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# F. W. Lancaster: A Bibliometric Analysis

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## ABSTRACT

F. W. Lancaster, as the most cited author during the 1970s to early 1990s, has broad intellectual influence in many fields of research in library and information science. This bibliometric study collected citation data for Lancaster's publications from 1972 to 2006 and analyzed the data in terms of the time and space and disciplinary breadth of his intellectual influence. The result shows that Lancaster has established an extraordinary record of both productivity and citedness. Six of his works, according to the criteria for citation classic, have been cited so extensively over a longtime span that they qualify as citation classics in library and information science. Although much of the citation data, especially those in non-English publications, are not covered in citation databases, the bibliometric depiction nonetheless provides a good picture of Lancaster's contribution to and influence in library and information science.

Evaluating scholarly communication by bibliometric analysis is one area in which F. W. Lancaster has made significant contribution. Many of his articles in bibliometric research have been cited extensively. I first read Lancaster's bibliometric articles at the beginning of my doctoral study at the Graduate School of Library and Information Science, University of Illinois at Urbana-Champaign. Wrestling with a wide range of topics and readings for the famous four seminars<sup>1</sup> in the first two years of my doctoral study, my interest was drawn to bibliometric research due to my participation in the citation analysis project for the *Transactions of the Royal Society of London*, in which Bryce Allen was the principle investigator and Lancaster the advisor. Later in Lancaster's seminar on information retrieval and evaluation, I had numerous discussions with him about the short pa-

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pers we had to complete for the course, which greatly influenced my decision on conducting a bibliometric study of interdisciplinary collaboration in science as my dissertation research. It is the most appropriate tribute, therefore, for me to use a bibliometric analysis to document Lancaster's prolific scholarly record and intellectual influence for this Festschrift.

Drawing a complete bibliometric picture for Lancaster's work, however, has proved to be challenging. Even though citations as a measure of the impact and quality of scholarly work has been in use since the early 1960s (Cole, 2000), most published citation analysis for evaluation purposes has been conducted for research fields or for institutions, the results of which were often used to rank research institutions and sometimes individual scholars. Rarely seen is using citations to show an individual's intellectual impact and influence through his/her work. While citation measure for research impact and quality has pitfalls, as many researchers have pointed out (see Meho & Spurgin, 2005 for a detailed review), it has gained wide acceptance in evaluating institutions' research performance as well as in providing evidence for academic tenure and promotion decisions. Unlike previous studies that use citations to measure and rank research productivity, this bibliometric analysis attempts to describe Lancaster's intellectual influences through citations to his work. It means that the focus will be on the breadth and depth of citations to Lancaster's work, rather than evaluating the research productivity and rank, which would allow this analysis to avoid some of the pitfalls in using citations as a measure for research productivity and impact.

Another challenge is the limit on citation data coverage. As a prolific scholar, Lancaster has maintained a highly productive academic career for over forty years, starting as early as 1963 when his first paper was published. His work includes a wide variety of types—books, book chapters, reports, papers, and journal articles—and covers several broad research fields in evaluation and measurement, information representation and retrieval, scholarly communication, and technology and management. (Table 1). To present a bird's-eye-view of Lancaster's research over the forty years in all areas, I tallied all publications in each type listed in his curriculum vitae into four broad subject categories. Each paper included in Table 1 was assigned to only one of the four categories, which was based on the dominant topic of the article, despite the fact that many of Lancaster's publications cover more than one category. Among all the publications, almost half of them are papers and journal articles, many of which were published in prestigious journals, for example, science journals such as *New Scientist* and *Nature*, and medical journals such as *Journal of the American Medical Association (JAMA)* and *Postgraduate Medicine*. The book publishing record has also been extraordinary: fifteen in total over a forty-year career—almost one book in every two and half years, not counting the multiple editions for several of them.

Table 1. Lancaster's publications (incomplete) by type and subject

Type	Subject categories				Total
	Evaluation and measurement	Information representation and retrieval	Scholarly communication and general work	Technology and management	
Books	3	5	4	3	15
Books edited	2		3	7	12
Parts of books	17	12	18	6	53
Reports and monographs	18	6	10	1	35
Papers and journal articles	27	17	48	4	96
Total	67	40	83	21	211

Since the citation databases include publications starting only from 1972, those citations to Lancaster's work prior to 1972 are not included in the databases. This caused a loss of some important citation data, such as those to Lancaster's research report on the evaluation of MEDLARS published in 1968, one of the most cited publications by Lancaster, as well as those in information retrieval literature at the time.

Another challenge is the limitation of citation databases in covering publications in non-English languages and outside of North America and Europe. Searches on Google Scholar for several of Lancaster's books and journal articles discovered a much larger proportion of citing documents in Chinese, French, Portuguese, and Spanish, compared to those in the citation databases. The citing documents on the Web represent a diverse language and cultural world, yet share the same intellectual threads as their English-speaking counterparts. Unfortunately, many such citation data are not available in the Science Citation Index or in the Social Sciences Citation Index databases. The bibliometric picture depicted in this article, therefore, only partially documents the intellectual influence that Lancaster's publications made, which is predominantly in the English-speaking world and for a period of 1972–2006. Even though there is an absence of non-English citation data, we can demonstrate the influence and impact from libraries' holdings data about Lancaster's work. According to OCLC WorldCat Identity system, Lancaster's work has been translated into Arabic, Chinese, Japanese, Spanish, and other languages, and copies are widely held in libraries over the world. Table 2 presents the library holdings statistics from the Worldcat Identify system for Lancaster's individual works; for example, *If You Want to Evaluate Your Library* was published in three different languages with five editions and held by more than 1,600 libraries worldwide. The book *The Measurement and Evaluation of Library Services* was published in both Spanish and English and held by 1,353 libraries worldwide (Table 2).

Table 2. Top 15 titles of Lancaster's books held by libraries worldwide: search results from OCLC's *WorldCat Identity* system

Title	Year	# of Editions	# of Libraries holding a copy	Languages
If you want to evaluate your library	1988–1996	5	1635	eng, arabic
The measurement and evaluation of library services	1977–1983	2	1365	eng, spa
Build your own databases	1999	2	1234	eng
The measurement and evaluation of library services	1991–2000	4	1032	eng, arabic
Information retrieval systems; characteristics, testing, and evaluation	1968–1984	4	815	chi, eng
Vocabulary control for information retrieval	1972–1995	3	712	eng, spa
Toward paperless information systems	1978	1	709	eng
Libraries and librarians in an age of electronics	1982–1985	2	705	chi, eng
Information retrieval: on-line	1973–1985	3	553	eng
Indexing and abstracting in theory and practice	1991–2003	8	541	eng
Investigative methods in library and information science: an introduction	1981	1	510	eng
Proceedings of the clinic on library applications of data processing	Serial	3	471	eng
Technology and management in library and information services	1997	2	316	eng
Problems and failures in library automation	1979	2	277	eng
Library automation as a source of management information	1983	1	273	eng

## DATA COLLECTION

The citation data for Lancaster's work was collected from three citation databases—Science Citation Index, Social Sciences Citation Index, and Arts & Humanities Citation Index—by using the cited author search query: “SELECT CA=LANCASTER FW?” This query generated a list of Lancaster's works with the times cited and other information enough for identifying a cited work, as shown in Table 3.

Table 3. Portion of the search results from the SciSearch Database

Times Cited	Cited Author	Cited Work	Year	Volume	Page
127	LANCASTER FW	PAPERLESS INFORMATIO	1978		
112	LANCASTER FW	MEASUREMENT EVALUATI	1977		
102	LANCASTER FW	INFORMATION RETRIEVA	1979		
97	LANCASTER FW	EVALUATION MEDLARS D	1968		
96	LANCASTER FW	INFORMATION RETRIEVA	1973		
81	LANCASTER FW	INFORMATION RETRIEVA	1968		
79	LANCASTER FW	VOCABULARY CONTROL I	1972		
73	LANCASTER FW	VOCABULARY CONTROL I	1986		
52	LANCASTER FW	AMERICAN DOCUMENTATION	1969	20	119
41	LANCASTER FW	INDEXING ABSTRACTING	1991		
38	LANCASTER FW	LIBRARIES LIBRARIANS	1982		
30	LANCASTER FW	INFORMATION STORAGE	1972	8	223
30	LANCASTER FW	COLLEGE & RESEARCH LIBRARIES	1978	39	345
29	LANCASTER FW	INDEXING ABSTRACTING	1998		
27	LANCASTER FW	AMERICAN DOCUMENTATION	1964	15	4
26	LANCASTER FW	INFORMATION RETRIEVA	1993		
26	LANCASTER FW	J AM SOC INFORM SCI	1985	36	389
23	LANCASTER FW	LIBRARY RESOURCES & TECHNICAL SERVICES	1991	35	377
22	...Lancaster FW	J AM SOC INFORM SCI	1997	48	893

Retrieved were 2,072 records from the citation databases. This number came close to what appear in HistCite, a bibliographic analysis and visualization software developed by Eugene Garfield (<http://www.histcite.com>), which shows that Lancaster received 2,177 citations to his publications during 1964–2007. The difference of only slightly more than 100 citations is a good indicator that the dataset used for this bibliometric analysis did not miss much of the citation data. The records for citing works were then downloaded with the data fields needed for analysis, including author names and affiliations, cited references, source (journal title, publication year, volume, and issue number), journal subject categories, document type, and language. Duplicate records were removed after merging the data files. The cited references were manually checked and verified for accuracy and completeness. The data was coded when necessary. For example, the author's affiliation address was used to extract the geographical location, and the journal subject category was coded using short name tokens for statistical program to run analysis.

It was common in the data that more than one work by Lancaster appeared in the same citing article, or the same work by Lancaster was cited by more than one article. Likewise, a journal in which the citing article was published often had more than one subject category, or the same subject category was assigned to more than one journal. Such many-to-many relationships between the citing and cited works were taken into consid-

eration during data processing so that the final data set reflected these relationships for drawing an as accurate as possible bibliometric picture.

### INTELLECTUAL INFLUENCE IN TIME AND SPACE

The thirty-four years (1972–2006) generated 2,072 citations to Lancaster's work (including 32 self-citations to works in which Lancaster is the first author). The largest group among all types of citing publications is research articles, counting for more than three-quarters of the total (Figure 1). The book reviews follow the articles to be the second largest group: the 224 book reviews translate into 15 reviews on the average for each of the books authored or coauthored by Lancaster. Lancaster was not only highly productive but also received remarkably more reviews than his peers did, as reflected in a study by Bates (1998) where she found that senior faculty members were producing slightly less than three authored books on the average during 1976–1992 and received an average of 10 reviews per authored book (Bates, 1998). The large margin between the number of Lancaster's book publications and reviews received and the average book production and reviews received by senior faculty members is evidence of the greater attention and broader audience that his works attracted.

The citation data in Figure 2 indicate that Lancaster's work has maintained a long history of being highly cited among his peers. According to Bates (1998), senior faculty members from four schools (Illinois, Indiana, Michigan, and UCLA) received an average of 83 citations for their publications during 1981–90. The total number of citations Lancaster received surpassed his peers by a large margin: 723 citations to his 67 publications in the same period. His extraordinary research record won him the reputation as the "most cited author" in the library and information science field (Hayes, 1983; Budd & Seavey, 1996). The Budd and Seavey study gathered data from 1981–92, picking up where the Hayes study left off. Lancaster's publications received 936 citations during 1981–92, almost double the number of citations for the second rank in Budd and Seavey's list. As the authors point out, Lancaster "continues to rank first during both time periods" (Budd & Seavey, 1996, p. 10–11).

Geographical distribution of citing authors is another indicator of the breadth of intellectual influence made by research publications. As mentioned earlier, the geographical data was obtained from citing the author's affiliation address, which is coded by country name. An analysis of citations to Lancaster's work revealed that slightly more than two-thirds were made by authors in the United States; authors from the United Kingdom consisted of the second largest group, 198 in total, and those from Canada (103) ranked as the third largest. The citing authors scattered in as many as fifty-one countries and regions, among which five countries were in Africa, eleven in Asia, twenty-five in Europe, three in North America, two in Oceania, and three in Central and South America (Figure 3).

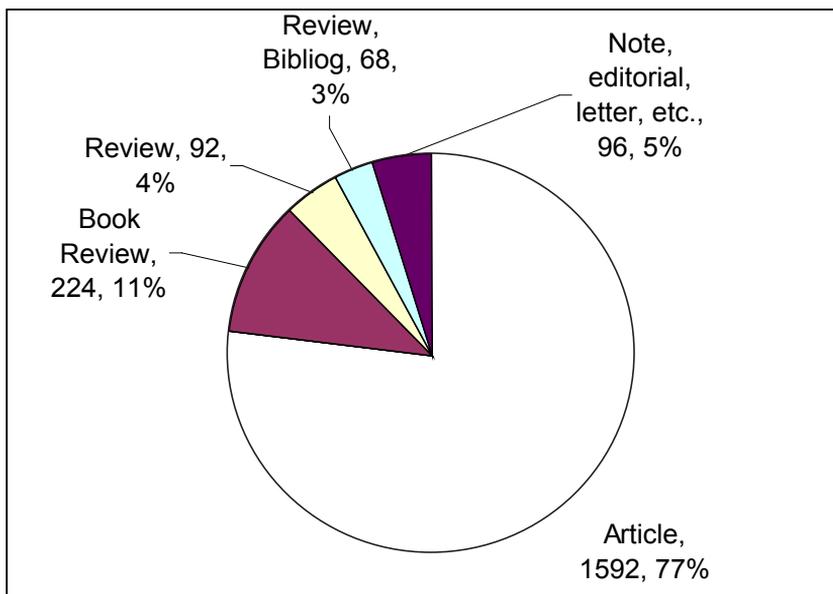


Figure 1. Citing documents by type

The geographic distribution data seem to correspond to the library holdings data mentioned earlier: the wide holdings in libraries made Lancaster's work more readily available to a broader audience, which in turn stimulated varied uses and eventually resulted in more citations. Although the number of citing authors from developing countries counted for only a small proportion (6.71 percent) of the total, they represented over half of the countries. Lancaster is well known in developing countries, and he has been invited to give lectures and presentations to numerous developing countries. However, because of limited coverage for developing countries' publications in the citation databases, the low number of citing authors from these countries and regions describes only a partial picture for this section. A good example is the publications published in Portuguese in Brazil, for example, *Cadernos de Pesquisa* and *Acta Cirurgica Brasileira*. A search in Google Scholar discovered that research papers citing Lancaster's numerous works were published in Brazilian journals, but none of the citing articles or journals was in the citation databases.

#### INTELLECTUAL INFLUENCE IN DISCIPLINARY BREADTH

The subject categories of citing journals represent the broad disciplinary territories to which the citing documents belong. In today's highly inter-

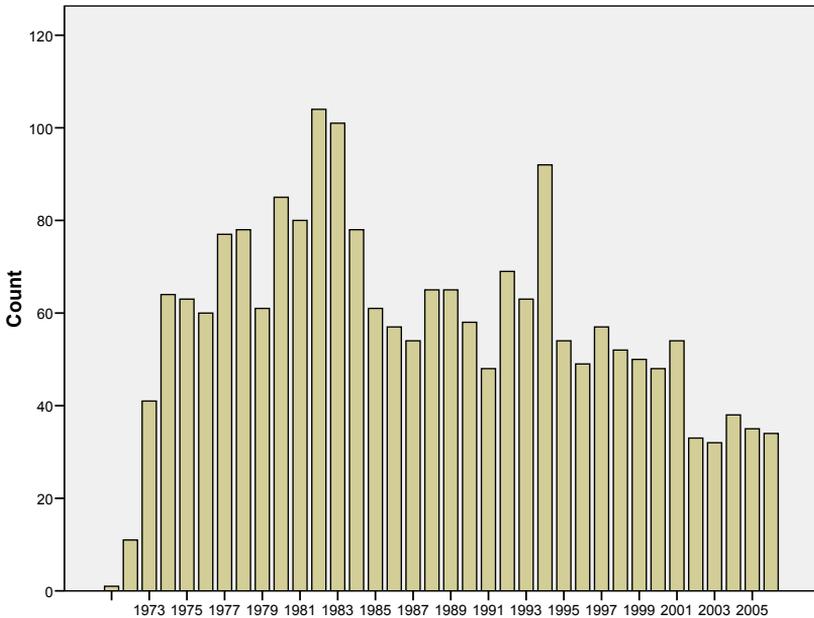


Figure 2. Distribution of number of citing publications by year

disciplinary environment, a journal's subject coverage often transcends more than one discipline. There were ninety-five unique subject categories in the citation dataset collected for this analysis. For the convenience of visual presentation, they were aggregated into nine categories as shown in Figure 4. Although some details were lost in the aggregation process, the coarse subject categories of citing journals nevertheless sketch a 10,000-foot view of the breadth of intellectual influence that Lancaster's work had on different research fields. Lancaster's work has the widest influence in library and information science among all the disciplines (Figure 4), counting for 65 percent in the total, and followed by computer science (22 percent). Many citing computer science journals have a second subject category: 75 percent of the computer science journals were in the Information Systems category; about 10 percent in Interdisciplinary Applications; and the rest in Artificial Intelligence, Cybernetics, Theory and Methods, and Software Engineering.

Among the ninety-five unique subject categories in citing journals, it was common that one citing journal often had more than one subject category. In other words, many citing journals are interdisciplinary or multidisciplinary in nature. A closer examination of these journal subject categories revealed that subject categories Information Science and Com-

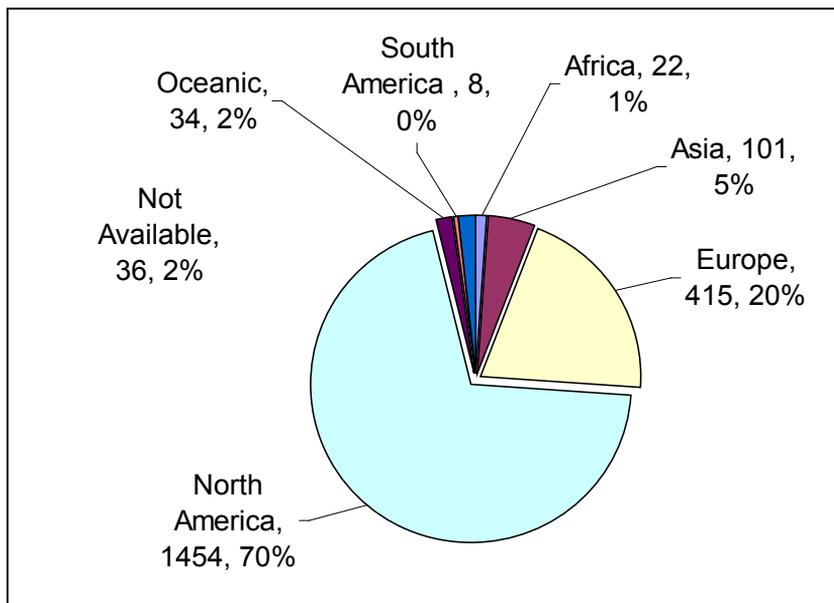


Figure 3. Geographic distribution of citing authors

puter Science were often assigned to the same journal together (Table 4). In other words, two or more disciplines or subject categories co-occurred in the same citing journal, which in bibliometric study is considered an indication of interdisciplinarity (Qin, Lancaster, & Allen, 1997). The data in Table 4 demonstrate that over four-fifths of journals were interdisciplinary between Library and Information Science and Computer Science, while other citing journals' subject categories covered other branches in Computer Science, including Medical Informatics, Electrical and Electronic Engineering, Biomedical Engineering, and Intelligent Applications. Library and Information Science also co-occurred with other disciplines, for example, Chemistry, Communication, Education, Humanities, and Law.

While the interdisciplinarity of citing journals demonstrates the breadth of Lancaster's publications, further analysis of top citing journals shows a high concentration of the most prestigious journals in library and information science. The two citing journals *JASIS/JASIS&T* and *Information Processing and Management*, which have a heavy computer science and information science orientation, generated the largest numbers of citing articles to Lancaster's work: 192 cited articles from *JASIS/JASIS&T* and

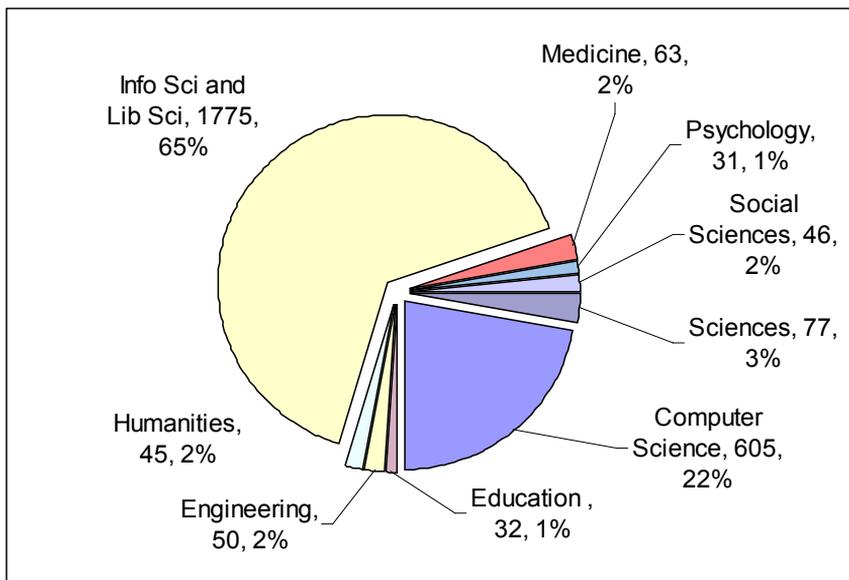


Figure 4. Subject categories of citing journals

120 from *Information Processing and Management* (Table 5).

If the subject category data (Table 4) demonstrate the interdisciplinarity or breadth of Lancaster's intellectual influence, then the top twenty citing journals manifest the quality of citing journals through the prestige of journals in the library and information science field. Lancaster's work not only influenced the library and information science fields, but also made significant impact on computer science and other fields described by the data in Table 5.

### CITATION CLASSICS

Lancaster's publications received a phenomenal number of citations during the years under analysis. Earlier quantitative analysis of the citations in this article demonstrated the intellectual influence they made in terms of time, space, and disciplinary breadth. To take the quantitative analysis a step further, I compiled a list of the top twenty publications by Lancaster that were cited most frequently based on the data from three citation index databases (Table 6). Statistics for different editions of the same book were grouped together to reflect the total number of citations received by the same work. The most cited work is Lancaster's book *Information Retrieval Systems*, which has two editions with a ten-year span in between. This

Table 4. Subject categories Computer Science and Information Science in citing journals

Occurrences of Subject Categories of Citing Journals	Count
Computer Sci., Information Sci.; Information Sci., Library Sci.	417
Computer Sci., Intelligent Applications; Information Sci., Library Sci.	56
Computer Sci., Information Sci.	8
Computer Sci., Information Sci.; Computer Sci., Software Engineering	5
Computer Sci., Artificial Intelligence; Computer Sci., Information Sci.	2
Computer Sci., Intelligent Applications; Medical Informatics	2
Computer Sci., Information Sci.; Telecomm	2
Computer Sci., Artificial Intelligence; Computer Sci., Information Sci.; Engineering, Electrical and Electronic	1
Computer Sci., Artificial Intelligence; Computer Sci., Information Sci.; Operations Res. & Management Sci.	1
Computer Sci., Intelligent Applications; Engineering, Biomedical; Medical Informatics	1
Computer Sci., Hardware & Archit; Computer Sci., Information Sci.	1
Computer Sci., Information Sci.; Computer Sci., Software Engineering; Computer Sci., Theory & Methods; Engineering, Electrical and Electronic	1
Computer Sci., Information Sci.; Health Care Sci. & Serv; Medical Informatics	1
Computer Sci., Information Sci.; Health Care Sci. & Serv; Medical Informatics	1
Computer Sci., Information Sci.; Health; Medicine	1
<b>Total</b>	<b>500</b>

Table 5. Top 20 citing journals

Rank	Citing Journals	Subject Category	Counts	
			Article only	All
1	JASIS/JASIS&T	CS, IS; IS, LS	172	193
2	Information Processing & Management	CS, IS; IS, LS	106	120
3	Journal of Documentation	IS, LS	63	99
4	Bulletin of the Medical Library Association	IS, LS	59	85
5	College & Research Libraries	IS, LS	59	79
6	Library Trends	IS, LS	58	68
7	Proceedings of the ASIS Annual Meeting	IS, LS	56	59
8	Annual Review of Information Science and Technology	IS, LS; CS, IS	47	58
9	Library Resources & Technical Services	IS, LS	40	52
19	Scientometrics	CS, IA; IS, LS	37	49
11	Journal of Information Science	IS, LS	35	48
12	Library Quarterly	IS, LS	28	48
13	Special Libraries	IS, LS	27	47
14	Journal of Academic Librarianship	IS, LS	27	43
15	RQ	IS, LS	25	42
16	Library and Information Science Research	IS, LS	21	34
17	Library Journal	IS, LS	20	28
18	Aslib Proceedings	IS, LS	20	27
19	Online Review	IS, LS	20	24
20	Library and Information Science	IS, LS	18	22

Note: CS=Computer Science; IS=Information Science, IA=Intelligent Applications.

book is the fifth most widely held book in libraries worldwide. The second and third books in Table 6 are also among the top of the list of widely held publications in libraries.

A citation classic, according to Eugene Garfield (2007), is “a highly cited publication as identified by the *Science Citation Index* (SCI), the *Social Sciences Citation Index* (SSCI), or the *Arts & Humanities Citation Index* (A&HCI).” If a publication is cited more than 400 times, it is generally considered a citation classic. Garfield also recognizes the differences between disciplines. He points out that in some fields with fewer researchers, one hundred citations might qualify a work. Six of Lancaster’s publications received more than one hundred citations. They have been cited continuously in the entire span of thirty-four years covered by the dataset. While library and information science does have much fewer researchers than most scientific disciplines do, the large numbers of citations and long life span of citedness of these six publications may well qualify them as citation classics.

HistCite presents a different set of numbers for the citations to Lancaster’s citation classics. A closer examination reveals that the automatic processing algorithm did not distinguish between word truncations at different locations of the same word, for example, the book *Information Retrieval Systems: Characteristics, Testing, and Evaluation* appears in the citation records as “INFORMATION RETRIEVAL” and “INFORMATION RETRIEVA,” and there are different years for different editions of the book. Such discrepancies were not detected by the software and resulted in smaller numbers of citations received than the actual number.

### CONCLUDING REMARKS

The bibliometric analysis in this article paints a picture of Lancaster’s works and their intellectual influence, though it may not be 100 percent complete. Aware of the limitations in citation database coverage (Jacso, 2008), I searched Google Scholar by Lancaster’s name and it returned a list of results with obvious discrepancies from what the citation databases have to offer. The search result for “*Indexing and Abstracting in Theory and Practice*,” for example, shows 121 publications have cited this book, while the dataset collected from the citation databases included only 105; among the 131 citations retrieved from Google Scholar for “*Vocabulary Control for Information Retrieval*,” few overlapped with those from the citation databases. Although there may be overlapping citations in both citation databases and Google Scholar, the citation data from Google Scholar would definitely enrich the bibliometric analysis should they be included. Since it is extremely time-consuming to collect them manually, an earlier attempt to include Google Scholar citation data had to be aborted. It is unknown how much citation overlap there is between the Web of Science and Google Scholar, but one thing is certain, Google Scholar has

Table 6. Top 20 most cited works

Number of Citations received	Title of Work Being Cited	Publication year
232	Information Retrieval Systems: Characteristics, Testing, and Evaluation	1968 and 1979 editions
227	Vocabulary Control for Information Retrieval	1972 and 1986 editions
214	The Measurement and Evaluation of Library Services	1977 and 1991 editions
168	Toward Paperless Information Systems	1978
159	Information Retrieval Online	1973
105	Indexing and Abstracting in Theory and Practice	1991, 1998, and 2003 editions
97	Evaluation of the MEDLARS Demand Search Service	1968
93	If You Want to Evaluate Your Library	1988 and 1993 editions
59	Libraries and Librarians in an Age of Electronics	1982
46	Information Storage and Retrieval	1972
45	"MEDLARS," Am Doc	1969
37	J Am Soc Inform Sci	1971
35	Occasional Papers U	1972
28	J Am Soc Inform Sci	1985
27	RQ	1994
27	College Res Libraries	1978
26	Collection Management	1982
25	Library Trends	1995
25	Library Resources and Technical Services	1991
23	Bulletin of the Medical Library Association	1971

more non-English citations to Lancaster's works, which would add richer information to the bibliometric picture if such data were collected more efficiently.

Lancaster as a prolific scholar has achieved an outstanding academic record that few in the library and information science field can match. Not only is the quantity phenomenal, the high quality is also witnessed by thousands of citations spreading through a long span of time and space, by the large numbers of prestigious citing journals, and by the broad disciplines in the citing journals.

#### NOTE

1. The four seminars were in the areas of history of libraries and librarianship, the social study of library and information science, information retrieval and evaluation, and organizational theories, and were required coursework for GSLIS doctoral students before 1994.

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