

Graduate Student Use and Non-Use of Reference and PDF Management Software: An Exploratory Study

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ABSTRACT

Graduate students at the University of Manitoba were surveyed to find out if they used reference management software (RMS), features used, challenges and barriers to using RMS. Interest in different types of PDF management features and training options were also investigated. Both users and non-users of reference management software were invited to participate. Non-users managed their citations and references with a variety of other tools. The principal reasons for non-use were that students were not aware of options that were available, and the amount of time needed to learn the program. RMS users also mentioned the steep learning curve, problems with extracting metadata from PDFs, technical issues, and problems with inaccurate citation styles. Most of the students saved PDF documents to their computer. Students were most interested in full-text searching of PDFs, automatic renaming of PDFs, and automatically extracting citation metadata from a PDF. PDF annotation and reading tools were also of some interest. Mobile features were of the least interest. There were no statistically significant differences in the interest of PDF management features between the user and non-user groups but there were statistically significant differences in the interest of some of the training options between the groups.

KEYWORDS

Academic Libraries, Graduate Students, Reference Management Software, Citation Management Software, Citation Managers, PDF Management, EndNote, Zotero, Mendeley, RefWorks

INTRODUCTION

Graduate students today have many reference manager options available to them, many of which are free, paid for by an institutional license or available at a low cost. Graduate students also have a growing amount of electronic information to manage and many of the documents needed by graduate students are available for download in PDF format. Many students may also have more than one device including mobile devices such as an iPad or tablet. Most reference managers now offer information management features that can help researchers manage downloaded PDF articles in addition to keeping track of references and citing them in a document and can help manage accessing documents on multiple devices with cloud storage options. Different programs offer slightly different features and new features are often added to help improve the programs and provide more features for PDF management.

Libraries have been providing support for reference managers for many years. According to their websites, the vast majority of Association of Research Libraries member organizations support reference management programs like EndNote, RefWorks, EndNote Web or Zotero (McMinn, 2011). Several other reference manager options are now available. Examples include Papers, Mendeley, WizFolio, Docear, Qiqqa, ReadCube, colwiz, Paperpile and F1000Workspace

(“Comparison of reference management software,” n.d.). Some of the software have been purchased by publishers or have partnered with a product that is now promoted on their journal website. (“About ACS ChemWorx,” n.d., “colwiz Interactive PDF Reader,” 2015, “Elsevier acquires Mendeley,” 2013, “Wiley offers Enhanced PDFs,” n.d.). It is possible that students may decide to use one of these reference managers even if it is not promoted by the university library if they recognize the software from a journal website.

This exploratory study looked at the use of reference management programs by graduate students at the University of Manitoba. The main research questions examined in this study were: Are graduate students aware of reference management programs and what programs do they use?; What challenges do graduate students have when using a reference management program?; Do graduate students use a reference management program to help manage their PDFs? ; Which PDF management features in reference management programs are of interest to graduate students?; What barriers exist when using a reference management program?; and What training options do graduate students prefer?

LITERATURE REVIEW

Many articles have compared features of different reference manager programs. Tramullas, Sánchez- Casabón and Garrido-Picaso (2015) in their systematic review of reference management software identified 37 articles between 1987 and 2014 that focused on “a comparison between two or more reference management software tools” (p. 682). Tramullas, Sánchez- Casabón and Garrido-Picaso (2015) noted that papers that included PDF management features in their comparisons started appearing around 2010. Several studies have also focused on quality of citations generated by reference management software (Brahmi & Gall, 2006; Fitzgibbons & Meert, 2010; Gilmour & Cobus-Kuo, 2011; Homol, 2014; Kratochvíl, 2017) but there are fewer studies on the use of reference management software by particular user groups.

Some earlier studies that included use of reference management software (RMS) by graduate students were part of a larger study looking at information literacy skills or information seeking behaviors of students or faculty and asked whether or not the researchers used a reference manager. Niu et.al. (2010) in their large national survey of the information seeking behaviour of 2,060 scientific researchers, including faculty and graduate students, found that approximately 50% of those surveyed used a reference manager and that they stored approximately 50% of their papers in the database. Antonijevic and Cahoy (2014) also discovered that slightly more than half (55%) of the science faculty used citation managers and only 30% of faculty in humanities and social sciences reported that they used such a program. Ollé and Borrego (2010) found that many of the faculty that they surveyed did not use a reference manager. Some of the barriers to using a reference manager they mentioned included the time it would take to create the database and issues with citations needing modifications.

Other studies that have focused on information behaviour of graduate students found that many graduate students do not use a reference management program (Harrington, 2009; Vezzosi, 2009; White, 2008; Wu & Chen, 2012). A study of Generation Y doctoral students in the U.K found that 58% of the students did use reference management tools. However, some of the graduate

students in this study indicated that they were not aware of RMS until it was too late. (Education for Change, 2012). These studies did not examine the use of RMS in detail.

Investigations focusing on the use of reference managers by different user groups have been published recently. Salem and Fehrmann (2013) studied undergraduate perceptions of RefWorks and EasyBib while Emanuel (2013) surveyed undergraduate honors students, graduate students and faculty. Other studies have examined graduate students and faculty use of RMS in a variety of disciplines including the reference management tool used, reasons for selecting the tool, features used and interest in library support of RMS by means of surveys or surveys combined with semi-structured interviews. Francese (2013) surveyed graduate students and faculty in scientific disciplines. Madhusudhan (2016) looked at reference manager use by library and information science students while Melles and Unsworth (2015) examined reference management practices of graduate students in the humanities and social sciences. Rempel and Mellinger (2015) utilized a qualitative approach that combined semi-structured interviews with three one-hour screen-recording sessions taken of the participants using a reference management program and journal entries. They investigated influences from advisors or peers on the selection of program, the program's effect on productivity, and the participants' troubleshooting preferences. Participants in this study included a small sample of Masters and PhD students as well as some faculty, staff and one undergraduate student from a variety of disciplines. Lonergan (2017) surveyed library arts faculty to determine their use of RMS, missing features of RMS and whether or not faculty recommended RMS to their students.

Previous studies have found that EndNote is still one of the more popular programs used by faculty and graduate students but Mendeley, Zotero, and RefWorks are also widely used. However, other reference managers are also selected by academics (Antonijevic & Cahoy, 2014; Emanuel, 2013; Francese, 2013; Melles & Unsworth, 2015). Usage of a particular reference manager can vary depending on whether or not the institution has a site license for a particular reference manager or purchases licences for their clientele. For instance, at the University of Torino a group of EndNote licenses were purchased and distributed to users. Training sessions were also offered on EndNote. EndNote was identified by the survey respondents as the software used most often (Francese, 2013). Melles and Unsworth's (2015) study was done at a university that held an institutional license for EndNote and some of the participants in their study were recruited from EndNote workshops that were offered by the library. Not surprisingly, EndNote was the most used program in their study and use of other software was very low. Since cost is an important factor for graduate student selection of a reference manager (Emanuel, 2013), an institutional site license for one reference manager is highly likely to influence use of that product. However, an institutional site license does not necessarily mean that other reference managers are not used. At the University of Illinois at Urbana Champaign a site-license to RefWorks was held but Emanuel (2013) found that other reference managers were also used, and EndNote was used more than the site-licensed software. Whether or not the library offers workshops on other products may also influence use of a reference manager. In Emanuel's (2013) case, workshops on reference management programs including EndNote, Mendeley and Zotero were offered by librarians. However, recommendation by a colleague is more likely to influence the decision of which reference manager to use than recommendations by librarians (Emanuel, 2013).

Melles and Unsworth (2015) found that 30% of the survey respondents decided to use the reference management system because it was recommended by their lecturer or supervisor. In Francese's (2013) study the top reason that the software program was chosen was that it was the tool suggested by other colleagues. In contrast, Rempel and Mellinger (2015) found that the graduate students in their study often did not use a tool based on a faculty member's recommendation and some advisors did not use a reference manager. Emanuel (2013) also noted that faculty started using EndNote when there were fewer options available and are reluctant to change to a new software, but graduate students have more options available to them now. Graduate students in her study used Mendeley, RefWorks, and Zotero more than faculty.

Barriers to using RMS by graduate students identified in the literature include the time needed to learn the software (Randall, Smith, Clark, & Foster, 2008; Vezzosi, 2009), time needed to create the database (Ollé & Borrego, 2010), keeping up-to-date with changes to the software (Randall et al., 2008) as well as interfaces that were not user-friendly (Randall et al., 2008; Wu & Chen, 2012). A lack of training and confidence in using reference managers have also been identified (Newton, 2007; White, 2008). Other students indicated that they did not use a reference management program because they did not have many references to manage (Wu & Chen, 2012). Another reason for not using a reference manager that was identified by Lisbon (2017b) is the difficulty of formatting multilingual citations with RMS.

Interest in PDF management features have not been investigated by many researchers. Emanuel (2013) included a question about mobile apps in her study and found that the presence of a mobile app was not as important to users as other functions. Hicks and Sinkinson (2015) looked specifically at features used in Mendeley. Their interviewees indicated that they used some of the highlighting and annotating features, but some participants also preferred to use other tools that had more features for note-taking than Mendeley. Another study that investigated academic preferences for digital reading applications but not necessarily using RMS, found that some academics wanted to be able to sync and export annotations (Franze, Marriott, & Wybrow, 2014). Some other researchers looked at the use of RMS to store and/or annotate PDFs (Emanuel, 2013; Francese, 2012, 2013; Melles & Unsworth, 2015), but they did not investigate the interest of some of the new features like syncing to mobile devices, the use of a watch folder or renaming of files. Lonergan (2017) found that annotating and highlighting uploaded documents were not that important to liberal arts faculty that were surveyed.

INSTITUTIONAL CONTEXT

The University of Manitoba is a research intensive medical doctoral institution that provides 135 graduate programs offered by 80 departments and units. The University belongs to the U15 group of Canadian research universities. The University of Manitoba Libraries is a member of the Canadian Association of Research Libraries as well as the Association of Research Libraries.

The University of Manitoba Libraries has subscribed to RefWorks since 2005 and has offered training and support for that program since that time. Librarians at the University of Manitoba have offered Mendeley, Zotero, RefWorks and EndNote workshops specifically to graduate students as part of the Faculty of Graduate Studies GradSteps professional development program

since 2012. Several students often attend more than one workshop to determine the best program for their needs, but it is not known which programs the students end up selecting.

METHODOLOGY

An online survey was developed using Survey Monkey based on surveys conducted by Emaneul (2013) and Francese (2013). This survey differed from previous studies by adding more questions to find out interest in PDF management features, including questions for non-users of reference management tools and free-text questions on challenges and barriers to using RMS (see Appendix A). The University of Manitoba Libraries Assessment Committee provided feedback on the survey and the survey was approved by the University of Manitoba Research Ethics Board. The survey ran from September to November in the fall of 2015. Three announcements with links to the survey were included in the Graduate Student Association electronic newsletter. Additionally, the survey was included in the Faculty of Graduate Student weekly Top 5 news items and in the Faculty of Graduate Studies Twitter and Facebook posts. This type of sampling method is a self-selection sampling option (Andrews, Nonnecke, & Preece, 2010). Incentives to fill out the survey included two \$50 university bookstore gift certificates. A link to a separate survey for the prize draw ensured that the survey answers would be anonymous.

The survey asked students if they had heard about different RMS and if they used a reference manager. The survey consisted of a branched survey design so that students that did not use a reference management tool answered questions about the reasons for not using a reference manager, how they kept track of their references and how they created citations for them. RMS users were asked about their use of a variety of reference managers including some not supported by the University of Manitoba Libraries, what features they used and their satisfaction with the software. All students who downloaded PDFs were asked about their interest in PDF management features and were invited to provide comments on any challenges and barriers that they had when managing PDF documents and/or citations as well as their interest in different training options.

RESULTS

One hundred and thirty-eight graduate students answered the survey out of a population of 3,800 students. Survey respondents represented most of the disciplines at the University of Manitoba except for law, fine arts and music. Six respondents did not indicate their discipline. The highest number of responses were from science and health science disciplines (Table 1). Only a small percentage (30%) of the responses to the survey were from non-users of RMS.

Table 1
Respondents by discipline that use or don't use reference management software.

Discipline	Use software	Don't use software
Science/Engineering	44	19

Health Sciences	27	5
Social Sciences	18	11
Humanities	4	4
Unknown	3	3
Total	96	42

Non-Users of Reference Management Software

Forty-two respondents indicated that they did not use reference management software. The respondents were from a variety of disciplines including the sciences, health science, social sciences, and humanities. Only 8% of the non-users were not familiar with any of the reference management products listed on the survey. The top four programs that these students had heard about included RefWorks (62%), EndNote (50%), Mendeley (33%) and Zotero (26%).

Reasons for not using a Reference Manager

The top two reasons for not using reference management software were that they did not know what options were available (55%) and that they did not have the time to learn a program (40%). One student indicated, “I have a lot of trouble organizing my pdfs and references. I am sure my current way of doing that is not the effective one. There should be some software for that, but I am not aware of it. And I don't feel right about digging into searching the right software and learning it by myself.” Other comments focused primarily on the time it takes to learn how to use a program. One student stated that they did not use a program at the beginning of their studies and they felt that it would not benefit them as much now as they have figured out a manual process that worked for them. Some students also felt that the learning curve was very steep. Other reasons listed included the fact that their primary sources did not work well with the programs (Arts and Humanities disciplines) and that references are often not correct.

Tools Used

Some of the respondents that indicated that they did not use a reference management program used other tools to help manage their citations. They mentioned that they managed their citations by keeping their papers in GoodReader, compiling a list of references in Microsoft Word, using Latex, Microsoft OneNote, manual notetaking, using the Cite tool in the library database and then copying to Word, BibWord XML, notebooks, and BibTeX citations downloaded from websites.

Challenges

Open-ended responses on the challenges for managing citations or downloaded PDF documents for these students included the time to organize their PDFs and references, challenges with changing styles and the time needed to create citations. Some comments highlighted the difficulty of learning a reference management program:

“I should have used a program. Wish I did! I actually think I may have started using one but it wasn't very easy to use and so stopped and should have kept with it.”

“I feel overwhelmed by the programs. The learning curve seems very steep.”

“The use of software needs time to learn and practice, which is challenging for a graduate student.”

Some of the challenges mentioned focused on the difficulty of managing their information, not just the references. As one student commented, “I am quickly realizing, that the manual methods used in undergrad are now unsuitable. Actually constructing the citation is of little concern, it is organizing my citations in a way so I don't forget to add this or that quote. And then pulling back to a larger view and realizing where the gaps are.” Another comment focused on the difficulty of relocating information they had found, “Sometimes I find it hard to track down a particular pdf document that I read last year which applies to something current I'm working on.” Another student commented that one of their challenges for managing PDFs was “saving them in a manner that will help me access them quickly and know the applicability to my train of thought.”

Users of Reference Management Software

Reference Software Used

Ninety-six respondents indicated that they used reference management software. As shown in Figure 1 the top four programs used were Mendeley (39%), EndNote (20%), Zotero (16%) and RefWorks (10%). This result is interesting to compare with the programs that students had heard about but did not necessarily use. The programs that they had heard about correspond closely to the programs that are supported by the library. The top four programs known included EndNote (74%), Mendeley (68%), RefWorks (69%) and Zotero (53%). Other reference management programs that were listed as being used included Papers, Qiqqa, Docear, EndNote Web, ReadCube, ReadCube combined with Mendeley, Bookends, BibTeX, and Refme Web. Some other options mentioned that were not technically reference managers included Microsoft Word and Evernote with Microsoft Word.

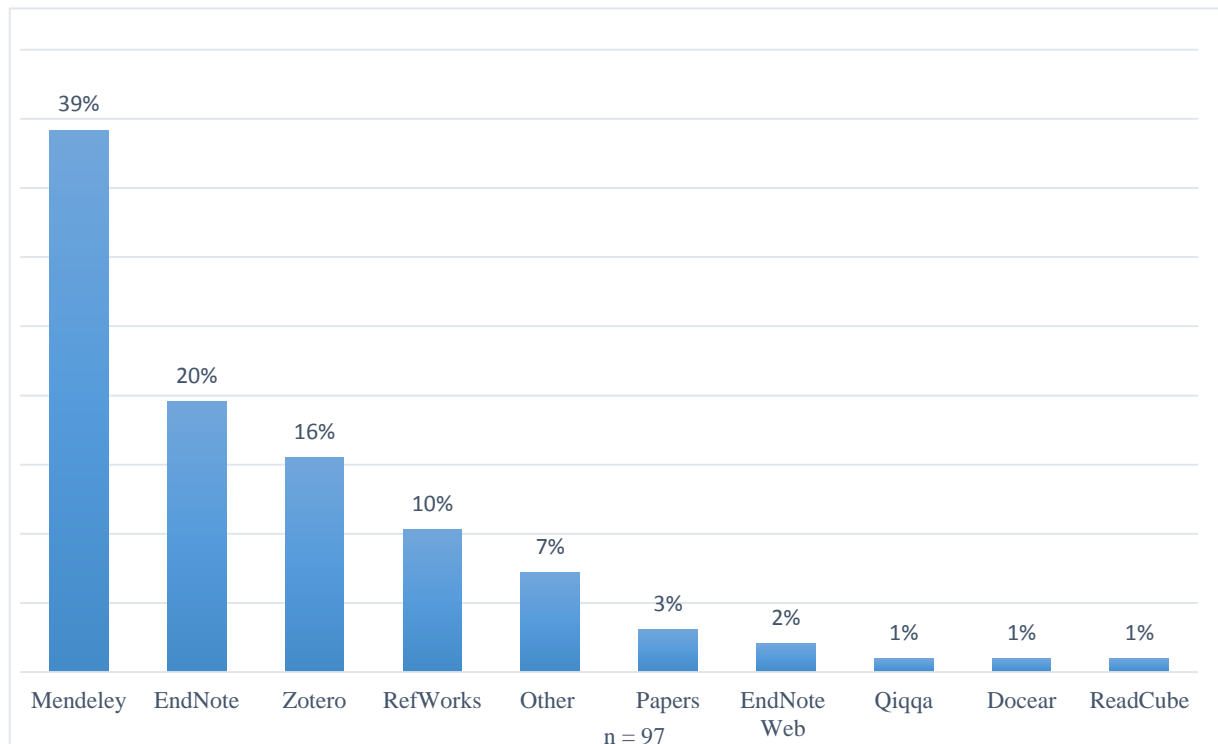


Fig. 1 Percentage of responses by reference management software used

Reasons for Selection

Figure 2 shows the reasons why the students selected the program. The top four reasons included: It is easy to use (62%), it is free (58%), it integrates with my word processing application (50%), and it has all the features I need (49%). Other reasons for selecting a software included suggestions from colleagues, their supervisor or the fact that their research group used the reference manager. Library training and support was not listed as an important a factor for selecting the program.

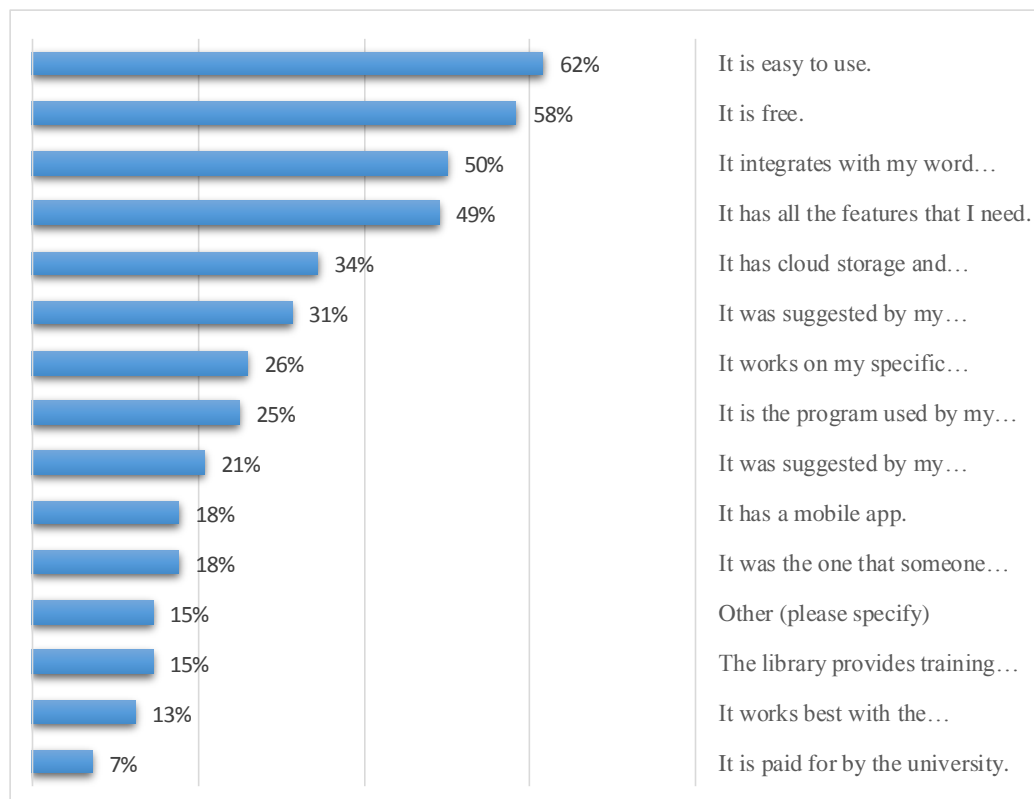


Fig. 2 Reasons for choice of reference management software

Features Used

The features used are shown in Figure 3. The top four features that were used included: Creating lists of references for papers, theses, dissertations and/or manuscripts (85%), creating folders to organize my citations (81%), adding in-text citations to my papers (73%), saving citations from databases like PubMed, Web of Science, EBSCOhost, Google Scholar (59%). Little used features included sharing citations with others and creating public or private groups for project collaboration. Students did not use tags as often as folders for organizing references. Other reasons for using the software included the ability to create notes and synchronize to a cloud storage, saving pdfs, adding notes and highlighting them, searching within papers and exporting BibTeX cite keys.

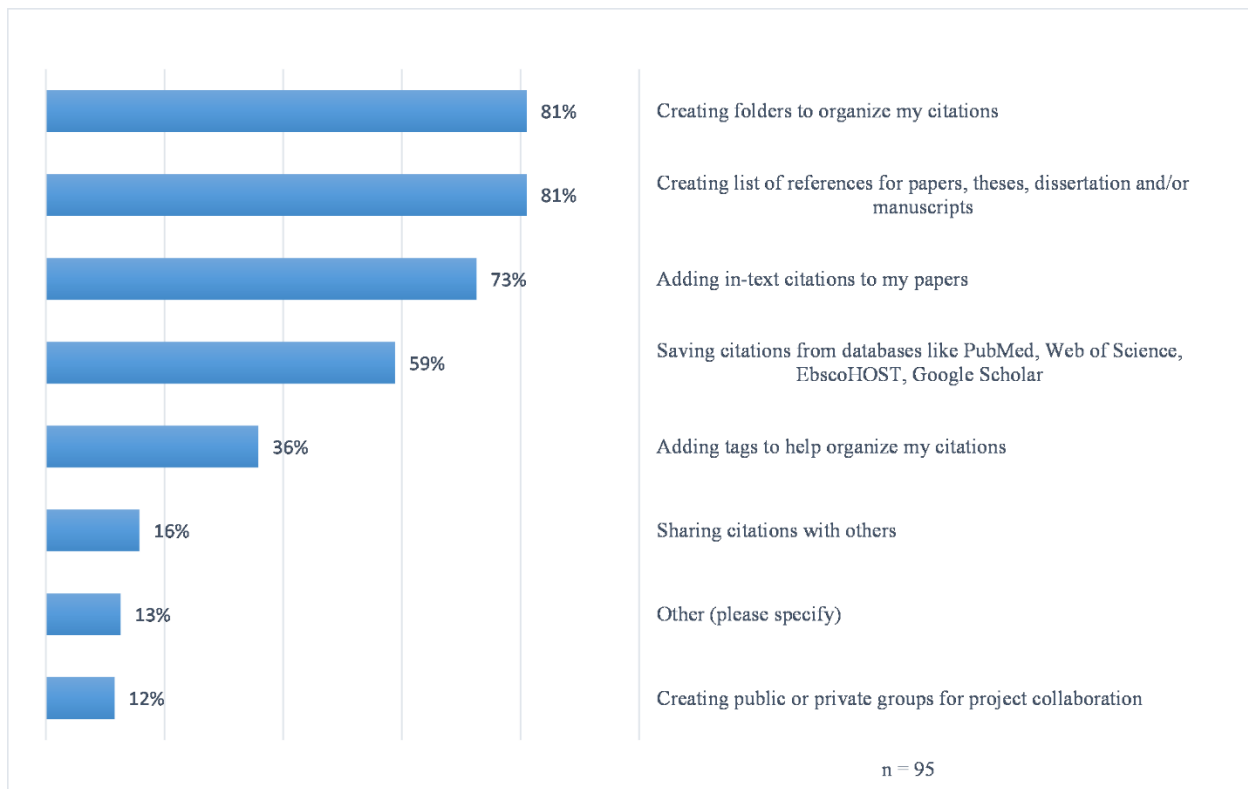


Fig. 3 Features used

Features Desired

Some students mentioned that they would like to see certain features that exist, indicating that they are not aware of all the options available. For instance, one Mendeley user commented, “I use LaTeX/BibTex to write papers and my thesis. It would be great to be able to export citations from my reference management software to BibTex format.” As another example, a Zotero user indicated that they would like to see an app that could scan barcodes.

Users would like to be able to create a citation quickly by ISBN, DOI or some other number and capture website information easily. Comments indicated that students would like to know which documents have not been sorted into folders, have more resource types, work off-campus as well as on-campus, have more advanced annotation capabilities, have automatic duplicate detection, and be able to generate a summary of the PDF annotations. Some of these features may be available in some reference managers but not the reference manager selected by the student. Some other comments indicated that they would like more features to help them organize their information. For instance, one student indicated that their ideal system “would allow me to contextualize why I read a document and then link back to any notes I made. And let me group those notes according to whatever chapter outline.” Another student commented, “If the software could tell me how are my papers related (ex. by topic, by authors, by method, etc. according to the tags or other) it may help draw a visual map of my literature.”

Satisfaction with Reference Manager

Most users were satisfied or very satisfied with their reference manager features, but a small percentage of users were dissatisfied or very dissatisfied with some of the features. Forty percent of the respondents did not have an opinion or selected not applicable for collaboration features indicating that these types of features may not be highly used or are not available (Table 2). While many people were satisfied or very satisfied with the creation of in-text citations, this feature also had the highest dissatisfaction with 11% of the respondents being dissatisfied or very dissatisfied with in-text citations.

Table 2*Satisfaction with reference management software features*

	Very Satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Very Dissatisfied	No opinion	N/A	n
Ease of use	36%	57%	7%	1%	0%	0%	0%	93
Creation of in-text citations	32%	39%	9%	9%	2%	4%	4%	90
Creation of reference lists or bibliographies	32%	45%	16%	2%	1%	3%	2%	92
Organizational features (tagging, folders etc.)	32%	35%	22%	3%	1%	3%	3%	91
Collaboration features	11%	21%	24%	4%	1%	24%	17%	89
PDF management	34%	34%	19%	5%	2%	4%	3%	92

Use by Discipline

The top four reference managers used were examined by discipline. There were a few differences in the use of reference manager by discipline with EndNote being more likely to be used in the sciences and health sciences and less likely to be selected by students in the social sciences and humanities (see Figure 4). EndNote and Mendeley were used more often in the sciences and health sciences than RefWorks or Zotero. Zotero use was higher for the social science and humanities disciplines. Mendeley had higher use in the sciences.

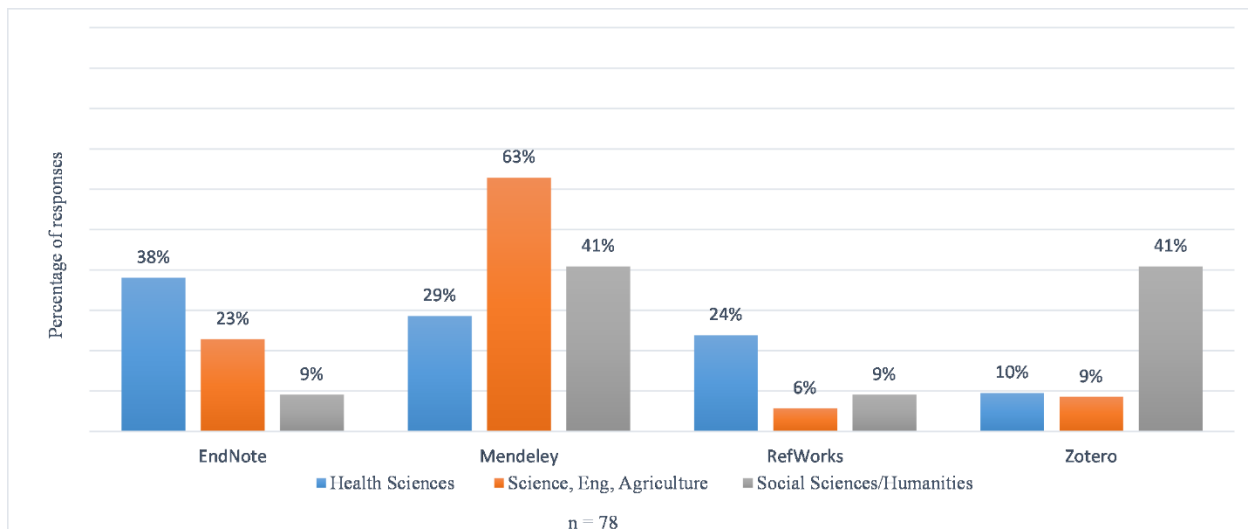


Fig. 4 Top four reference managers used by discipline

PDF Storage

Only one survey respondent indicated that they did not save PDF articles for future use. Most respondents indicated that they saved PDF documents to their computer. One respondent indicated that they saved their PDFs to their mobile device instead of a computer. Sixty-four percent of the students that used a reference manager indicated that they organized PDF documents with their software. Forty-two percent of the EndNote users indicated that they used their RMS to organize their PDF articles compared to 79% of the Mendeley users. Fifty percent of RefWorks users and 50% of Zotero users used their RMS to help organize their PDF articles.

Challenges

Survey respondents were asked if they experienced any challenges creating citations or managing references and/or PDF documents. Some of the challenges mentioned were that their reference manager did not support non-standard types of citations such as several papers in one citation, footnotes, or manuscripts in preparation or submitted. Other challenges included a steep learning curve, technical issues, problems extracting correct metadata from PDFs, no metadata extracted from PDFs, problems handling duplicates, and inaccurate citation styles. Support for other word processors other than Word was also mentioned.

Interest in PDF Management Features

All survey respondents that downloaded PDFs regardless of whether they used a reference manager or not were asked about their interest in various features that would assist in PDF management and use of PDF documents. Only three students indicated that they did not save PDF articles. Questions asked about features to help organize PDFs, reading, and annotations, and use on multiple devices and/or mobile devices.

These questions were analyzed to determine if there were any statistical differences between the responses of the users and non-users of RMS. The questions had a Cronbach alpha score of more than .7 which indicates that the internal consistency of the questions was good (Connelly, 2011). Chi-square tests revealed that there were no relationships between the use of reference management software and the interest in PDF management features. Nonparametric Mann-

Whitney tests showed that there were no statistically significant differences between the responses received between the user and non-user groups.

There was substantial interest in PDF organizing options including automatic extraction of citation data, full-text searching of PDFs, and automatic renaming of PDFs. While optical character recognition of scanned PDFs and a watch folder feature were not as highly desired as the latter features, 52% of the respondents indicated that they were extremely interested in optical character recognition of scanned PDFs and 44% were extremely interested in a watch folder to automatically save PDFs to a reference manager (see Figure 5).

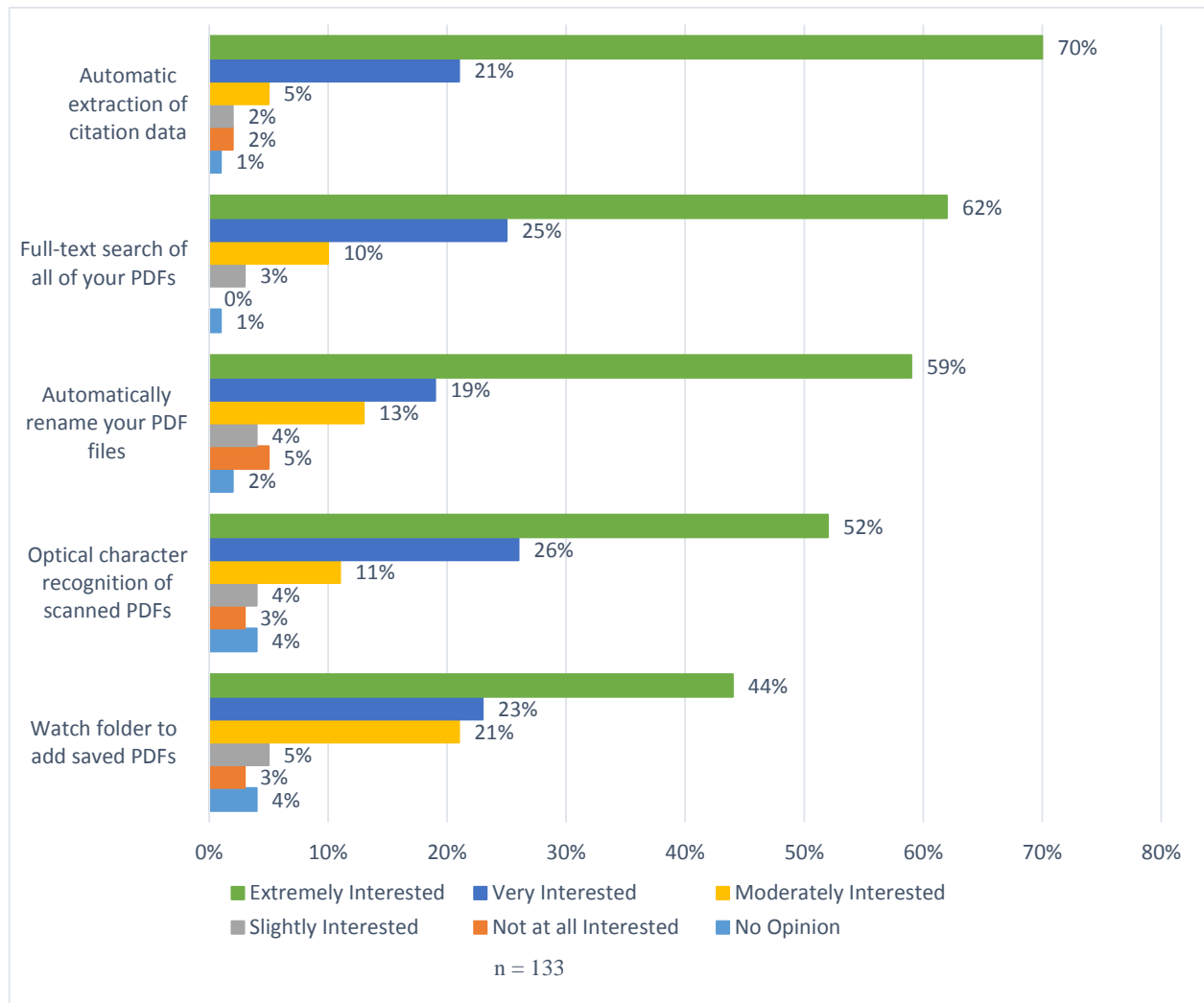


Fig. 5 Interest in PDF organizing features

Figure 6 indicates graduate student interest in PDF annotation and reading tools. While these types of features were still of interest, fewer students were extremely interested in them. There was less interest in mind-mapping features than other PDF annotation and reading tools. Survey respondents were also asked about their interest in features related to using a mobile device with

their reference manager. Figure 7 shows that interest in mobile features was lower than other PDF management features. Twenty-nine percent of the respondents indicated that they were extremely interested in synchronizing their PDF collection to a mobile device and being able to annotate on a mobile device and 26% were extremely interested in being able to add PDFs directly to a mobile device. While several students indicated that they were not interested in mobile features, some students are very interested in being able to have access to their references on any device. As one student commented, “Portability of references is very important - i.e. being able to access references/pdfs from whatever device I am using, be it ipad, laptop, school computer. So, having the software as an app, a desktop program, as well as online access, is very important.”

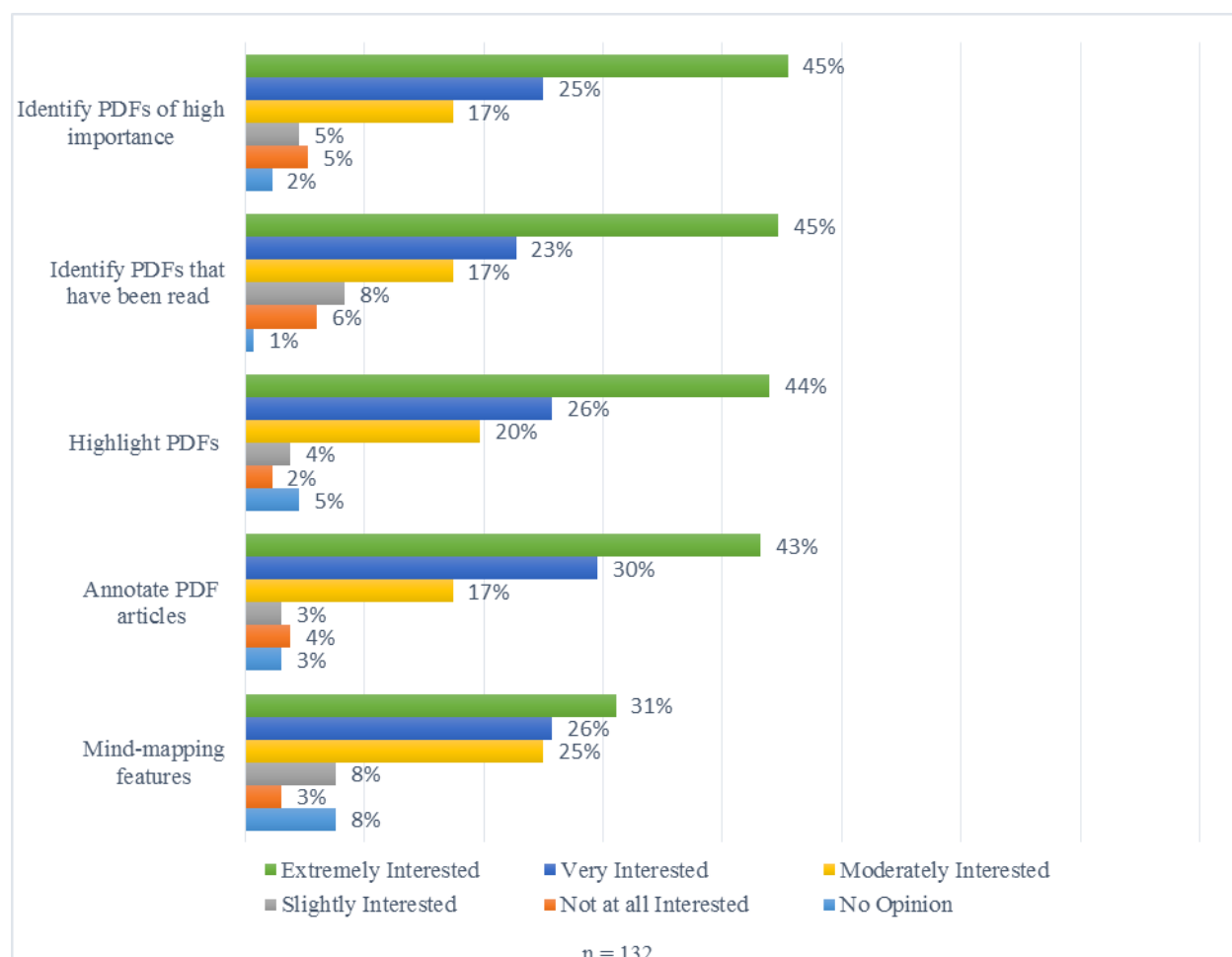


Fig. 6 Interest in PDF annotation and reading features

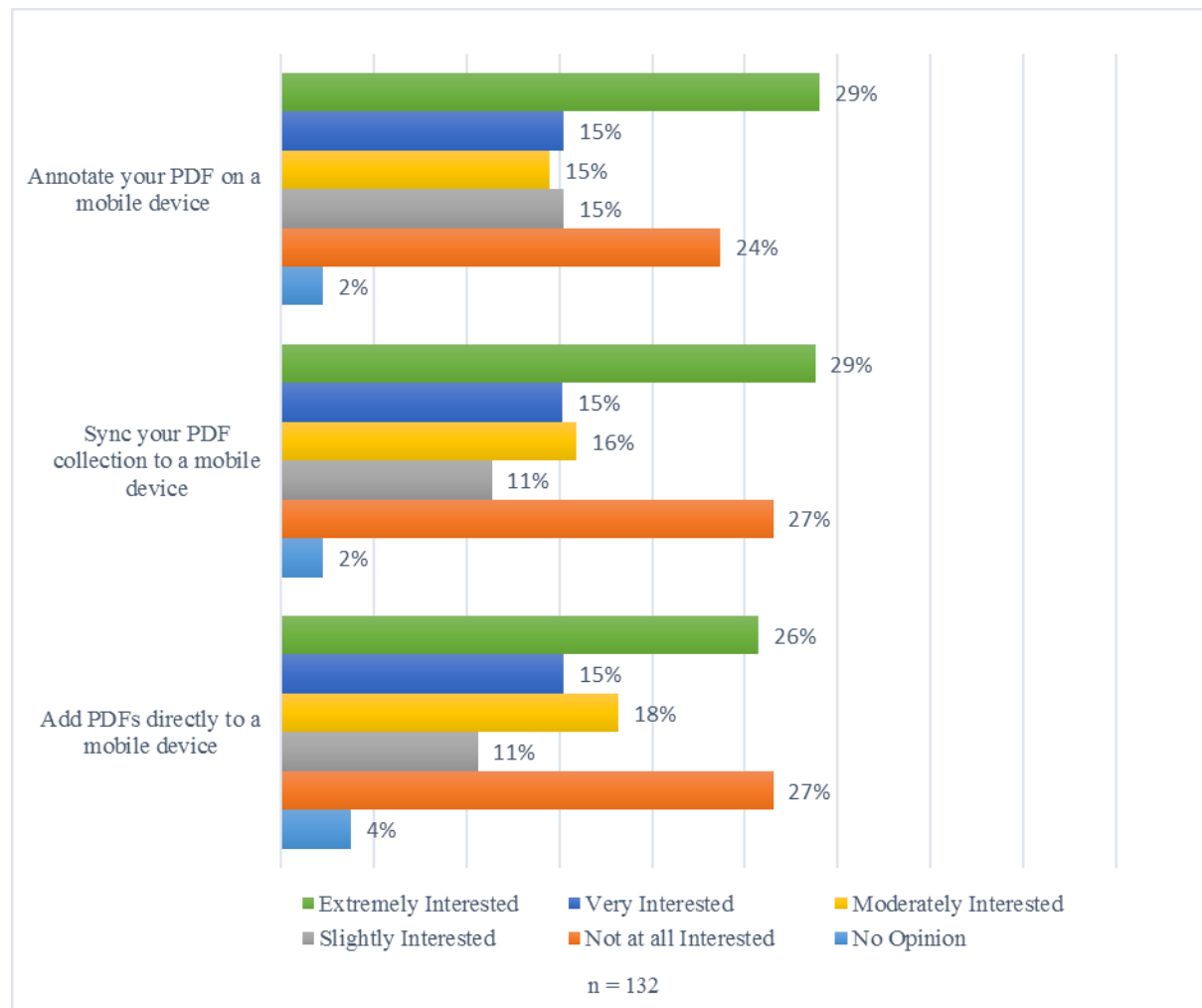


Fig. 7 Interest in mobile device features

Training Options

Survey respondents indicated their interest in various training options including workshops, online tutorials, one-on-one consultations, web pages with resources, email assistance and online chat assistance.

These questions were also analyzed to determine if there were any statistically significant differences between users and non-users of RMS. Reliability analysis for these sets of questions revealed a Cronbach's alpha of .841. Chi-square tests indicated that there were relationships between the responses of the user and non-user groups for the questions related to online tutorials ($p = .007$), one-to-one consultations ($p = .014$) and email assistance ($p = .04$) if the significance level is set at .05. There were moderately strong relationships between the use of reference management software and workshops ($p = .110$) and assistance through online chat service ($p = .121$) if the significance level is set at 0.125. The differences between the users and non-users of reference management software for these questions were then tested by using the non-parametric independent samples Mann-Whitney U test that examines the difference between two ordinal variables with independent measures. The following results were found: there were

statistically significant differences between the user and non-user responses for workshops ($p = .041$), online tutorials ($p = .011$), one-to-one consultations ($p = .039$), email assistance ($p = .041$) and assistance through online chat service ($p = .014$) with the significance level set at 0.05.

The Friedman Test for ranking options was used to determine the training options that were of more interest. When all survey results are considered the top four training options included online tutorials, web page with resources, email assistance and workshops (see Table 3). The ranks of these options were statistically significantly different ($p = .000$). The lowest ranked training options for all users were assistance through the online chat service, one-on-one consultations and walk up assistance at the library.

Table 3

Training options with mean ranks - All respondents

Training Option	All Respondents mean rank (lower number = more interest)
Online tutorials	3.50
Web page with resources	3.52
Email assistance	3.96
Workshops	3.97
Assistance through online chat service	4.22
Walk up assistance at the library	4.34
One-on-one consultations	4.49

There were some differences between the rankings of non-users and users of RMS. The top four ranked options for respondents that are already using RMS were a web page with resources, online tutorials, email assistance and workshops (see Table 4). The ranks of these options were statistically significantly different ($p = .000$).

Table 4

Training options with mean ranks - Users of reference management software

Training Option	Users mean rank (lower number = more interest)
Web page with resources	3.32
Online tutorials	3.54
Email assistance	3.96
Workshops	4.06
Walk up assistance at the library	4.25
Assistance through online chat service	4.31

One-on-one consultations	4.55
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Table 5 shows that respondents that did not use a reference manager ranked workshops higher than email assistance or a web page with resources. However, the difference between these ranks are not as statistically significant as the reference management users' group ($p = .142$).

Table 5

Training options with mean ranks - Non-users of reference management software

Training Option	Non-Users mean rank (lower number = more interest)
Online tutorials	3.41
Workshops	3.74
Email assistance	3.96
Web page with resources	3.97
Assistance through online chat service	4.03
One-on-one consultations	4.35
Walk up assistance at the library	4.54

All graduate students were interested in self-help training options like online tutorials and web pages with resources and were not as interested assistance in the library or one-on-one consultations. Email assistance was ranked higher than chat help by the graduate students in this study. This survey revealed that there were statistically significant differences in the interest of some training options between the graduate students who lack experience with a reference manager and those that were already using a reference manager. Although the ranking of the training options was slightly different for each group, the top four training options for both groups were the same: webpages with resources, online tutorials, email assistance and workshops. Although workshops were of interest to both user and non-users of RMS, non-users ranked the interest in workshops higher.

DISCUSSION

Reference Management Use

This study corroborated the results of other studies that have examined the use of RMS by academics (Antonijevic & Cahoy, 2014; Emanuel, 2013; Francese, 2013; Melles & Unsworth, 2015; Rempel & Mellinger, 2015). Some of these studies involved undergraduate students and faculty members in addition to graduate students and in some cases, they focused only on specific subject areas such as humanities, social sciences or science. This study explored graduate student use of reference managers and included students from a variety of subject areas, yet the results are comparable to other studies that looked at the top features used, reasons for

choosing a reference manager and barriers to using a reference manager (Emanuel, 2013; Francese, 2013; Melles & Unsworth, 2015; Rempel & Mellinger, 2015). Although the University of Manitoba Libraries has a site license for RefWorks, the results indicated that other reference managers were also used. Since librarians provide training and support for Mendeley, EndNote and Zotero this result was not unexpected. This study also sought to find out if there were other reference managers being used by graduate students. A few respondents did indicate that they used other software, but most survey respondents used software supported by the Libraries.

Barriers to using a Reference Manager

Graduate students that did not use a reference manager indicated that the main reasons for not using a program included the time needed to learn the technology and the steep learning curve. Some students also indicated that they were not aware of what programs were available. These issues were also found by Randall et. al. (Randall et al., 2008) and other more recent studies (Emanuel, 2013; Francese, 2013; Hicks & Sinkinson, 2015; Mead & Berryman, 2010; Melles & Unsworth, 2015). Even though some of the features available in RMS have changed over the years, students still find these programs difficult to use. In this study, ease of use was the top reason to select a reference manager. Other researchers have also identified the importance of an easy to use interface as well as the difficulty many users face when using a reference manager (Emanuel, 2013; Francese, 2013; Hicks & Sinkinson, 2015; Mead & Berryman, 2010; Melles & Unsworth, 2015; Nilashi, Ibrahim, Sohaei, Ahmadi, & Almaee, 2016). Some comments received in this study indicated that students were unaware of the availability of certain desired features. Other studies have also found that reference management users typically use only the basic features of the software (Francese, 2013; Hicks & Sinkinson, 2015; Melles & Unsworth, 2015).

PDF Management

This paper expanded on previous work by examining interest in a variety of PDF management features. Results showed that most graduate students download PDF documents and store them on their computer but not all students used their reference manager to aid in the organization of their PDF files. Other surveys of academics have reported comparable results (Antonijevic & Cahoy, 2014; Emanuel, 2013; Melles & Unsworth, 2015). This survey found that both users and non-users of RMS were interested in options to help them organize and use PDFs.

Automatic extraction of citation metadata from a PDF was the highest desired feature suggesting that students want to import PDF documents into their reference manager and automatically extract information for a citation. This survey did not examine how many students added PDFs directly into their reference manager. However, comments received indicated that many of the students are currently using the PDF import option as they mentioned problems with their software extracting the correct citation information when importing PDF articles into their RMS. When the metadata is incomplete, inaccurate or is not available, users become frustrated with the program as they need to verify and manually add missing information to create an accurate citation. Other authors have identified some of the same issues (Hull, Pettifer, & Kell, 2008; Mead & Berryman, 2010; Rempel & Mellinger, 2015). If improvements could be made to the PDF import features either by the software developers or by publishers providing additional metadata, reference management software would be easier for students to use.

Graduate students were also interested in PDF annotation and reading features but not to the same extent as the PDF organizing features. Melles and Unsworth (2015) found similar results in their study. Franze, Marriott and Wybrow (2014) discovered that the top preferences for reading by academics were either print or desktop computer and that annotating documents either in print or PDF was important for academic reading. While annotating the print document was still used by 44% of their survey respondents due to the ease of use, they noted that "...there is a clear need for digital reading software to provide more flexible annotation features, including various styles of annotation links, syncing and export of annotations, and improved display of in-place annotations within the document" (Franze et al., 2014, p. 202). Even though the interest in annotating and highlighting PDFs was lower than PDF organizing features, many students were still interested in being able to use this option. As one student commented, "I would LOVE to be able to write on and highlight on pdfs."

This study identified that graduate students were less interested in being able to annotate on a mobile device, add PDFs and sync a PDF collection to a mobile device. The lower interest in mobile device features may indicate that graduate students in this study were not using mobile devices as their primary tool for academic work which corresponds to Franze, Marriott and Wybrow's (2014) findings. Even though there was less overall interest in mobile device features, some users were extremely interested in these types of features thus having a reference manager that syncs to a mobile device is important for them.

Challenges

One of the main challenges identified by students in this study related to problems with generating correct citations and the difficulty in learning how to use the programs. These citation problems may be due to inaccurate output styles (Brahmi & Gall, 2006; Kratochvíl, 2017). Brahmi and Gall (2006) found that many of the citation errors in EndNote and RefWorks could be fixed by editing the output style. They recommended that instruction sessions on reference management software include information on editing styles. While making minor changes could be included in an instruction session, more extensive editing requires specialized knowledge and does not make the software easier to use. For reference managers to become more user-friendly, improvements to the styles are necessary so that editing is not required. Librarians, users, publishers and software developers could all work towards improving citation styles. Librarians can inform users on how they can report errors to the software developer for correction or to the Citation Style Language repository (Zelle, 2017) which is used by many reference managers including Zotero and Mendeley. Publishers could use an existing style for their publications or help create accurate styles for their publications. Reference management software developers could also ensure that they make the requested corrections and make it easier for users to edit styles.

A few of the student comments alluded to having a much greater challenge of organizing their information and not solely needing a reference manager to help create citations. They indicated that they would like a reference manager that can also help them identify connections and themes amongst their references. Mind-mapping features could help students with this challenge. As noted by Fourie (2011b), mind mapping software offers several benefits for managing personal

information and can be useful for organizing ideas, synthesizing information and identifying gaps in research. While some students indicated that they were extremely interested in this option, interest in mind-mapping features were not as highly desired as some other PDF management features. It is possible that students may not have understood how this type of feature could benefit them. Although separate mind mapping software does exist, some lesser known reference managers like Qiqqa and Docear do have mind-mapping features that could be explored further to determine their usefulness to graduate students.

Training

Non-user and users of RMS have different levels of interest in various training options. A variety of training approaches appear to be desired. Some students prefer to learn on their own whereas other students would like more assistance. This idea is supported by a comment provided by a non-user, "I would like to learn more about what's available in a workshop setting so as to be less overwhelmed by how to use them." In this study workshops were not ranked as highly as online tutorials by all the participants which differs from Fong, Wang, White and Tipton's (2016) findings that graduate students preferred in-person workshops more than online videos or tutorials. This difference may be due to the subject area of the participants as in the Fong et al. (2016) study more participants were from the social sciences whereas in this study more graduate students in the sciences participated. Fong et al. (2016) also noted that there were differences in the training preferences of graduate students in different subject areas with students in the sciences having slightly more preference for online video/tutorials than workshops.

Implications for Practice

Since it is difficult to provide support for all programs that might be used at an institution, offering training and web resources for those programs utilized by most users is recommended. Studies such as this one can help identify which reference managers are being used on campus. Keeping up-to-date and providing training on more than one reference manager can be challenging. A core group of librarians that specialize in different software could act as a resource for other librarians and users in larger institutions. For smaller institutions it may not be feasible to provide training and assistance on more than one program. However, librarians can still create or link to subject guides for the more popular reference management programs. Subject guides that highlight specialty features can be also be shared. As an example, Lisbon (2017a) created a guide on using the Juris-M version of Zotero to help users with multilingual needs after identifying that these researchers struggled with using RMS (Lisbon, 2017b). This guide will be a resource to other reference management users on this feature.

RMS users and non-users have different preferences for training. Librarians can focus on the top four training options selected by users and non-users: a webpage with resources, online tutorials, email assistance and workshops. A webpage with resources is important to have available as it was highly ranked by both users and non-users. Vendor-created tutorials could also be linked on the webpage. Providing links to online support forums would also be valuable. In addition to these guides, in-person workshops should still be offered for those students that would like more assistance in learning reference management software. Librarians should also be aware that users with different needs may attend a workshop. Students that are new to RMS may not be the only

ones that attend as those users that already use a RMS might come to learn about more features. Offering some more advanced workshop options might be useful for those students that already have some knowledge of the software but are interested in learning more features.

Graduate students in this study were very interested in features that would also help them manage their PDF articles. When promoting reference management software and workshops, librarians should highlight the usefulness of the software to manage PDF collections in addition to creating citations. Most graduate student respondents were extremely interested in being able to import PDF documents into their reference manager and automatically generate a citation. Training sessions that are offered should therefore illustrate the PDF import feature or ways to add a PDF directly into the software. Since most students already save PDF files to their computer, importing PDF documents might be easier for students than transferring citations from databases and works with their established workflow as was suggested by Mead and Berryman (2010). Training sessions should include features that students can use to correct or retrieve missing metadata like the DOI lookup in Mendeley or using the EndNote Find Reference Updates option. Other features that can help students organize and re-find their documents would also be useful to highlight in addition to teaching how to generate citations. As an example, even though many users did not indicate that they used the tagging feature, this feature can be demonstrated to show how records can be organized beyond the folder structure.

While some studies have identified that librarians may not be perceived to be experts in reference management software (Francese, 2013; Gessner, Jaggars, Rutner, & Tancheva, 2009; Giannakopoulos, Sakas, & Francese, 2016), librarian skills and background are suited to providing support in this area as well as the field of information management. This idea has been advocated by other researchers (Antonijevic & Cahoy, 2014; Fourie, 2011a; Gessner et al., 2009; Lush, 2014). To increase expertise in RMS, librarians are advised to actively use reference management software themselves to create citations and manage PDF files so that they can develop a better understanding of the issues faced by students. Librarians that are designated experts in a software should learn more advanced features including how styles can be modified to assist users that experience problems. In addition, librarians should monitor new products and features to determine their potential suitability for graduate student use.

LIMITATIONS OF STUDY

Although the survey invitation encouraged all students to participate by not specifically asking about reference management software in the survey invitation, more of the survey respondents were reference manager users. Due to the number of respondents and the fact that a random sample was not used, it is not known if the results of this survey are representative of the entire graduate student population.

FUTURE RESEARCH

Further research could look at how well the PDF management features that were identified as being of interest meet the needs of graduate students. The broader issue of graduate student information management could also be investigated to better understand graduate student workflow and determine ways in which librarians could help them manage their information in

addition to their citations. Additionally, researchers could also look at training and confidence of library professionals in supporting reference management software.

CONCLUSION

While there are many reference managers that are available now for graduate students to use, this study found that the main programs used were EndNote, Mendeley, Zotero and RefWorks with a few students using other programs. Graduate students are interested in reference management software features that can help them manage not only their citations but their PDF documents as well. There is considerable interest in various PDF management options and particularly the retrieval of metadata from PDF documents. Both users and non-users of reference management software find that learning reference management software is challenging. Improvements with the PDF import features and citation styles would help make the reference managers easier to use. While many graduate students like online training opportunities, other options like workshops, are of interest. A variety of training options including online tutorials, web pages with resources, workshops and email support are recommended in order to meet the needs of students currently using a reference manager and those who are not familiar with a RMS. By examining the challenges experienced by graduate students when using reference management software, identifying features of interest and keeping abreast of the developments in RMS that match student needs, librarians will be able to provide enhanced support to graduate students and help them overcome the steep learning curve that is often associated with using a reference manager.

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