Gender and Citation in Two LIS E-Journals:

A Bibliometric Analysis of *LIBRES* and *Information Research*

Linsay Reece-Evans

University of Southern Mississippi MLIS Program

l.reece.evans@gmail.com

Abstract

Though women outnumber men at a ratio of approximately 4:1 in the library and information science (LIS) field as a whole and 3:1 in academic librarianship, past studies suggest that male-authored LIS print journal articles outnumber female-authored articles both in number and in citations received. The amount of citations received can serve as an indication of status within the LIS profession and can affect chances for professional advancement. This study uses citation analysis to measure patterns of gender, authorship and citation within the LIS e-journals *LIBRES* and *Information Research*, and compares these results to Håkanson's (2005) citation analysis of gender and citation patterns in three core LIS print journals.

Results of this study suggest gendered affinity in citation and reference behavior. Findings include that from 1995-2007 more men than women published articles in *LIBRES* and *Information Research*; that both men and women referenced more male-authored articles; that men referenced male-authored articles at a greater rate than women referenced female-authored articles; that articles by women received more citations overall; and that men cited articles by men at a greater rate than they cited articles by women.

Though female authorship was proportionately higher in the two LIS e-journals than in the three core LIS print journals, the imbalance in citation and reference patterns suggests that gender influences both male and female authors' choice of references, as well as the amount of citations that authors receive.

Introduction

For library and information science (LIS) professionals working in academia, publishing can be an important indicator of status; tenure, salary and influence may be dependent upon publishing success, or lack thereof (Tescione, 1998). Determining how often an article is cited, or citation analysis, is one method of measuring an author's visibility and influence (Baird & Oppenheim, 1994; Cronin & Overfelt, 1994; Ferber, 1988; Håkanson, 2005; Harter & Kim, 1996; Pilkington & Meredith, 2009; Smith, L., 1981; Tescione, 1998; Ward, Gast & Grant, 1992; Zhao, 2005). Despite the fact that women outnumber men in academic librarianship by a ratio of approximately 3:1 (Association of Research Libraries, 2008), past analysis of LIS journals has found that female authorship is lower than that of men and that articles by male authors are cited

at a higher rate than articles by female authors (Al-Ghamdi et al., 1998; Buttlar, 1991; Cline, 1982; Håkanson, 2005; Korytnyk, 1988; Metz, 1989; Nisonger, 1996; Olsgaard & Olsgaard, 1980; Raptis, 1992; Terry, 1996).

Citation analyses of core academic journals from several disciplines finds that authors tend to cite other authors of the same gender at a higher rate (Ferber, 1986; Ferber, 1988; Håkanson, 2005; Korytnyk, 1988). Many academic disciplines are heavily male-dominated; thus, men are cited more frequently than women, an imbalance that potentially places female academics at a disadvantage (Ferber, 1988; Håkanson, 2005; Koehler & Persson, 2000). In LIS, which is a female-dominated field, Håkanson's (2005) citation analysis of three core print journals indicates that though the number of female authors has increased since the 1980s, articles by women are cited at a significantly lower rate than articles by men. If, as research suggests, women's status in LIS authorship is not on par with that of men's, more attention needs to be paid to this issue in order to determine the effects of gender bias in scholarly LIS publishing (Håkanson, 2005) .

Does gender-based inequity in publishing and citations also exist within non-print LIS journals? Since their introduction in the early 1990s, e-journals, or open-access journals with peer-reviewed content that are published only on the Internet, have grown increasingly important as sources of research dissemination within LIS (Smith, A., 2005). According to Koehler et al. (2000), the content of the newer, online LIS journals tends to reflect a more innovative perspective than that of more established, mainstream journals. While Koehler et al.'s research indicates that women are more likely to publish in e-journals than in more established print journals, more study is needed.

While citation analysis related to gender, authorship and citation data exists for three core LIS print journals, there is a lack of research focused on gender, authorship, and citations in LIS e-journals. This study attempted to contribute to filling the gap by collecting authorship, citation and reference data from two online LIS publications, *LIBRES* and *Information Research*. The data were analyzed to answer the following questions: 1. Do men publish more peer-reviewed articles than women in online LIS journals?; 2. Do e-articles written by women receive as many citations as those written by men?; and 3. Do online LIS journals reflect different publishing and citation gender patterns than print LIS journals? Results were compared to the results of Håkanson's (2005) citation analysis of three core LIS print journals.

Literature Review

A literature review was undertaken covering the areas of citation analysis, gender and citation in scholarly publishing and also in LIS journals, and the significant articles are now reported.

Citation Analysis

A scholarly publication cannot exist in a vacuum; rather, each article is set within the context of the research that both precedes and follows it (Smith, L., 1981). Smith, L. explains the "embedded" nature of scholarly publications in terms of reciprocal relationships:

> A reference is the acknowledgment that one document *gives* to another; a citation is the acknowledgment that one document *receives* from another. In general, a citation implies a

> relationship between a part or the whole of the cited document and a part or the whole of the citing document (Smith, L. (p. 83).

These giving and receiving relationships can be quantified through citation analysis. Edwards (1999) defines citation analysis as "a procedure of counting and ranking the number of times documents are cited in bibliographies, footnotes, and/or indexing tools" (p. 10). The Institute of Scientific Information (ISI) began tracking all references to journals indexed by the Science Citation Index in the 1970s, making the procedure of counting and ranking easier for bibliographic researchers.

The method of citation analysis is not without its weaknesses. Many authors may not reference works that are relevant to their own work. Smith, L. (1981) notes that it is impossible to know about and have access to all research, or speak all languages in which research is published. Tescione (1998) suggests that citation analysis can be an unreliable indicator of quality, as citation counts include references to articles that are cited as negative examples. Only published works can be included in citation data; the use of journals by undergraduate and graduate students, staff, faculty members, and any other unpublished user goes uncounted (Duy & Vaughan, 2006). The treatment of self-citing behavior is another problematic issue; Nisonger (2004) states that self-citations, or citations made by an author to their own previous work, are often not included in citation analysis. This is because, as Bakri and Willet (2008) note, "self-citations reflect in part an attempt to promote an author's research credibility and standing in the discipline"(p. 110), and therefore are often treated as less valid than citations to other authors' works. Despite these valid criticisms, citation analysis is often utilized as a method to judge both author status and patterns within a field.

Håkanson (2005) suggests that "high levels of citations to a scientific publication have been interpreted as signs of scientific quality, importance, relevance, utility, influence, impact, and visibility" (p. 313). Zhao (2005) agrees, stating that an author's visibility can be measured through a determination of how often their publications have been cited in other authors' publications. Further, Pilkington and Meredith (2009) suggest that highly cited articles are perceived as more important to the field, which in turn implements professional advancement. This echoes Ward, Gast and Grant's (1992) and Tescione's (1998) findings that research is the most important factor considered in tenure decisions and that, though flawed, citation analysis is a common way to determine productivity. Further, Harter and Kim (1996, para. 6) note that citation analyses' value may lie in their ability to "reveal formal communication patterns and scholarly impact".

Gender and Citation in Scholarly Publishing

Gender bias within journal authorship and citation reference is one such pattern. Ferber (1986; 1988) researched the role of gender in scientific publishing and questioned the assumption that citations are an objective indication of scholarly merit. In order to test the hypothesis that researchers tend to cite more authors of their own sex than they do authors of the opposite sex, Ferber (1986) analyzed citations from a core economics journal. She found that female authors cite publications by women at a five percent higher rate than male authors; that male authors tend to cite other male authors at a much higher rate than female authors; and that both men and women cite male authors at a much higher rate than female authors. Ferber concludes that these results support her hypothesis, but the greater implication is that this

imbalance in citations "unquestionably has substantial consequences in a field where men constitute a large majority…any affinity between authors of the same sex works to the disadvantage of those in the minority" (p. 389) which, in this case, is women.

Ferber's further (1988) analysis explores gender and citation patterns in four other fields, with results similar to those of her earlier study. Both men and women tend to cite authors of the same sex more and male authors were cited more often overall. Ferber calls this phenomenon the "citation gap" and notes that the gap tends to decrease when numbers of female academics in a field increase (p. 86). Ferber concludes that women in predominantly male fields face many obstacles to achieving professional status.

Later studies on gender, authorship and citation patterns reflect similar results. Ward, Gast and Grant (1992) performed citation analysis on 100 articles from a high-impact sociology journal, known for being "open to… women's research" (p. 292), in order to determine gendered patterns. Like Ferber, their research also found that women tend to cite women and men tend to cite men, evidence of gendered affinity in citation behavior. Roland and Fontanesi-Seime (1996) found that female faculty members across fields receive lower pay than male faculty due to lower publishing rates; in fact, men out-publish women two to one. Mathews and Andersen's (2001) analysis of political science volumes found that 15 percent of articles in male-edited books were authored by women. However, when a volume was edited or co-edited by a woman, the number of female-authored articles increased to 52 percent.

Is the gender gap less pronounced in *online* scholarly journals? Since their inception in the 1990s, both the amount of open-access journals with peer-reviewed content that are published only on the Internet, or "e-journals", available and their usage has rapidly increased. One metastudy of e-journal usage found that academics' use of various electronic sources increased from under one percent of total readings (.3%) in 1990-1993, to 39 percent in the late 1990s, to nearly 80 percent in 2004 (Boyce, King, Montgomery, and Tenopir, 2004). Similarly, De Groote's (2008) study of online journal citation patterns at the health sciences library at the University of Illinois Chicago found that in 1998 only 15 online biomedical journals were available; only two years later, this number jumped to over 3,000, reaching more than 20,000 by 2006.

The reputation of scholarly e-journals has grown, as well, becoming increasingly credible, reputable and prestigious, and reaching a level almost comparable to that of print journals (Deshpande & Pathak, 2008). Speier, Palmer, Wren and Hahn (1999) describe the advent of the electronic journal as "the grandest revolution in the capture and dissemination of emerging academic knowledge" (p. 537). This statement is reflected in the work of Zhao and Strotmann (2007), who posit the emerging existence of a "two-tier scholarly communication system" (p. 1285), noting that in some fields, the information disseminated by print journals actually lags several years behind that contained in e-journals. Similarly, Nowick's (2008) study of authors' academic rank suggests a significant trend for pre-tenured faculty to publish in e-journals, indicating that the status of open access journals is increasing.

As such, the increasing prevalence of online journal usage within the academic community has affected citation patterns. Herring's (2002) citation analysis indicates that

researchers cite electronic resources in increasing numbers each year. De Groote's (2008) citation analysis finds that the amount of citations to online journals has significantly increased over the past decade, especially at academic libraries with small print collections. Similarly, Frandsen (2009) notes that online journals are being included in ISI's citation indexes in increasing numbers.

While researching online publications by members of a scientific network, Kretschmer and Aguillo (2005) used bibliometric indicators to examine differences in how male and female authors of scientific articles are perceived in what they call "e-science", or online scientific resources. Their findings indicate that both women's contributions to publications and women's visibility are higher in the realm of e-science networks than has been indicated by previous research on traditional scientific networks. Similarly, Kohler et al.'s (2000) bibliometric research indicated that women are more likely to publish in e-journals than in more established print journals.

Gender and Citation Patterns in LIS Journals

Though many studies have been done on gender in academic publishing, fewer focus specifically on gender and publishing in the LIS field. Analyses of authorship in core LIS journals indicates that, while articles by men outnumber those by women, there has been a slow but steady increase in the number of articles authored by women over the years (Al-Ghamdi et al., 1998; Cline, 1982; Metz, 1989; Nisonger, 1996; Olsgaard & Olsgaard, 1980; Terry, 1996). However, women's authorship varies by publication. For example, Nisonger's (1996) study reflects widely differing ratios of male:female authorship, from 78.85:21.15 in the high-impact *College and Research Libraries* to 17.4:80.8 in *Top of the News,* a youth/children's services journal. Al-Ghamdi et al.'s (1998) analysis of twenty-five years of *Journal for the American Society of Information Science* (JASIS) indicates that women's authorship grew from 16 percent to 32 percent. Similarly, Koehler and Persson's (2000) citation analysis of JASIS indicates that female authorship increased from 15 to 30 percent during the time period of 1950 to 1999. The authors note that at this rate, gender equity in publishing would not be reached for another 50 years. Significantly, information science is a field in which women make up almost half of the faculty. If a gender gap exists in the information science field, it can be assumed to be even larger in fields where males are dominant (Kohler & Persson, 2000).

Even less research specifically focuses on the relationships between gender, authorship, and citation in LIS scholarly journals, and existing studies have conflicting results. Olsgaard and Olsgaard's (1980) study found that though women comprise 40.8 percent of library school faculty, the highest percentage of female faculty-authored articles in the journals analyzed was 33.9 percent, and the lowest 12.5 percent. Korytnyk's (1988) study of LIS doctoral holders found that male LIS faculty publish almost twice as many works as do female LIS faculty and that female faculty are almost six times as likely as male faculty to have no publications, perhaps because female faculty tend to seek employment at schools that "emphasize teaching at the expense of research" (p. 63). However, Peñas and Willet's (2006) citation analysis of publications by and citations to 57 male and 48 female authors in LIS found that men publish significantly more articles than women, but that citation patterns indicated no significant gender differences.

Alternately, Håkanson's (2005) study used quantitative citation analysis to examine patterns of gender and citation in three core LIS print journals from 1980 to 2000. Like Ferber (1986; 1988), Håkanson sought to discover whether gender influences both male and female authors' choice of references, and whether gender affects the amount of citations that these authors receive. Håkanson describes citations as a system of accumulated advantage that perpetuates a social hierarchy among researchers by granting automatic value to research published by those with already high status. This accumulated advantage makes it difficult for new researchers or minorities to gain prestige in their academic field, echoing Ferber's earlier conclusion that women as minorities in predominantly male fields face many obstacles to achieving professional status.

Do these findings carry over into a field not dominated by men, such as LIS? Håkanson's (2005) study analyzes almost 30,000 articles from twenty years of three core LIS journals. The majority of references, 59 percent, were to works by men-only, while 27 percent were to works by women-only. Female authors reference works by other women 34 percent of the time, whereas 53 percent of references are to works by men. Conversely, male authors reference female authors 22 percent of the time, as compared 65 percent of references to other male authors. Citation analysis indicates that male authors receive substantially more citations than female authors. Håkanson interprets these findings by stating that "the article authors of this sample assume that their own publications gain more credibility if they refer to publications by men" (p. 319). In other words, the publications written by men may have more perceived value, influence, and status than those written by women. These results indicate the existence of gender bias in three core LIS print journals.

Do LIS e-journals reflect the same patterns? Since their introduction in the early 1990s, e-journals have grown increasingly important as sources of research dissemination within LIS (Hawkins, 2001; Smith, A., 2005). Though numerous bibliometric studies have been performed within the LIS field, very few focus specifically on quantitative citation analysis as related to gender, authorship, and citation, and even fewer studies have examined these patterns within e-journals.

One exception is a bibliometric study by Koelher et al. (2000) who suggest that the content of online LIS journals tends to reflect a more innovative perspective than that of more established, mainstream journals. This conclusion is the result of a bibliometric study of five information science journals, four of which were established as e-journals and one that was continuously published for over fifty years in print and, more recently, both in print and online. Their analysis indicates that two-thirds of the articles in the more traditional, print-only journals are authored by men. In contrast, the four e-journals have a higher percentage of articles authored by women.

Given the lack of research into patterns of gender, authorship and citation within LIS journals in general, and LIS e-journals in specific, this study attempted to contributing to filling that gap by replicating Håkanson's (2005) citation analysis of LIS print journals on two LIS e-journals, *LIBRES* and *Information Research*.

Methodology

The collection of the data, its organization and categorization and analysis are now described**.**

Data Sources and Collection

Authorship and citation data from all volumes from inception to 2007 of the LIS e-journals *LIBRES* and *Information Research* were examined. These e-journals were chosen due to their relatively high Web Impact Factor, which is the online equivalent of the ISI Journal Impact Factor (Smith, A., 2005). E-journal articles included any peer-reviewed content that had one or more authors and one or more references. Book reviews, editorials, and letters were not included.

The gender of each article's first-listed author was noted, as was the gender of the first-listed author of all publications cited in the articles. First-listed authors' gender was used for analysis as, according to Jones (1996), "in general, the first author deserves most credit" (p. 13); Riesenberg and Lundberg (1990) also note that being a "first-listed author versus, say, sixth on a major article can carry substantial weight in the attainment of those academic rewards to which investigators rightly aspire" (p. 1857).

Gender was determined by author's first name when possible; if gender was not immediately apparent, due to the use of initials or a language barrier, the author was "Googled". If an author's gender was not determinable through online research (CV, affiliations, other publications, etc.) this was noted and the article was not included.

The ISI Web of Science Citation Indexes were consulted. Each article was processed through the ISI Cited Reference Search to determine the number of citations each e-journal article received and the gender of researchers that cited the e-journal articles.

Data Organization and Categorization

Articles were categorized and defined in the following groups: 1. articles authored by one or more women and no men were defined as "WA"; 2. articles authored by one or more men and no women were defined as "MA"; and 3. articles authored by both men and women were defined as "WA" if the first author was female, "MA" if the first author was male.

References were categorized and defined in the following groups:

1. references to articles authored by one or more women and no men were defined as "WR";
2. references to articles authored by one or more men and no women were defined as "MR"; and
3. articles authored by both men and women were defined as "WR" if the first author was female, "MR" if the first author was male. If the author's gender was not determinable, the reference was not included.

Citations were categorized and defined into the following groups:

1. citations from articles authored by one or more women and no men were defined as "WC";
2. citations from articles authored by one or more men and no women were defined as "MC"; and

3. citations from articles authored by both men and women were defined as "WC" if the first author was female, "MC" if the first author was male. Again, if the author's gender was not determinable, the citation was not included.

Data Analysis

Data were recorded and calculated numerically in an Excel spreadsheet document. Recorded data included: the first and last name of each author of each article; the gender of each author of each article; the gender of each author of each reference cited in the articles; the gender of each author of each article that cites an article; numerical count of each category of the articles (WA, MA); numerical count of each category of reference (WR, MR) and numerical count of each category of citation (WC, MC).

Results

The results of the analyses are reported and cover data collected on authorship, reference analysis and citation analysis.

Authorship

The data collected on authorship allowed for an answer to the question: *Do men publish more peer-reviewed articles than women in online LIS journals*? Of a total of 277 articles analyzed, 144 (51.8%) were written by male authors and 127 (45.68%) were written by female authors. Six (2%) articles were written by authors of unidentifiable gender, and were not included in the analysis.

The number of articles written by males (MA) and females (WA) varied by year, as illustrated in Figure 1. Men published more articles than women in every year analyzed with the exception of 1997, 1998, 2001 and 2006. Similarly to previous bibliometric analyses of LIS print journals (Al-Ghamdi et al., 1998; Buttlar, 1991; Cline, 1982; Håkanson, 2005; Kohler et al., 2000; Korytnyk, 1988; Metz, 1989; Nisonger, 1996; Olsgaard & Olsgaard, 1980; Raptis, 1992; Terry, 1996), these results indicated a gradual increase in the amount of female-authored publications over the years.

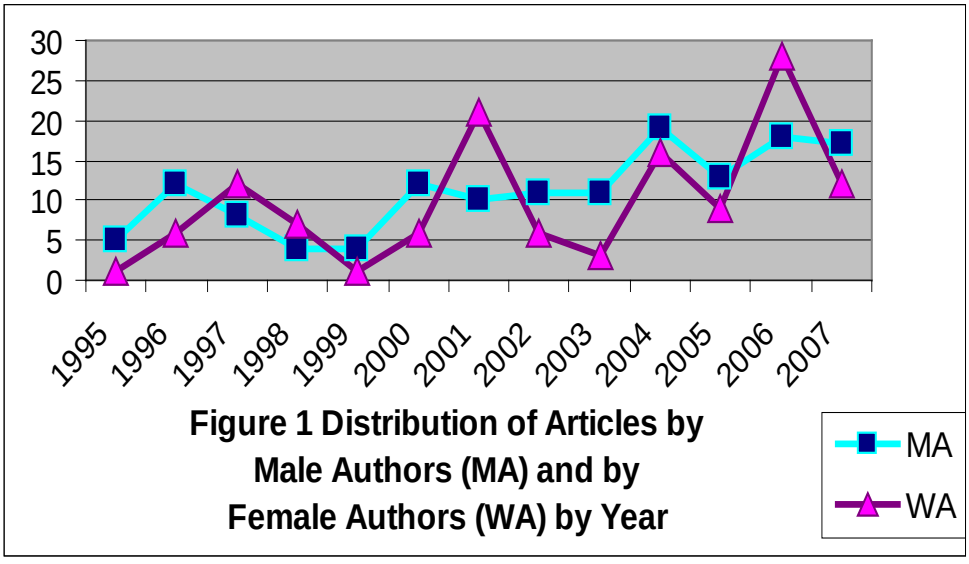

Figure 1 Distribution of Articles by Male Authors (MA) and by Female Authors (WA) by Year

Reference Analysis

Answering the second and third questions, Do articles written by women receive as many citations as those written by men? and Do online LIS journals reflect different publishing and citation gender patterns than print LIS journals?, required analysis of the authors' use of references. Overall, 63 percent of references were to male-authored articles (MR), and 31 percent were to female-authored articles (WR) (see Figure 2).

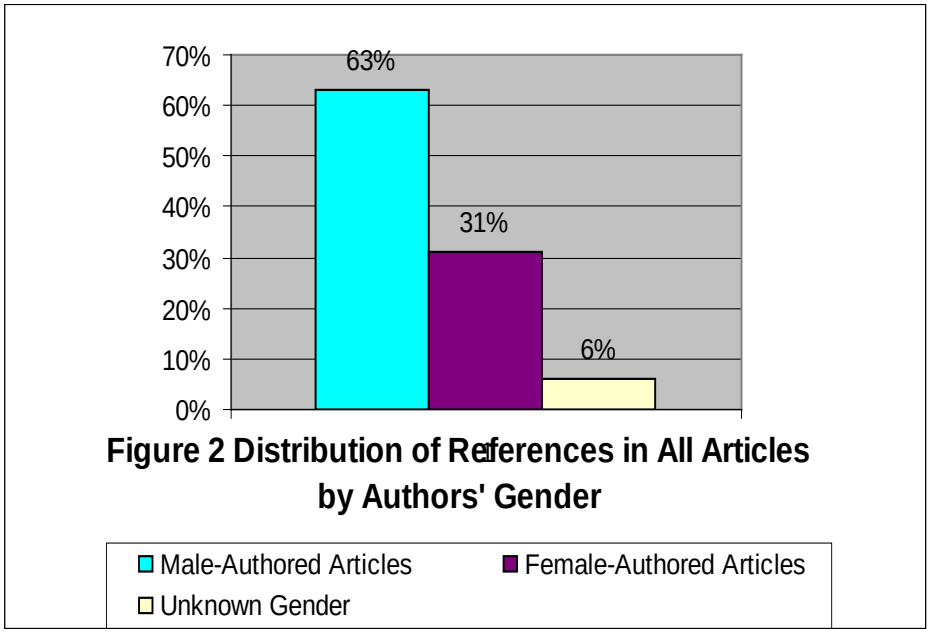

Figure 2 Distribution of References in All Articles by Authors' Gender

As reflected in Figure 3, in every year analyzed, both MA and WA referenced more male-authored publications than female-authored publications. Stratification ranged from a high of 90 percent of references to MR in 1995, to a low of 57 percent MR in 1997. In contrast, references to WR reached a high of 43 percent in 1997 and a low of 10 percent in 1995. The mean of MR per article was 13.5, while the mean of WR per article was 6.85.

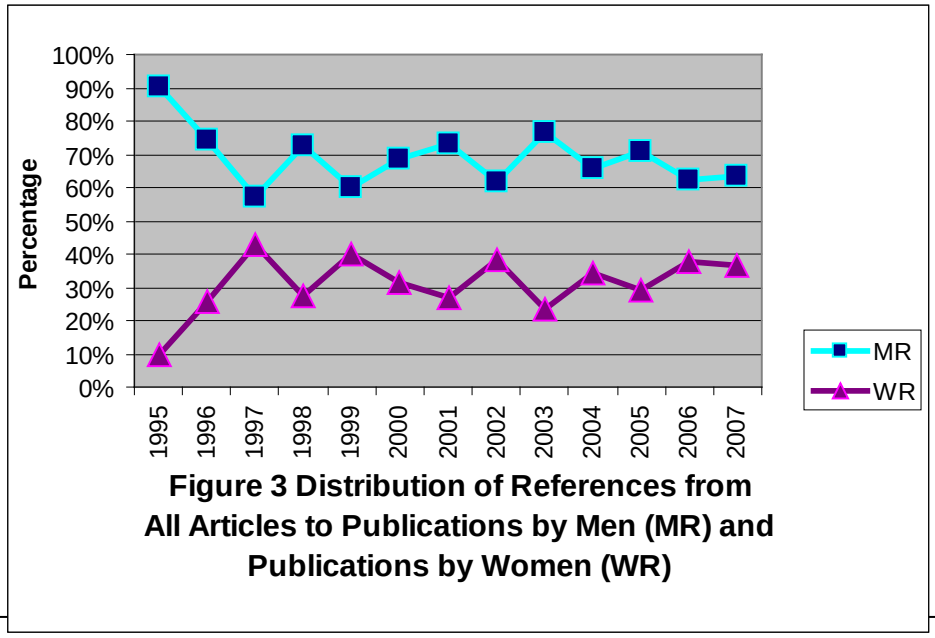

Figure 3 Distribution of References from All Articles to Publications by Men (MR) and Publications by Women (WR)

An analysis of the references in all articles written by women (WA) had different results. While female authors also referenced MR more (59.5 percent), references to WR totaled 40.4 percent. As indicated in Figure 4, references varied widely by year. The largest difference was in 1995, with 83 percent of references going to MR and only 17 percent to WR. However, references to WR did surpass those of MR in 1997, 1999, and 2002. The mean of WR per article was 8.11, while the mean of MR was 12.12 per article.

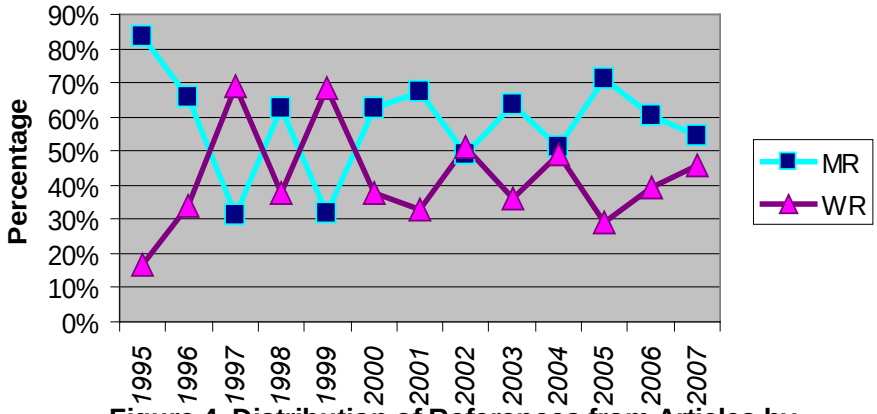

Figure 4 Distribution of References from Articles by Female Authors to Publications by Men (MR) and Publications by Women (WR)

Articles written by men reflected very different reference patterns from those written by women, as illustrated in Figures 4 and 5.

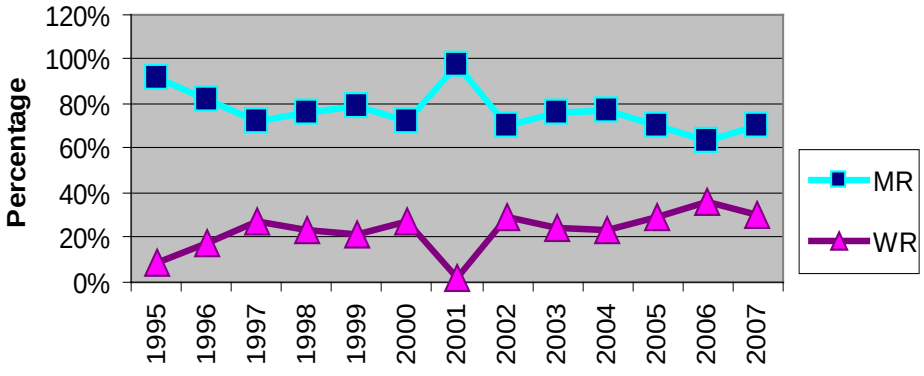

Figure 5 Distribution of References from Articles by Male Authors to Publications by Men (MR) and Publications by Women (WR)

Again, male authors were referenced more, at 74 percent when compared to 26 percent for WR. Differences year-to-year were less pronounced, with WR never reaching above a one-time high of 36 percent. The mean of MR per article was 15.04, while the mean of WR was 5.56 per article.

References did indicate a trend toward convergence, as indicated in Figures 4 and 5. In 1995, the first year of analysis, MR outnumbered WR nine to one. By 2007, the last year of analysis, the difference had decreased to approximately three MR to every one WR.

Citation Analysis

Answering the questions *Do articles written by women receive as many citations as those written by men?* and *Do online LIS journals reflect different publishing and citation gender patterns than print LIS journals,* also required the analysis of citations to both men's and women's articles. Overall, WA received more citations, 175, as compared to 129 citations to MA. However, as indicated by Figures 6 and 7, the distribution of citations differs by gender.

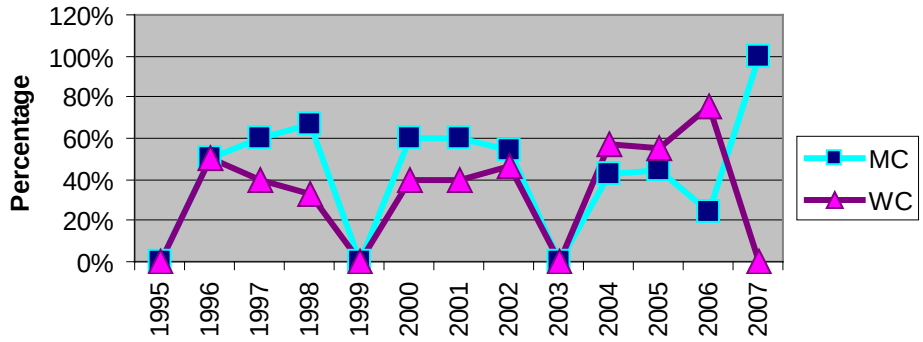

Figure 6 Distribution of Citations to Publications by Women from Articles by Male Authors (MC) and by Female Authors (WC)

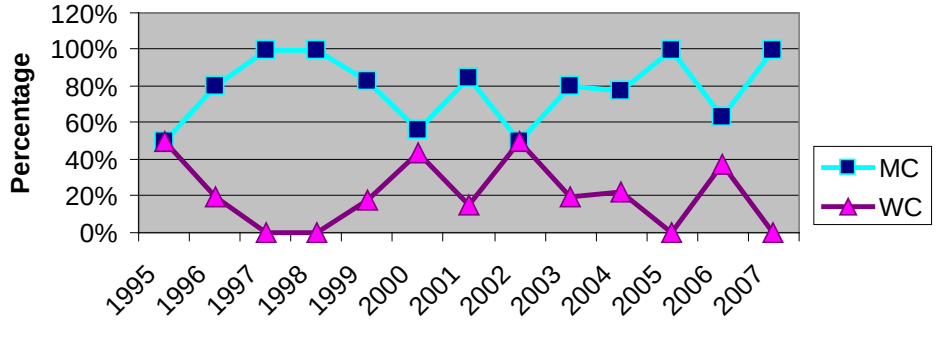

Figure 7 Distribution of Citations to Publications by Men from Articles by Male Authors (MC) and by Female Authors (WC)

MA received more cites from males in every year analyzed with the exception of 2002, when MC and WC were equal at 50 percent. Overall, WA received more cites from men than women, but WC did overtake MC in 2004, 2005 and 2006.

In summary, the analysis indicated that:

- More men than women published articles in *LIBRES* and *Information Research* during the 13-year period of 1995 through 2007;
- Both men and women referenced more articles by men;
- Men referenced other men at a greater rate than women referenced other women;
- Articles by women received more citations overall; and
- Men cited articles by men at a greater rate than men cited articles by women.

Discussion

Citation analysis indicated that men published a greater number of articles in both *LIBRES* and *Information Research*. This is consistent with Håkanson's (2005) citation analysis, which indicated that men tend to publish greater numbers of articles than women in three core LIS print journals, as well as Korytnyk (1988) and Peñas and Willet's (2006) research on gender and publishing in LIS, both of whom found that men both publish at a higher rate than women. Why are men out-publishing women in a field where women outnumber men 3:1? Korytnyk (1988) postulates that the LIS field may be inherently gender-biased; she writes that librarianship is

> a field that practices intraoccupational segregation, or dual career patterns for men and women. Men engage in academic librarianship and hold administrative posts three times more often than women. Female librarians dominate school and children's librarianship and are clustered at low-level positions (p. 55),

further noting that those in "low-level positions" are less likely to hold a PhD, and therefore less likely to publish in scholarly journals. Buttlar's (1999) research also indicates that "a higher proportion of males than females in the field of library and information science are involved in research and publication" (p. 240).

However, though men published a greater number of articles overall in *LIBRES* and *Information Research*, women published a higher percentage of articles in the two e-journals than in the three print LIS journals analyzed by Håkanson (2005). Specifically, 46 percent of articles in the e-journals were female-authored, whereas 38 percent of the print journal articles were female-authored. These results were consistent with those of Koehler et al. (2000), whose comparison of four LIS e-journals to a well-established LIS print journal (*JASIS*) finds that the e-journals have a larger percentage of female authors (both first and all) than does *JASIS*. According to Koehler et al.(2000), there are three possible explanations:

> First, there are more women in the disciplines attracted to publishing in the four [e-] journals than there are in the information science in general; second, more women are interested in the subject matter than these journals represent than in information science in general; and third, women submit articles to the newer journals because they have a greater expectation of publication success in those journals (para. 31).

Regardless of why men publish more articles in general and why women publish at a higher percentage rate in the LIS e-journals than in the LIS print journals, the question remains: what can be done to increase the number of women publishing scholarly LIS articles? Koehler

and Persson (2000, para. 4) suggest that "one strategy that would bring about the fastest change is probably to collaborate with more productive scientists, many who are men. Another would be for women to co-author more with other women". Korytnyk (1988) and Hart (2000) also note that research indicates that co-authored articles are more likely to be accepted by prestigious LIS journals if they are co-authored, and that co-authorship is an effective way to increase publishing output.

Results of the reference analysis of the two LIS e-journals supported the results of Håkanson's (2005) study in which both men and women referred to other authors of the same gender at a higher rate. However, men tended to both refer to and cite other men more than women tended to refer to and cite other women. These results suggest the existence of a "gendered Matthew effect" based upon Merton's theory of accumulated advantage in which men, as the predominant publishers in the field, receive more of the citations and therefore more influence, stature, and visibility (Håkanson, p. 321).

Why is this significant? Perhaps the most pressing reason to pay attention to the issue of gender bias and imbalance in citation data is that, as past research suggests, references to and citations of published works is a commonly used method of measuring an author's visibility and influence (Baird & Oppenheim, 1994; Cronin & Overfelt, 1994; Ferber, 1988; Håkanson, 2005; Harter & Kim, 1996; Pilkington & Meredith, 2009; Smith, L., 1981; Ward, Gast & Grant, 1992; Tescione, 1998; Zhao, 2005). Further, publishing can be an important indicator of status and tenure, salary and influence may be dependent upon publishing success (Tescione, 1998). When men are cited more frequently than women, this is an imbalance that potentially places female academics at a disadvantage (Ferber, 1988; Håkanson, 2005; Koehler & Persson, 2000).

A researcher's productivity can also be affected by the citation imbalance. According to Cole and Cole (1967) as cited in Ferber, (1988),

> The importance of recognition by peers in gaining rewards for meritorious performance is widely accepted. Such reinforcement is seen as confirming the validity and significance of a scholar's work, and even as an affirmation of the personal worth of the scholar. Peer recognition improves motivation, which in turn raises productivity (Norman Storer, quoted by Cole and Cole 1967). Few scientists continue to do research when they are not rewarded (p. 83).

Why do these citation patterns, which point toward a gendered imbalance in authorship and citations, exist? The literature suggests several possibilities. First, but least plausible, is that authors may deliberately cite those of the same gender due to prejudice against the other gender (Ferber, 1986; 1988). Another possibility is that women have a higher opinion of other women's publications than men do, though several citation analyses have suggested that both men and women tend to give more credit to male-authored publications (Ferber, 1986; Ferber, 1988; Håkanson, 2005). Håkanson suggests the possibility of the existence of a system of accumulated advantage in the LIS field in which men, as the predominant publishers in the field, receive more of the citations and therefore more influence, stature, and visibility.

Finally, Ferber (1988) suggests that the preference for male publications, as well as each gender's affinity for citing and referencing members of their own gender, may be an effect of

> gender-segregated net-working. The existence of 'old boys' networks' has long been accepted. Women's committees and caucuses within professional organizations are now common as well. Colleagues within

> such networks are likely to exchange manuscripts and reprints and hence become particularly familiar with each other's work" (p. 86).

Regardless of the reasons behind gendered citation imbalance**,** Ferber (1986) notes that researchers should be aware of the inequity, and not perceive citation data as purely objective and unbiased.

As such, there are other limitations facing citation analyses that attempt to uncover patterns of gender. Peñas and Willet (2006) note that "publication and citation behavior is very different in different subject domains" (p. 480) of LIS. An example can be found in Nisonger's (1996) study, which suggests that differing ratios of male:female authorship in various journals is dependent on their subject matter.

Another limitation of gendered citation analysis is the logistics of determining gender. Two percent of the articles in *LIBRES* and *Information Research* were written by authors that were gender-unidentifiable due to their names, use of initials only, or lack of information using Google searches. As most articles in the two e-journals, and all citations in the ISI Web of Science Citation Index, use initials instead of spelling out first names, researching each author to determine their gender was extremely time-consuming. Similarly, Tescione (1998) notes that that citation analysis can be unreliable due to inconsistencies in the way authors' names are indexed.

Conclusion

Though some results of the citation analysis indicated that women's status within LIS scholarly publishing is increasing – higher citation rates, increasing amounts of female-published articles, a higher percentage of female-authored articles in e-journals than print journals – gender inequity clearly exists, as indicated by the imbalance in both authorship and referencing counts. The reasons for the imbalance are not clear and are beyond the scope of this study. As Håkanson (2005) states,

> more research of gender impact on citations is needed, on the one hand, to eliminate the reasonable supposition that the differences depend on variables other than gender and, on the other hand, to explore what the tendency means to LIS research (p. 322).

If a gendered system of accumulated advantage indeed exists, then women are at a disadvantage. Instead, female LIS professionals should enjoy the increased status, productivity, and opportunities for promotion that an equitable scholarly publishing system would bring.

References

Al-Ghamdi, A., Al-Harbi, M., Beacom, N. A. B., Dedolph, J., Deignan, M., Elftmann, C., Finley, N., LoCicero, L., Middlecamp, J., O'Regan, C., Pluskota, F., Ritter, A. A., Russell, S., Sabat, I., Schneider, J., Schoeberl, M., Tragash, P., & Withers, B. H. (1998). Authorship in JASIS: A quantitative analysis. *Katharine Sharp Review 6*. Retrieved on March 1, 2010 from <http://www.cindoc.csic.es/cybermetrics/pdf/333.pdf>.

Association of Research Libraries. (2008). ARL annual salary survey 2007/2008. Retrieved on March 1, 2010, from <http://www.arl.org/bm~doc/ss07.pdf>.

Baird, L., & Oppenheim, C. (1994). Do citations matter? *Journal of Information Science 20*(1), 2-15.

Bakri, A., & Willet, P. (2008). The Malaysian Journal of Library and Information Science 2001-2006: A bibliometric study. *Malaysian Journal of Library & Information Science 13*(1), 103-116.

Boyce, P., King, D. W., Montgomery, C., & Tenopir, C. (2004). How electronic journals are changing patterns of use. *Serials Librarian 46*(1/2), 121–41.

Buttlar, L. (1991). Analyzing the library periodical literature: Content and authorship. *College & Research Libraries, 52*, 38-53.

Buttlar, L. (1999). Information sources in library and information science doctoral research. *Library & Information Science Research 21*(2), 227-245.

Cline, G. S. (1982). College and Research Libraries: Its first forty years. *College & Research Libraries, 43*, 208-232.

Cole, S., & Cole, J. R. (1967). Scientific output and recognition: A study in the operation of the reward system in science. *American Sociological Review 32*, 377-90.

Cronin, B., & Overfelt, L. (1994). Citation based auditing of academic performance. *Journal of the American Society for Information Science* 45(2), 61-72.

De Groote, S. L. (2008). Citation patterns of online and print journals in the digital age. *Journal of the Medical Librarian Association 96*(4), 362-269.

Deshpande, N. J., & Pathak, S. K. (2008). Use of electronic journals in astronomy and astrophysics libraries and information centres in India: A users' perspective. *The International Information & Library Review 40*, 153-164.

Duy, J., & Vaughan, L. (2006). Can electronic journal usage data replace citation data as a measure of journal use? An empirical examination. *Journal of Academic Librarianship 32*(5), 512–517.

Edwards, S. (1999). Citation analysis as a collection development tool: A bibliometric study of polymer science theses and dissertations. *Serials Review 25*(1), 11-21.

Ferber, M. A. (1986). Citations: Are they an objective measure of scholarly merit? *Signs 11*(2), 381-389.

Ferber, M. A. (1988). Citations and networking. *Gender and Society 2*(1), 82-89.

Frandsen, T. B. (2009). The integration of open access journals in the scholarly communication system: Three science fields. *Information Processing and Management 45*,131–141.

Håkanson, M. (2005). The impact of gender on citations: An analysis of College & Research Libraries, Journal of Academic Librarianship, and Library Quarterly. *College Research Libraries 66*(4), 312-322.

Hart, R. (2000). Co-authorship in the academic library literature: A survey of attitudes and behaviors. *The Journal of Academic Librarianship 26*(5), 339-345.

Harter, S. P., & Kim, H. J. (1996). Electronic journals and scholarly communication: A citation and reference study. *Information Research, 2*(1). Retrieved April 20, 2009 from <http://InformationR.net/ir/2-1/paper9a.html>.

Hawkins, D. T. (2001). Bibliometrics of electronic journals in information science. *Information Research, 7*(1). Retrieved March 17, 2009 from <http://InformationR.net/ir/7-1/paper120.html>.

Herring, S. D. (2002). Use of electronic resources in scholarly electronic journals: A citation analysis. *College & Research Libraries 63*(4): 334–340.

Jones, A. W. (1996). Some thoughts and commentary on authorship. *Alcohol & Alcoholism 31*(1), 11-15.

Koehler, W., & Persson, O. (2000). Will it take another 50 years to reach equality in science? *Bibliometric Notes 6*(4). Retrieved February 25, 2009, from <http://www8.umu.se/inforsk/BibliometricNotes/BN6-2000/BN6-2000.htm>.

Koehler, W., Aguilar, P., Finarelli, S., Gaunce, C., Hatchette, S., Heydon, R., McEwen, E., Mahsetky-Poolaw, W., Melson, C. T., Patterson, R., Stahl, M., Walker, M. A., Wall, J., & Wingfield, G. (2000). A bibliometric analysis of select information science print and electronic journals in the 1990s. *Information Research 6*(1). Retrieved February 14, 2009 from <http://informationr.net/ir/6-1/paper88.html>.

Korytnyk, C. (1988). Comparison of the publishing patterns between men and women Ph.D.s in librarianship. *The Library Quarterly 58*(1), 52-65.

Kretschmer, H., & Aguillo, I. F. (2005). New indicators for gender studies in Web networks. *Information Processing and Management 41,* 1481–1494.

Mathews, A. L., & Andersen, K. (2001). A gender gap in publishing? Women's representation in edited political science books. *Political Science and Politics 34*(1), 143-147.

Metz, P. (1989). A statistical profile of College and Research Libraries. *College & Research Libraries, 50,* 42-47.

Nisonger, T. E. (1996). Authorship in *Library Acquisitions*: *Practice & Theory. Library Acquisitions*: *Practice & Theory 20*(4), 395-419.

Nisonger, T. E. (2004). Citation autobiography: An investigation of ISI database coverage in determining author citedness. *College & Research Libraries 65*(2), 152-163.

Nowick, E. (2008). Academic rank of authors publishing in open access journals. *Agricultural Information Worldwide 1* (2), 45-51.

Olsgaard, J. N., & Olsgaard J. K. (1980). Authorship in five library periodicals. *College & Research Libraries, 41,* 49-53.

Peñas, C. S., & Willett, P. (2006). Gender differences in publication and citation counts in librarianship and information science research. *Journal of Information Science 32*(5), 480-485.

Pilkington, A., & Meredith, J. (2009). The evolution of the intellectual structure of operations management—1980–2006: A citation/co-citation analysis. *Journal of Operations Management 27,* 185–202.

Raptis, P. (1992). Authorship characteristics in five international library science journals. *Libri 42*, 35-52.

Riesenberg, D., & G. Lundberg. (1990). The order of authorship: Who's on first. *Journal of the American Medical Association 264*(14), 1857-1860.

Roland, C. B., & Fontanesi-Seime, M. (1996). Women counselor educators: A survey of publication activity. *Journal of Counseling & Development 74,* 490–495.

Smith, A. G. (2005). Citations and links as a measure of effectiveness of online LIS journals. *IFLA Journal 31*(1), 76-84.

Smith, L. C. (1981). Citation analysis. *Library Trends 30*(1), 83-106. Retrieved June 3, 2009 from <https://www.ideals.uiuc.edu/bitstream/handle/2142/7190/librarytrendsv30i1i_opt.pdf?sequence=1>.

Speier, C., Palmer, J., Wren, D., & Hahn, S. (1999). Faculty perceptions of electronic journals as scholarly communication: A question of prestige and literacy. *Journal of the American Society for Information Science 50*(6), 537-543.

Tescione, S. M. (1998). A woman's name: Implications for publication, citation and tenure. *Educational Researcher 27*(8), 38-42.

Terry, J. L. (1996). Authorship in College and Research Libraries revisited: Gender, institutional affiliation, collaboration. *College & Research Libraries, 57*, 377-383.

Ward, K. B., Gast, J., & Grant, L. (1992). Visibility and dissemination of women's and men's sociological scholarship. *Social Problems 39*(3), 291-298.

Zhao, D. (2005). Challenges of scholarly publications on the Web to the evaluation of science: A comparison of author visibility on the Web and in print journals. *Information Processing and Management 41*, 1403–1418.

Zhao, D., & Strotmann, A. (2007). Can citation analysis of web publications better detect research fronts? *Journal of the American Society for Information Science and Technology 58*(9), 1285–1302.