Survey respondent academic rank

Academic rank	Number of responses	Percentage
PhD graduate students	34	50%
Faculty	19	28%
Master's graduate students	8	12%
Staff	4	6%
Undergraduates	2	3%
Other	1	1%

Respondents represented a variety of fields. While the highest number of respondents came from the sciences, they represented a broad cross section of campus departmental affiliations. Unlike the studies led by Jiepu Jiang and by Wei Jeng, which found that researchers in computer and biological sciences are the most active researchers within Mendeley, these data showed that scholars in the geological sciences and physics are amongst the keenest local UCB users.[33] This finding tallies with the Mendeley Global Research report (see Table 2).[34]

Table 2.
Survey respondent academic affiliation

Department	Number of responses	Percentage
Geological sciences	7	10%
Physics	6	9%
Ecology and evolutionary biology	4	6%
Computer science	4	6%
Geography	4	6%
Psychology	4	6%
Communication/pre-communication	3	4%
Media studies	3	4%
Environmental studies	2	3%
Architecture	2	3%
Molecular, cellular, and developmental biology	2	3%
Other	14	21%

Six users participated in the semi-structured interviews. The investigators selected interviewees to provide a broad cross section of local Mendeley users. The spread of respondents was chosen to mirror the Jiang team's findings that junior researchers were more likely to use Mendeley (see Table 3).[35]

Table 3.
Interview participant demographics

Academic rank	Subject
Master's student	Integrative physiology
PhD student	Theoretical physics
Postdoctoral researcher	Physics education
PhD student	Integrative physiology
Postdoctoral researcher	Geology
Assistant professor	Information science

Survey Results

While sixty-eight respondents completed the survey, sixty identified themselves as active Mendeley users. The remaining figures are calculated on those sixty respondents.

Introduction to Mendeley

An initial goal of the survey was to establish how survey respondents discovered Mendeley as well as their intention to continue use of the tool. Respondents primarily learned about Mendeley through colleagues (28, or 47 percent). Other introductions to the software came from teachers, friends, or workshops (4, or 7 percent for all three sources); or from librarians or news sources (3, or 5 percent for both). Respondents' duration of use varied from less than six months to five years. Most rely solely on Mendeley's free Basic plan (57, or 84 percent), with only three respondents subscribing to Mendeley's Pro (1) or Team (2) plans. Respondents indicated that they adopted Mendeley because of the cost, the ease of use, and the cloud-based storage. In terms of satisfaction with the tool, the survey revealed a higher degree of satisfaction than dissatisfaction. Forty-seven percent of the survey respondents (28) reported that they were very likely to continue use of Mendeley, while only 10 percent (6) indicated that their continued use was very unlikely.

Depth of Use

Overall, survey respondents reported a shallow use of advanced features. The participants predominantly described using Mendeley as a tool for pdf storage, for citing within a word processor, for storing or managing citations, for note-taking, and for searching. Participants reported that they seldom utilized the features that support open and digital scholarship practices: collaborating, tracking citation readership, networking, self-archiving, and profile development (see Table 4). This finding corroborates the Jeng team's study, which showed that account holders mostly used Mendeley as a document and reference management system.[36]

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Complementary Digital Scholarship Tools

The authors anticipated that respondents might couple their use of Mendeley with other tools that support digital scholarship practices. However, the survey indicated that they did not. Most respondents (39, or 67 percent) do not employ Mendeley in tandem with other tools. The few who do use complementary tools mentioned workflow and task management tools, such as WorkFlowy, Trello, and Evernote; or cloud storage tools, such as Google Docs and Dropbox. Some respondents reported that they used other reference managers in conjunction with Mendeley, including Zotero, RefWorks, Reference Manager, and EndNote.

Table 4.
Survey respondent usage of Mendeley

Features used always or most of the time, in rank order	N = 60
Store and manage citations (with pdfs)	48
Cite in Word or OpenOffice documents	25
Store and manage citations (without pdfs)	15
Notes and highlight	14
Search for articles/papers	11
Share my publications (i.e. self-archiving of pdfs)	7
Collaborate in groups	6
Track or follow users/groups	4
Personal profile	3
View publication statistics	3
Networking (social features)	1

Problems, Learning, and Support

To identify areas where scholars might benefit from training and support, the survey asked respondents to indicate the primary problems that they encountered with Mendeley. When respondents reported that they had problems, they most commonly mentioned difficulty in importing citations (34, or 57 percent, told of some difficulty) and integrating with word processing tools (25, or 42 percent, reported some difficulty). In addition to these common problems, free text survey questions revealed trouble with duplicate entries; importing from other services (EndNote or Reference Manager); linked file and pdf default locations; formatting for specialized citation styles; and citation capture of gray (or grey) literature—that is, preprints or prepublication versions, technical reports, and similar documents not published commercially or not generally accessible.

When learning to use Mendeley, the majority of survey respondents (53, or 91 percent) indicated that they were self-taught. Help documentation, friends and colleagues, as well as online tutorials ranked as popular references for learning. A smaller number (14, or 23 percent) consulted a librarian or attended a workshop. The low use of in-person help services may be attributed to the fact that 36 (62 percent) of the respondents did not know Mendeley advisers were available on the campus, and 34 (60 percent) were not aware of local workshops, which are offered through the University Libraries. Yet 43 (74 percent) of the respondents indicated that they would attend local workshops on Mendeley in future.

Interview Results

The semi-structured interviews revealed themes consistent with the survey results, while also offering in-depth snapshots of scholars' workflow and use of Mendeley.

Introduction to Mendeley and Disciplinary Integration

Consistent with survey results, interview participants predominantly became aware of Mendeley through peers, mentors, or scholars in their field. However, while disciplinary peers provided initial exposure to the tool, these discipline and research communities also imposed barriers to use of Mendeley. Several interviewees described collaborative research settings in which all members of the research team shared a reference library. Mendeley offers functionality to support shared references; however, the participants reported that their fellow researchers preferred inherited reference management systems rather than new services like Mendeley. Reference management systems that predated Mendeley tend to be the preferred tool of senior researchers, and an established library of references might represent years of curation and compilation. While several of the interviewees expressed a preference for Mendeley, they encountered numerous obstacles balancing personal and team reference libraries.

Managing, Tracking, and Discovering Information Sources

Mendeley offers two primary means of information source discovery: paper search, which provides access to over 300 million user-added papers, and Mendeley Suggest, which offers recommendations based on a user's library. These findings do not cover Mendeley Suggest because it requires a Pro or Team account. Interviewees demonstrated minimal interest in using Mendeley as a discovery tool for literature and recommended sources, a finding that is replicated in Katy Jordan's study of Academia.edu.[37] Instead, as Smiljana Antonijević and Ellysa Stern Cahoy found, the researchers preferred alternative discovery methods, such as mailing list servers, respected journals, and known discipline databases.[38] Most tracked these services through push notifications that deliver information without a specific request from the user, such as table of contents RSS feeds or alert e-mails direct from the journal publisher. Some interviewees described how they mined e-mails sent by their lead researcher or affiliate professional organization for potential articles of interest. Others would actively search established journals or databases at the point of need, or, in other words, when time permitted or research demanded a review of the literature. Tracking citation trails from core or known sources was a far more popular strategy than identifying recommended sources through Mendeley. In addition, interviewees repeatedly indicated that after working in a field for some time, they felt confident trusting the recommendations from peers, mentors, or representatives of professional organizations. These practices were the primary reasons for not using Mendeley as a discovery service. However, one participant did express doubt about Mendeley's breadth and depth of sources in his field.

Interviewees demonstrated minimal interest in using Mendeley as a discovery tool for literature and recommended sources …

Organizing a Reference Library

Mendeley offers several ways to organize, sort, and search a reference library, which include folders, tags, and stars to indicate favorite items. Each interviewee described the use of folders to organize sources either by topic or by specific research project. Specifically, some scholars sorted citations into folders that represented subtopics or components of their overarching research interest. Others favored folder organization based on project and publications, where citations might reside in multiple folders. Lastly, some utilized a hybrid structure of both project- and topic-based folders. Tagging and use of the "favorite" star were far less popular. Only one interviewee discussed the tags as an advanced organization feature, while just two participants actively used the favorite option in Mendeley to mark important sources or citations.

The desktop version of Mendeley also offers users the ability to monitor a folder on one's hard drive for new publications. Several interviewees reported hosting a folder on their hard drive, where they saved articles to read. None of the respondents, however, enabled Mendeley to watch this folder. This disuse is possibly due to lack of awareness but could also be linked to the finding that interviewees predominantly only stored articles in their Mendeley library if they evaluated the materials as important or as a source for a published manuscript. This finding matches results from the study by Xi Niu and his coauthors, who found that researchers tended to store about half of the articles from their article collection in a reference manager.[39]

Reading and Writing

Mendeley offers a built-in pdf viewer, which allows users to highlight, annotate, and search documents. Interviewees reported some use of these advanced features, but the practice was in no way consistent. For example, four participants regularly highlight pdf files while reading within Mendeley, but only one uses the annotation feature. Interviewees expressed hesitation with note-taking in Mendeley because other, more feature-rich tools exist and because the notes are stored in Mendeley rather than in the pdf file itself. In terms of writing, none of the interviewees employ the word processor citation plug-in during the writing phase of their research. At least two attempted to use this integration but stopped due to frustration with technical issues or because they had specialized formatting needs.

Researcher Profile and Dissemination

The social networking components of Mendeley offer certain capabilities that are distinct from other popular reference managers, although other reference management vendors indicate they may enter this arena in the near future. When establishing a Mendeley account, a user can create a personal research profile as well as upload recent publications. However, with one exception, interviewees were unaware that they could self-archive publications in Mendeley and thereby gain readership statistics. Two actively reported no interest in the social and networking advantages of Mendeley. Only one scholar indicated that he uploads and makes his publications available when he is able to do so in agreement with publisher licensing restrictions.

Analysis

Research Process and Practices

The survey and the interviews reveal several interesting findings that shed light on researcher practices and capacities. One of the most noticeable themes is that respondents do not always use Mendeley's more advanced features, which make it distinct from traditional reference managers. The reasons for this tend to be complex, involving both personal habits and group dynamics.

Scholar As an Individual

Analysis of the survey responses and interview transcripts revealed that participants found it difficult to integrate Mendeley into established workflows and tools. Having established satisfactory methods for managing their research without Mendeley, participants were often reluctant to abandon these processes. For example, the majority of participants did not use the Mendeley research catalog for finding new articles or papers because table of contents and keyword alerts from journals of interest met their needs. In other cases, Mendeley adoption was limited because the program did not integrate with other research-related software or devices. These issues were often exacerbated by participants' failure to fully investigate Mendeley functionality. For example, many users did not know about key features, such as tagging or statistics. In some cases, participants knew of advanced features like the Microsoft Word plug-in, but they quickly abandoned the functionality when faced with minor technical issues. Lack of time was another complicating factor. One participant who struggled to remember where he saved documents on a partitioned computer recognized that his workflow was unnecessarily complex. Notwithstanding, he felt that he could not take the time to resolve the issue.

Having established satisfactory methods for managing their research without Mendeley, participants were often reluctant to abandon these processes.

These problems demonstrate that individual scholarly workflows appear to be built haphazardly, with little time dedicated to reflection and revision of practices. Scholars often adopt new tools and technologies without a holistic understanding of their research process and needs. They may continue to follow established workflows even if they recognize that the old methods are inefficient. A lack of time, training, and support may also lead to shallow adoption of tools.

Scholar As Community Member

The survey and interviews revealed tension between the scholars' individual research processes and disciplinary or community norms. Scholarship is not a solitary act. Instead, all scholars belong to communities, whether these are local research groups or the broader disciplinary community. These factors often impacted participants' use and exploration of Mendeley. For example, the principal investigator or the senior members of a research group might have already established norms related to the research process.

These practices could include the use of specific programs for reference management as well as established mechanisms for information discovery. These expectations were particularly problematic for graduate students who had to reconcile their personal workflows and habits with the team's established process. The same barriers might also hinder professional or disciplinary sharing and use of networking platforms. Facebook and ResearchGate, for example, were the preferred tools in several of the participants' disciplines, which meant they had little impetus to adopt Mendeley's social networking components. These issues demonstrate that although participants may wish to adopt new strategies and workflows, they cannot do so without acknowledging the context within which they work.

Adoption of Habits of Digital Scholarship

The survey and interviews also revealed that participants demonstrated minimal use of and engagement with Mendeley features that support digital scholarship practices, for example, self-archiving, altmetrics, and personal profiles. Typically, participants did not employ these Mendeley features because they lacked awareness about these features or failed to understand the benefit of them. Others rejected these features, judging them to be unimportant or irrelevant in their field. Scholars saw Mendeley's group features as far more useful, yet as Jordan found in her 2014 study, usage remained somewhat superficial.[40] For instance, participants might use groups to support the goals of a local research team but rarely employed them to connect or engage with scholars at a distance. Interestingly, participants did not question this reliance on local groups, with most showing no desire to reach a broader network of scholars. These findings demonstrate that participants use Mendeley without significantly engaging in new and open scholarly practices. This observation presents an opportunity for librarians and universities to foster discussions about the value of openness or the nature of literacies and the support structures that are needed.

. . . participants demonstrated minimal use of and engagement with Mendeley features that support digital scholarship practices, for example, self-archiving, altmetrics, and personal profiles.

Outcomes

While this study is limited in scope and not generalizable, the findings pose compelling questions about the emerging literacies and capacities that scholars need to adopt habits of digital scholarship. This research has also proved vital in the design of local support structures, which have been redeveloped to merge traditional models of research training with broader considerations of values and contexts. Notwithstanding, it is important to note that this study focused exclusively on Mendeley, which is only one tool available to digital scholars. In addition, Mendeley users, who may represent early adopters, might form a subset of local users. Accordingly, this study represents the first step in

our understanding of evolving practices, literacies, and support requirements rather than giving a thorough picture of local scholar needs.

One important realization centered on the idea that both experienced and novice scholars would benefit from integrated training and support. While librarians and educators offer training to novice scholars, the instruction often focuses on tools rather than the bigger picture. Similarly, librarians may assume that the experienced scholar requires little assistance adjusting research practices to meet new needs and demands. Evidence from this study, however, indicates that both groups of scholars would benefit from training programs that are integrated into and contextualized for departmental cultures. In addition, training must take a reflective practice approach that allows researchers to assess, evaluate, and revise their own habits and workflow.

At UCB, these findings have pushed us to design workshops that focus on the research process rather than the software. Reference manager workshops, for instance, have shifted from a focus on a specific tool to a structure that centers on workflow and comparison among services. This approach facilitates deep engagement with the research process because it enables individual reflection on existing practice while portraying alternative models and highlighting disciplinary differences.

Reference manager workshops, for instance, have shifted from a focus on a specific tool to a structure that centers on workflow and comparison among services.

In addition to adjusting training and workshop design, these findings suggest that there is an opportunity for librarians to open dialog with researchers about the foundations of digital scholarship. In this local study, interviewees demonstrated little awareness or knowledge of digital scholarship beyond personal use of online tools. Accordingly, the authors suggested that training should start to expose scholars to digital scholarship, an approach that must focus on values as well as the adoption of emerging tools. At UCB, these findings led to the creation of a weeklong local conversation about digital scholarship, CU Academics Online. The week began with a panel of respected scholars who were invited to share their definitions and attitudes toward digital scholarship. This discussion was followed by workshops in which attendees explored capacities for digital scholarship both through hands-on participation and broader conversation. This approach encouraged candid exchanges between scholars who have actively engaged in the values and practices of digital scholarship and peers who may be skeptical or hostile.

This research also demonstrates a need to broaden discussions about digital literacies on campus given the shifts in scholarly practices. On the one hand, new emerging practices call attention to faculty literacy development. On the other hand, it is important that support structures not only teach new skills and retrain scholars, but also acknowledge the real and perceived risks of engaging in digital and open scholarship, such as idea theft, the balance between personal and professional identities, and time management. At UCB, these ideas have played out in the creation of several workshops open to the entire campus community. The workshop 10 Steps to Becoming a Digital Scholar provided a broad introduction to online scholar platforms as well as giving space for attendees to pose practical and comparative questions to guide their decision-making. The workshop

Creating Your Online Professional Identity isolated one aspect of digital scholarship to provide hands-on training as well as an opportunity to discuss critical considerations related to the establishment and maintenance of a professional online identity.

Conclusion

In conclusion, the authors designed this local study to meet several needs: to understand Mendeley usage, to explore the adoption of digital practices, and to redesign learning opportunities around new and emerging digital literacies. In analyzing findings, the study revealed significant differences between articulated notions of digital scholarship and observed practices in the local community. In particular, this study found that while scholars experiment with new tools, they ignore the values of openness that characterize evolving notions of scholarship. These understandings have led to the design of local learning opportunities that focus on practices rather than tools, an approach which foregrounds reflection and context.

. . . while scholars experiment with new tools, they ignore the values of openness that characterize evolving notions of scholarship.

At the same time, this study raises important questions about the individual's and the academy's adoption of new and emerging practices. What drives a scholar to adopt the values of digital scholarship? Shifting to digital practices is a highly personal process, and educators must acknowledge the motivators and hindrances that affect the transformation. What catalysts encourage revision of engrained practices? It is clear that tensions with established, traditional practice have yet to be resolved. Only ongoing and iterative research will answer these questions and help librarians to design responsive support structures.

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