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Web-based Citation Management Tools: Comparing the Accuracy of Their Electronic Journal Citations

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ABSTRACT

Many students struggle when citing sources in their research papers and have turned to web-based citation tools in increasing numbers. In order to test the accuracy of the citations generated by these products, a sample of student-selected electronic journal articles was collected and MLA and APA citations for these articles were created using EBSCO Discovery Service's Cite tool, EndNote Basic, RefWorks, and Zotero. Although EndNote Basic, RefWorks and Zotero's APA citation error rates were significantly lower than that of EBSCO Discovery Service, none of the programs was capable of generating an error-free MLA electronic journal citation.

INTRODUCTION

Works cited. Bibliography. Reference list. No matter the words used to describe them, these lists of research sources can inspire alternating feelings of confusion and frustration in students. According to a Project Information Literacy report, 41 percent of undergraduates surveyed expressed difficulty in knowing how to cite sources (Head & Eisenberg, 2010). In another survey, 13 percent of students indicated that citations were the most challenging aspect of research (Miller, 2013).

Many students, knowing the importance of citing their sources accurately, turn to bibliographic management tools for assistance. According to a 2012 EDUCAUSE study, the number of students using web-based citation/bibliography tools is five times greater than it was in 2010, with 80 percent of undergraduates surveyed indicating that they used these types of tools (Dahlstrom, 2012). The rising trend of web-based citation tool use among undergraduates continued in 2013 (Dahlstrom et al., 2013).

It has become clear, both from student admission and personal observation, that students at our online public university are also frequent users of web-based citation tools. Based on reference questions asked, as well as students' work in the library instruction exercises, many students appear to be relying on the citation feature available in EBSCO Discovery Service (EDS). While these generated citations follow the basic format for APA or MLA citations, they may be missing information, include incorrect information, or have formatting errors.

When the Library was undergoing its annual review of library resources and databases, librarians decided to review RefWorks, the library's current bibliographic management product, to see if the library should continue to support it, or if a free option, like Zotero or EndNote Basic, would better meet the needs of our students.

While these products were being assessed based on a number of factors, like ease of use and quality of support documentation, it seemed an opportune time to evaluate the accuracy of the citations these products generated, especially compared to those generated by EDS. As many students already use EDS for citations with mixed results, it was worth investigating whether one of the other three products could consistently produce more accurate citations and should therefore be recommended more heavily to our students. This study therefore examined APA and MLA bibliographies created using the citations generated by RefWorks, EndNote Basic, Zotero, and EDS to determine the frequency and type of errors each program's citations contained. These errors were studied to determine if any one citation product was able to consistently generate more accurate citations than those created by the other products.

LITERATURE REVIEW

Several articles have been written about bibliographic management products. Some have compared their features (Gilmour & Cobus-Kuo, 2011; Hensley, 2011; Ovadia, 2011), others have investigated their use among students (Emanuel, 2013; Salem & Fehrmann, 2013), or how faculty perceive them (Martin, 2009). However, relatively few publications have examined the actual accuracy of the citations generated from these products. Brahmi and Gall (2006) compared EndNote and Reference

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Manager's citations to the instructions provided for references by top medical journals. It was discovered that both programs had difficulties formatting the author, article title, journal title and punctuation according to the journals' standards (Brahmi & Gall, 2006).

Kessler and Van Ullen (2005) examined the accuracy of citations generated by NoodleBib, EasyBib and EndNote. The three products differed in the types of errors they generated, as well as in their handling of print and electronic sources, with NoodleBib having the lowest error rate.

BACKGROUND

Every year, the library reviews its current resources and services to make sure they are meeting the needs of students and faculty. During this year's review, it was suggested that perhaps RefWorks, the library's current bibliographic management tool, could be replaced with a free alternative that would still meet the research and citation needs of students and faculty. RefWorks, a subscription bibliographic management product, allows users to import references directly from library databases. These references can then be organized and shared, or added to bibliographies.

The free alternatives to RefWorks that were considered were Zotero and EndNote Basic. Zotero, a project of the Roy Rosenzweig Center for History and New Media at George Mason University, is a free reference manager that permits collecting, organizing, citing, and collaborating on documents (Roy Rosenzweig Center for History and New Media, 2014). Zotero supports thousands of citation styles, and functions within the Internet browser to capture reference information.

EndNote Basic is the free reference manager from Thomson Reuters (Thomson Reuters, 2014). EndNote Basic allows researchers to import references directly from library databases. Researchers can then organize and create bibliographies from these references, in the twenty most popular citation styles.

Zotero, EndNote Basic, and RefWorks were compared using a number of factors, including ease of use and installation, user support, and citation accuracy. This article will focus on the accuracy of the citations generated from the three citation managers, in comparison with the citations generated through the citing feature of EDS, which is commonly used by our students.

METHODOLOGY

To compare the accuracy of the citations generated by Zotero, EndNote Basic, and RefWorks, bibliographies were created in APA and MLA style. The reference sources used for these bibliographies were drawn from actual student research. When our librarians are invited into the online classroom for instruction, they upload an active learning exercise that focuses on creating a topical search statement and using it to locate an appropriate academic journal article. Once the students choose an article, they are asked to cite it using the citation style for their course, generally either APA or MLA. The student-selected citations from eight courses taught in the Spring 2014 semester were collected. The courses varied in subject area and included Writing, Asian Studies, Health Care Administration, Business and Management, Art History, Biotechnology, and Psychology. After duplicate and incomplete citations were weeded out, 47 unique journal citations remained.

The database record for each source was then located using EDS. Once each source was located in EDS, the Export tool was used to add the citation to the RefWorks and EndNote Basic web accounts created for this project. Each citation was imported to Zotero through the Chrome browser plug-in. The Cite tool in EDS was also used to create an APA and MLA citation for each source, to serve as a baseline comparison for this study. Many of our students use the citation feature within EDS when they complete the library exercise, so we wanted to compare the accuracy of the EDS-generated citations with those generated by RefWorks, Zotero, and EndNote Basic to see if they could offer an improvement in citation accuracy.

After all citations had been added to RefWorks, Zotero, and EndNote Basic, APA and MLA bibliographies were created using each product. Each of these bibliographies, as well as the two created from the EDS citations, were compared to corrected MLA and APA citation lists that had been created using the citation formats for electronic journal articles outlined in the *MLA Handbook for Writers of Research Papers*, 7th ed. and the *Publication Manual of the American Psychological Association*, 6th ed., respectively.

Errors were categorized and recorded in an Excel spreadsheet. Errors were primarily categorized according to their location. The location of error categories referred to the specific section of the citation that was incorrect and consisted of author(s), date, article title, journal title, volume/issue number, page range, and access information (DOI or journal web address for APA; database name, method of access, and access date for MLA). If errors were present across multiple categories, all were recorded.

In addition to the primary categorization of error location, the citations were also studied for the specific type of error. The error type categories consisted of incorrect information, missing information, added information, and formatting errors. The formatting errors were further broken down into a range of categories, including capitalization, punctuation, and spacing. If a type of error occurred across multiple locations in the citation (i.e., both the article and journal titles were incorrectly capitalized), each instance of the error was counted. Additionally, if a single portion of the citation had multiple errors (i.e., authors' names spelled incorrectly and capitalized incorrectly), each type of error was counted. It was therefore possible for any given citation to have more errors when categorized by type than by location.

RESULTS

Errors were tallied and calculated for EDS, EndNote Basic, RefWorks, and Zotero, in both APA and MLA citation styles. Table 1 reveals that none of the four products was able to consistently generate error-free electronic journal citations. RefWorks, EndNote Basic, and Zotero each only generated two error-free APA citations, while EDS could not generate a single error-free APA citation. None of the four products was able to generate a single error-free MLA electronic journal citation.

Table 2 reveals the average number of errors per citation. All four tools averaged at least 1.5 errors per citation, based on the location of the error. EDS citations had the most errors across both categories, with over 2.5 errors per citation for both APA and MLA styles. RefWorks had the lowest average errors per citation for APA, with 2.0, and EndNote Basic had the lowest average errors per citation for MLA, with 1.83. RefWorks was significantly better at creating APA electronic journal citations than MLA ones, while EndNote Basic was significantly better at creating MLA electronic journal citations than APA citations. The differences between the MLA and APA error rates for Zotero and EDS were not significant.

RefWorks, EndNote Basic, and Zotero's average errors per APA citation are all significantly better than the error rate for EDS. Although RefWorks has the lowest number of average errors per citation, this average is not statistically significant when compared to the APA averages for EndNote Basic and Zotero at a 95 percent confidence interval.

For the MLA citations, EndNote Basic's error rate was significantly better than the error rate for EDS, RefWorks, and Zotero at a 95 percent confidence interval. However, as none of the products was capable of

Table 1
Number of error-free citations.

Citation style	EDS	EndNote Basic	RefWorks	Zotero
APA	0	2	2	2
MLA	0	0	0	0