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A comparative study of interdisciplinary changes between information science and library science

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Abstract This study employs the method of direct citation to analyze and compare the interdisciplinary characteristics of the two disciplines of library science and information science during the period of 1978–2007. Based on the research generated by five library science journals and five information science journals, library science researchers tend to cite publications from library and information science (LIS), education, business/management, sociology, and psychology, while researchers of information science tend to cite more publications from LIS, general science, computer science, technology, and medicine. This means that the disciplines with larger contributions to library science are almost entirely different from those contributing to information science. In addition, researchers of library science frequently cite publications from LIS; the rate is as high as 65.61%, which is much higher than the rate for information science, 49.50%. However, a decreasing trend in the percentage of LIS in library science indicates that library science researchers tend to cite more publications from non-LIS disciplines. A rising trend in the proportion of references to education sources is reported for library science articles, while a rising trend in the proportion of references to computer science sources has been found for information science articles. In addition, this study applies an interdisciplinary indicator, Brillouin's Index, to measurement of the degree of interdisciplinarity. The results confirm that the trend toward interdisciplinarity in both information science and library science has risen over the years, although the degree of interdisciplinarity in information science is higher than that in library science.

Keywords Interdisciplinary changes · Library science · Information science · Direct citation

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Introduction

Information science (IS) and library science (LS) are two interrelated disciplines which both address issues related to information. In response to the impact of information technology, the discipline of LS has incorporated the concept of "information" from the discipline of IS since the 1950s. As a result, library and information science (LIS) has gradually become recognized as a single discipline, and the scope of LIS has been broadened ever since.

Although the discipline of IS has been incorporated into LIS, numerous recent studies still focused on IS issues but not LIS ones (e.g., Holland 2008; Ma et al. 2009; Milojevic 2010; Robinson and Karamaftuoglu 2010; Zins 2007). This implies that some researchers regard IS as an independent discipline. In addition, some subfields, including library service activities, cataloging, and publishing are traditionally regarded as belonging to LS (Järvelin and Vakkari 1993), while some other have closer ties with IS, such as bibliometrics, information retrieval, scientific communication, webmetrics, and patent analysis (Janssens et al. 2008; White and Griffith 1981; White and McCain 1998). This indicates that the different number and nature of source materials from LS-oriented journals and IS-oriented journals may lead to different interdisciplinary characteristics of LIS. Therefore, the interdisciplinary characteristics of LIS based on IS or LS articles cannot be demonstrated properly. As Åström (2010) reported, the selection of journals is an important factor to the characteristics of LIS. If more IS journals are included in samples, the characteristics of LIS will be more IS-oriented.

While examining the selected journals for previous citation analysis studies related to the interdisciplinary characteristics of LIS (Buttlar 1999; Cheng 1995; Chikate and Patil 2008; Shi 2002), it can be seen that quite few analyses specifically noted the ratio of LS journals to IS journals. In addition, comparing the disciplinary distribution of references from articles published in IS, LS, and LIS (both LS and IS) journals, the percentage of references to computer science sources is higher based on IS articles (Al-Sabbagh 1987; Tsay 2008), while the percentage of references to education sources is higher based on LS articles (Cheng 1995; Shi 2002; LaBorie and Halperin 1976; Pluzhenskaya 2008).

Because the prior studies on IS interdisciplinarity only analyzed references in articles in single journals, the characteristics of IS may not have been appropriately represented. Huang and Chang (2011) examined the interdisciplinary characteristics of IS based on references and authorial institutional affiliations in articles from five IS journals published from 1978 to 2007. They found that the percentage of cited publications in LIS was 49.50%, which is much lower than that shown in prior results of interdisciplinary studies in LS or LIS (Chen and Liang 2004; Cheng 1995; Shi 2002). For example, according to Shi's study based on references from 14 LS journals, approximately 83% of references were LIS articles (Shi 2002). The considerate difference of references to LIS sources between IS articles and LS articles means that the nature of IS is not the same as that of LS. To clarify the differences in interdisciplinary characteristics between IS and LS, this study aims to analyze and compare interdisciplinary characteristics in IS and LS, respectively.

The concept of interdisciplinarity has been discussed by many researchers (Huutoniemi et al. 2010; Leydesdorff and Probst 2009; Rosenfield 1992; Tijssen 1992), and can be defined as the use of knowledge, methods, techniques, and devices as a result of scientific activities from other fields (Tijssen 1992). Additionally, studies of interdisciplinarity can be performed using different approaches. In addition to surveys (Hargens 1986; Pair 1980;

Palmer and Neumann 2002; Song 2003), bibliometrics (Cheung 1990; Choi 1988; Hurd 1992; Khawam 1992; Rinia et al. 2002; Sanz-Casado et al. 2004) is the most frequently practiced method, as it enables large-scale research with little interference with subjects, which may avoid the inconsistency of cross-disciplinary recognition among the interviewers over different time periods and environmental conditions. In particular, direct citation is a commonly adopted bibliometric technique for analyzing the distribution of references across disciplines.

Although numerous LIS studies of interdisciplinarity employ direct citations, most analyze limited data, such as articles from a specific journal or articles published in a short time period. It is difficult to picture the characteristics of LIS based on the prior studies. Moreover, no study has reported whether the degree of interdisciplinarity in LIS is rising. Therefore, this study uses the method of direct citation to investigate the differences between IS and LS during a long-term period (1978–2007), comparing these results with those of prior studies. Additionally, this paper demonstrates the trends in degree of interdisciplinarity in IS and LS, respectively.

The main research questions addressed in this study are:

(1) What are the disciplines of cited sources of IS journal articles and LS journal articles published during 1978–2007? How is the disciplinary distribution of references from the articles in IS and LS?
(2) Do researchers of LS and IS cite more sources from disciplines outside of LIS?
(3) Do the top disciplines cited by the researchers of IS and LS change over time?
(4) Are the degrees of interdisciplinarity in IS and LS rising or not? Is the degree of IS interdisciplinarity higher than that of LS?

Methodology

Journal selection

This study used direct citation analysis to explore interdisciplinary characteristics and changes in IS and LS across a 30 year period (1978–2007) by analyzing the disciplinary attributes of references from journals of IS and LS. In order to compare the interdisciplinary characteristics between IS and LS, the same number of journals of IS and LS have been examined, totaling five IS journals and five LS journals. The ten journals were selected from the category of "Information science and Library science" as classified by Journal Citation Reports in 2006, with annual journals excluded. The scope of IS journals should emphasize "information science" and LS journals should be focused on "library science". Next, the journals had to have been published between 1978 and 2007. Finally, the selected journals had to hold the highest impact factor in their category, because journals with a high impact factor are widely considered as the core journals disseminating the essential knowledge of a discipline. Thus, articles in the core journals are often regarded as important publications, even though some are not cited frequently or at all. The references cited by core articles may make essential contributions to the development of a discipline because the authors of core articles evaluate and cite high-quality literature (Peters and Van Raan 1994). Table 1 lists the ten journals that were selected according to the above requirements.

Table 1 Five IS journals and five LS journals during 1978–2007

Discipline	Journal title	No. of articles	No. of LS and IS articles	No. of 20% LIS articles with systematic sampling
LS	*College & Research Libraries*	1,044	1,044	208
	Journal of Academic Librarianship	1,263	1,263	252
	Library and Information Science Research	427	427	85
	Library Quarterly	436	436	87
	Library Resources & Technical Services	672	672	134
	Total	3,842	3,842	766
IS	*Information Processing & Management*	1,466	329	65
	JASIST	2,224	828	165
	Journal of Documentation	550	255	51
	Journal of Information Science	1,072	484	96
	Scientometrics	1,966	1,966	393
	Total	7,278	3,862	770

Data collection

The references of this study are collected from research articles in the ten selected journals. Research articles were those classified as "Articles" by the Social Science Citation Index (SSCI). There are 3,842 research articles from five selected LS journals and 7,278 research articles from five selected IS journals. Five selected IS journals are also the journals in computer science. Four journals, namely *Information Processing & Management, JASIST, Journal of Information Science*, and *Scientometrics* are classified as journals in computer science by JCR. Another journal, *Journal of Documentation,* is indexed and abstracted in two databases related to computer science, computer science index, and computers and applied science complete. In addition, the discipline of computer science and the discipline of LIS are regarded as two independent disciplines in this study, and thus computer science articles have to be distinguished from those in IS. The process for identifying computer science articles was to examine the title, abstract of each article, and even full text if needed. Finally, a total of 3,416 articles from the discipline of computer science were excluded from 7,278 articles from IS journals.

As the database identified 3,842 LS articles and 3,862 IS articles, systematic sampling was used to select a representative sample of 766 LS articles (20% of 3,842 articles) and 770 IS journals (20% of 7,704 articles; see Table 1). To achieve a confidence level of 95% and considering the process of systematic sampling, we selected as sample articles every 5th subject, i.e., the 5th, 10th, 15th, 20th, 25th, etc. Before conducting systematic sampling, IS articles and LS articles were individually listed by publication year and sorted by journal name so that the sample contained an even distribution of articles per year of publication.

The scope of references analyzed in this study was limited to references to books and journals. A reference that appeared more than one time in a single article was counted only once. In addition, all selected references were marked by discipline based on their Library of Congress classification (LCC) number. The classification numbers of references were distributed across all 21 main classes of LCC. However, due to differences in scope among the classes and the assignment of similar subjects to different classes, we examined the category name of each subclass and identified the class numbers with similar subjects. As a result, eight disciplines were produced from one or more main classes in LCC, four disciplines were produced by combining one main class and some subclasses (e.g., education), 15 disciplines were yielded by combining two or more subclasses (e.g., literature), two disciplines were established based on a partial subclass (e.g., computer science), and one discipline (general science) was developed by combining one main class and a partial subclass. A total of 30 disciplines were determined in this study. By such means, the LCC system was used to divide all of the sample data into 30 disciplines (see Appendix).

The classification numbers were obtained by searching the Library of Congress Online Catalog for the titles of books and journals contained in references. Since *Research Evaluation* and *Scientometrics* are each classified as LIS journals by JCR, each of these two journals was changed to a LIS classification number from a general science number. In addition, 5,398 disqualified references (16.32% of 33,076 references) for which classification numbers could not be found were excluded from the sample. Most of them were Internet resources, proceeding papers, and theses, therefore, their exclusion will not change the results. A total of 27,678 references consisting of 15,075 references from IS journals and 12,603 references from LS journals were analyzed for this study.

Interdisciplinary indicator

Compared to citations outside category (COC), wherein a citation-based indicator measures the percentage of citations outside a specific discipline and then divides the disciplinary sources of citation into two groups (Porter and Chubin 1985), the Brillouin index is a proper indicator of interdisciplinarity, since it considers the number of observations and the distribution of observations among categories (Steele and Stier 2000). Although originality is also an interdisciplinary indicator based on the number of observations and the distribution of observation among categories, it is applied to a large sample size or to categories of large scope (Huang and Ho 2009; Trajtenberg et al. 1997). Therefore, Brillouin's index was applied in this study to measure the interdisciplinary degree in each year from 1978 to 2007. Brillouin's index has been widely adopted to measure biological diversity (Steele and Stier 2000). Though this index has been applied to evaluate interdisciplinary diversity of LIS (Huang and Ho 2009; Tang 2004), it has not received much attention in the discipline.

The interdisciplinary degree is calculated according to the disciplinary distributions of references: the higher the value of Brillouin's index, the greater the degree of interdisciplinarity. Its calculation can be interpreted with the following formula. N refers to the number of observations, and n_i refers to the number of observations in category i. In measuring the references, N refers to the quantity of references and n_i refers to the quantity of references in i discipline.

$$\frac{\log N! - \sum (\log n_i!)}{N}$$

Results

Number of disciplines

Table 2 shows that the number of disciplines in references of LS articles and IS articles is 28 and 29, respectively, so there is not an obvious difference in this respect, and both

Table 2 Disciplines and frequency of direct citation analysis in LS articles and IS articles during 1978–2007

No.	Source discipline	LS	IS
1	Agriculture	7	21
2	Anthropology	104	38
3	Arts	93	29
4	Astronomy	3	24
5	Biology	10	96
6	Botany	0	24
7	Business/management	671	547
8	Chemistry	7	71
9	Computer science	177	834
10	Earth science	10	38
11	Economics	73	507
12	Education	712	241
13	General science	198	1,771
14	General social science	183	338
15	History	150	42
16	Law	54	75
17	LIS	8,269	7,462
18	Linguistics & language	221	246
19	Literature	217	54
20	Mathematics	31	199
21	Medicine	190	575
22	Military science	2	5
23	Philosophy & religion	147	134
24	Physics	15	176
25	Political science	97	42
26	Psychology	290	364
27	Recreation/sport	12	0
28	Sociology	466	454
29	Technology	194	662
30	Zoology	0	6

authors of IS articles and LS articles cite publications across several disciplines. The two disciplines of botany and zoology are not included in the results obtained by LS articles, and only the publications in recreation/sport are not cited by the authors of IS articles.

Top five disciplines

Table 3 demonstrates the percentage distribution of the top five disciplines of references cited in LS articles and IS articles, respectively. There is a low consistency of findings for the top five disciplines generated from the references in LS articles and IS articles. Among the top five disciplines, only the top one, LIS, is the same in both LS and IS. The second- to fifth-ranked disciplines for LS are education, followed by business/management, sociology, and psychology. The second- to fifth-ranked disciplines generated from IS are general science, followed by computer science, technology, and medicine, respectively. The

Table 3 Distribution and ranking of the top five source disciplines

Source discipline	LS		IS	
	Percentage (%)	Rank	Percentage (%)	Rank
LIS	**65.61**	**1**	**49.50**	**1**
Education	**5.65**	**2**	1.60	12
Business/management	**5.32**	**3**	3.63	6
Sociology	**3.70**	**4**	3.01	8
Psychology	**2.30**	**5**	2.41	9
General science	1.57	8	**11.75**	**2**
Computer science	1.40	12	**5.53**	**3**
Technology	1.54	9	**4.39**	**4**
Medicine	1.51	10	**3.81**	**5**
Accumulated percentage of top 5 disciplines (marked in bold)	82.58		74.98	

findings reveal that LS researchers tend to cite more publications of social sciences except LIS, while IS researchers cite more publications of natural sciences.

Although LS researchers and IS researchers cite publications of LIS most frequently, a significant difference was found in the percentage of LIS based on disciplinary distribution of the cited sources. The figure of the LIS percentage is 65.61% in LS, which is much higher than that (49.50%) in IS. This implies that LS researchers tend to cite more publications on LIS than IS researchers. In addition, a great difference appeared in the proportion between the disciplines of the first and second place of the ranking. However, the results generated from LS articles show a difference between the percentages of LIS and that of the second-ranked discipline, with a percentage of 59.96%, which is much greater than that in IS (37.75%). The result has revealed that LS researchers highly rely on LIS literature. The disciplines outside LIS have only slight influence on LS publications.

Disciplines other than the top five with percentages of greater than 1%

As shown in Table 4, the results reveal that only two disciplines, linguistics and language, and general social science, do not belong to the top five disciplines but have percentages of more than 1% in the fields of both LS and IS. Different disciplines between the two included education, the second most cited discipline (5.65%) by LS researchers, but not as much cited by IS researchers (12th rank, 1.60%). Similarly, computer science was the third most cited discipline (5.53%) by IS researchers, but ranked as 12th most cited by LS researchers. Although obvious differences have appeared in the ranking of some disciplines between IS and LS, the differences in the proportions of most disciplines having contributions to IS and LS are less obvious due to their close proportions.

Disciplines with percentages between 0 and 1%

Table 5 shows the disciplines with percentages between 0 and 1%. The number of disciplines with references in LS articles and IS articles is 14 and 15, respectively. This reveals that more than half of the disciplines have percentages greater than 0% but less than 1%, indicating that many disciplines have little influence on LS and IS. In addition, IS

Table 4 Distribution and ranking of disciplines with percentages over 1% (Excluding the top five disciplines)

Source discipline	LS		IS	
	Percentage (%)	Rank	Percentage (%)	Rank
Education	5.65	2	**1.60**	**12**
Business/management	5.32	3	**3.63**	**6**
Sociology	3.70	4	**3.01**	**8**
Psychology	2.30	5	**2.41**	**9**
Linguistics & language	**1.75**	**6**	**1.63**	**11**
Literature	**1.72**	**7**	0.36	19
General science	**1.57**	**8**	11.75	2
Technology	**1.54**	**9**	4.39	4
Medicine	**1.51**	**10**	3.81	5
General social science	**1.45**	**11**	**2.24**	**10**
Computer science	**1.40**	**12**	5.53	3
History	**1.19**	**13**	0.28	20
Philosophy & religion	**1.17**	**14**	0.89	15
Economics	0.58	18	**3.36**	**7**
Mathematics	0.25	20	**1.32**	**13**
Physics	0.12	21	**1.17**	**14**
Accumulated percentage of disciplines (over 1%, excluding the top 5 disciplines) (marked in bold)	13.30		20.37	

researchers cited publications from the two disciplines of botany and zoology while researchers of LS did not. The publications on botany and zoology cited by researchers of IS only accounted for tiny percentages, ranging from 0.04 to 0.16%. Similarly, the publications on biology cited by researchers of LS only accounted for 0.10%.

Interdisciplinary changes–growth trend in number of disciplines

Figure 1 illustrates the annual number of disciplines identified by results of IS and LS. The number of disciplines resulting from references of the articles in IS is higher than that in the articles of LS in each year, except in the years of 1978, 1988, 1994, 1999, and 2001. This means that IS researchers cited more disciplines than LS researchers did. Although the number differs between the results generated from the articles of IS and LS, all the results indicate an increasing trend. This may indicate the fact that the interdisciplinary natures of both IS and LS have become more obvious.

Trend lines of percentages of the top three disciplines

According to the percentage of disciplines in each year, we find that the top three disciplines are those with the greatest influence on IS and LS. The percentages of the top three disciplines in each year were further observed in this study. Figs. 2 and 3 exhibit the trend lines of the percentages of the top three disciplines in IS and LS, respectively. Despite the obvious fluctuations in the percentages of LIS over the years, it remains ranked as the top

Table 5 Distribution and ranking of disciplines with percentages between 0% and 1%

Source discipline	LS		IS	
	Percentage (%)	Rank	Percentage (%)	Rank
Literature	1.72	7	**0.36**	**19**
History	1.19	13	**0.28**	**20**
Philosophy & religion	1.17	14	**0.89**	**15**
Anthropology	**0.83**	**15**	**0.25**	**22**
Political science	**0.77**	**16**	**0.28**	**20**
Arts	**0.74**	**17**	**0.19**	**24**
Economics	**0.58**	**18**	3.36	7
Law	**0.43**	**19**	**0.50**	**17**
Mathematics	**0.25**	**20**	1.32	13
Physics	**0.12**	**21**	1.17	14
Recreation/sport	**0.10**	**22**	–	–
Biology	**0.08**	**23**	**0.64**	**16**
Earth science	**0.08**	**23**	**0.25**	**22**
Chemistry	**0.06**	**25**	**0.47**	**18**
Agriculture	**0.06**	**25**	**0.14**	**27**
Astronomy	**0.02**	**27**	**0.16**	**25**
Military science	**0.02**	**27**	**0.03**	**29**
Botany	–	–	**0.16**	**25**
Zoology	–	–	**0.04**	**28**
Accumulated percentage of disciplines under 1% but not 0% (marked in bold)	4.14		4.64	

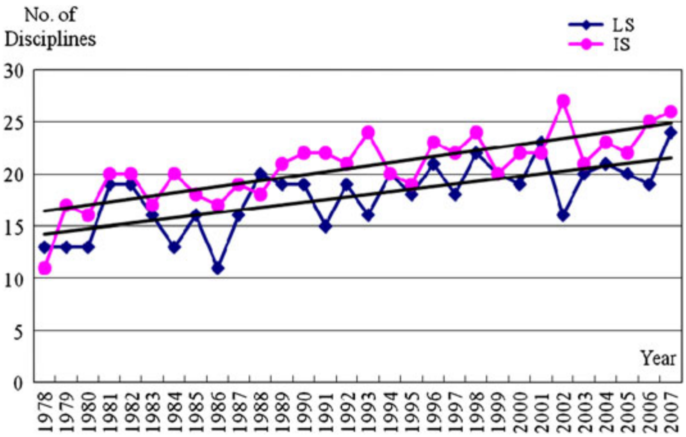

Fig. 1 Number of disciplines by year (1978–2007)

discipline, with percentages consistently much higher than those of other disciplines. The percentage of LIS shows a decreasing tendency based on the results of LS, whereas a slight increasing tendency is shown based on the results of IS.

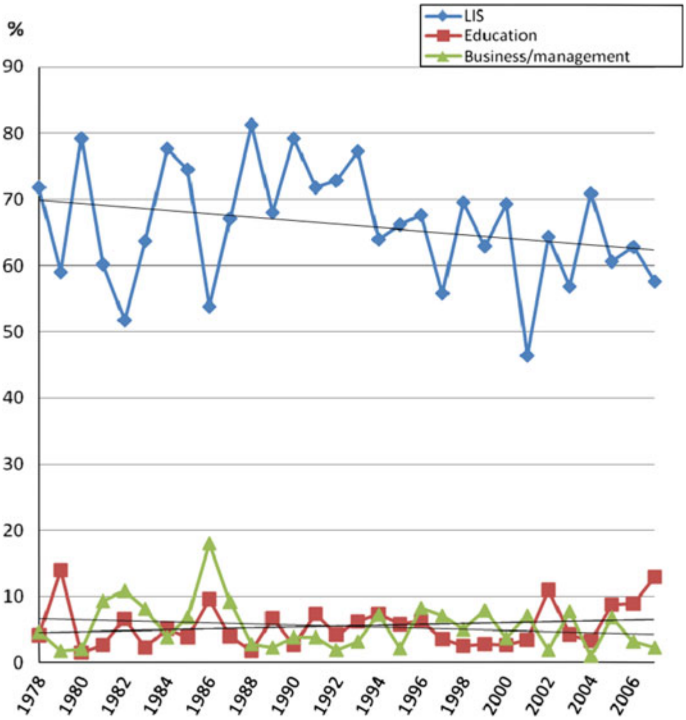

Fig. 2 The annual rates of the top three disciplines generated by LS (1978–2007)

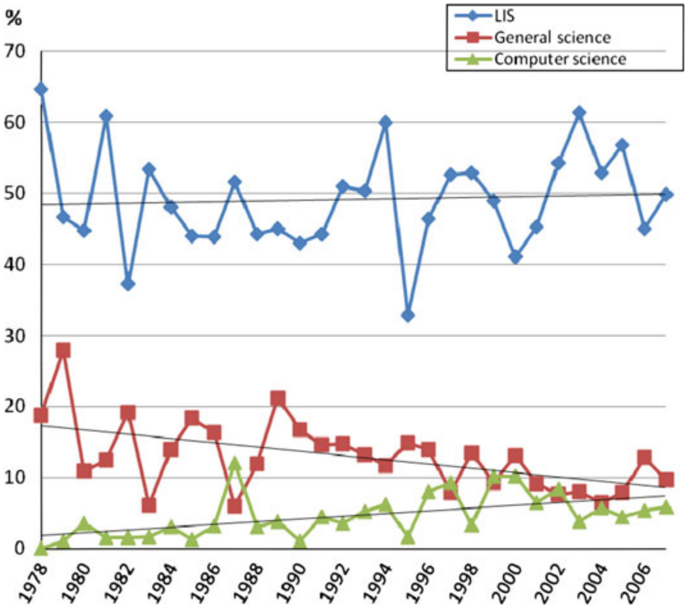

Fig. 3 The annual rates of the top three disciplines generated by IS (1978–2007)

With regard to the trend lines of the second and third top disciplines in LS, the percentage of education has gradually increased, whereas the percentage of business/management has dropped slightly. As for the trend lines of the second and third top disciplines in IS, the percentage of general science presents a significantly decreasing tendency, whereas the percentage of computer science shows a rising tendency. Based on these findings, there are reverse results in the tendency of the top three disciplines generated by references from the articles of IS and LS, published during the period of 1978–2007. In particular, LS researchers tend to rely on less publications of LIS than IS researchers.

Degree of interdisciplinarity

Figure 4 illustrates the annual changes in the degree of interdisciplinarity. Based on the results, the degree of interdisciplinarity of IS in each year is higher than that of LS, except the years of 1978, 1981, 2001, and 2003. The trends of interdisciplinary degree in LS and IS have been increasing, indicating that the researchers of LS and IS have reduced the reliance on their own publications. In addition, the growth range of the degree of interdisciplinary in both IS and LS is almost identical.

Discussion

This paper compared the characteristics and trends of IS interdisciplinarity and LS interdisciplinarity based on the references listed in IS and LS articles published from 1978 to 2007. The findings reveal that both the degree of IS interdisciplinarity and LS interdisciplinarity have been increasing over time. Moreover, the degree of IS interdisciplinarity is higher than that of LS interdisciplinarity. Numerous prior related studies have found that authors of LS articles and IS articles have cited sources across disciplines and confirmed that both IS and LS are interdisciplinary disciplines (Al-Sabbagh 1987; Buttlar 1999; Cheng 1995; Chikate and Patil 2008; Shi 2002), and quite few studies have demonstrated the trends in the degree of IS interdisciplinarity and LS interdisciplinarity.

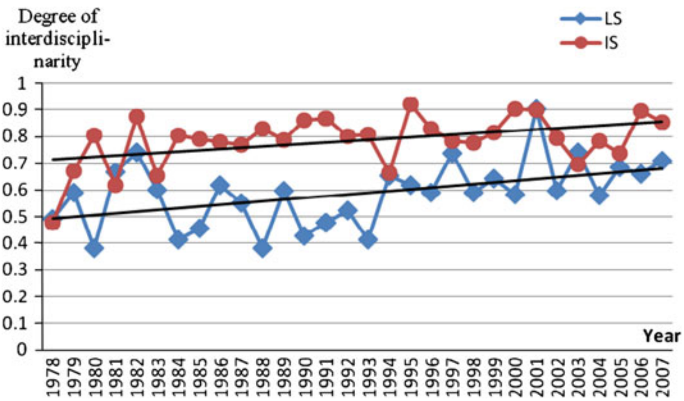

Fig. 4 Annual changes in the degree of interdisciplinarity (1978–2007)

As predicted, the authors of both LS articles and IS articles cited LIS most frequently due to the fact that LS and IS are two subfields of LIS. However, a decreasing tendency in the percentage of LIS was present in LS, while an increasing tendency in the percentage of LIS was shown in IS. This means that researchers of LS tend to cite more sources from non-LIS disciplines. Moreover, the top five disciplines outside LIS contributing to IS are totally different from those contributing to LS. The results generated from references in IS articles show that those disciplines primarily included the natural sciences, especially general science, computer science, technology, and medicine. In contrast, the results yielded from the references in the LS articles reveal that the top disciplines outside LIS were focused on social sciences, including education, business/management, sociology, and psychology. In particular, computer science can be considered closely correlated with LS, but not on the top list in LS based on the result of this study. This study confirms the close relationship between computer science and IS (Hawkins 2001; Saracevic 1992), and this finding can be supported by the fact that many IS journals assigned by JCR are also journals in computer science. In addition, because the percentages of more than half of source disciplines in the references from the articles of IS and LS are under 1%, even if those disciplines with lower percentages have been rising in the rankings, they still make little contribution to IS and LS. As a result, the domination of the entire distribution and ranking with its interdisciplinary changes in IS and LS is the main concern of this study.

The reason that IS researchers cited more sources from LIS and natural sciences may be attributable to two traditions in IS, namely a documentary tradition focusing on document management and a computational tradition focusing on applying information technology to the problems of managing documents (Buckland 1999). If we compare the results of this study to prior citation analysis studies in IS (Al-Sabbagh 1987; Tsay 2008), some common findings can be identified. One is that LIS sources are most frequently cited by their own researchers, and the other is that publications in general science or computer science are the second most cited sources. The dominant share of LIS references in both IS and LS articles reveals that IS and LS have common core knowledge foundation.

Conclusion

This study focused on the differences between IS interdisciplinarity and LS interdisciplinarity over the past three decades. The direct citation method was used to examine and compare the knowledge bases of IS and LS. The results indicate that both LS and IS researchers most frequently cite publications in LIS. There is a large contribution to LS from the social sciences, while the natural sciences exhibit a greater influence on IS. This confirms the difference in the main contributive disciplines between LS and IS.

Although the results of LS and IS reveal an increasingly interdisciplinary trend, the results obtained from LS and IS differ via the percentage of LIS, the ranking of disciplines, and the trend lines in the percentages of the top three disciplines. Such differences imply that the main source disciplines are different between LS and IS. Based on the differences in nature of IS and LS, the rate of the LS-oriented and IS-oriented journals is a significant issue in conducting interdisciplinary studies of LIS.

Appendix

See Appendix (Table 6)

Table 6 Discipline code list of references

No.	Discipline	Main class(es)/subclass(es) of Library of Congress Classification
1	Arts	M, N, TR, TT
2	Literature	PN–PZ
3	Linguistics & language	P–PM
4	Philosophy & religion	B
5	History	D, E, F
6	Anthropology	C, GF–GT
7	Business/management	HD, HF
8	Sociology	HM–HX
9	LIS	A, Z
10	Economics	HB–HJ
11	Education	L
12	Political science	J
13	Law	K
14	Psychology	BF
15	General social science	H–HA
16	Medicine	QM–QR, R
17	Astronomy	QB
18	Biology	QH301-
19	Agriculture	S
20	Botany	QK
21	Zoology	QL
22	Computer science	QA75–76
23	Mathematics	QA(excluding QA75–76)
24	Chemistry	QD
25	Military science	U, V
26	Technology	HE, T (excluding TR, TT)
27	Physics	QC
28	Earth science	G–GE, QE
29	Recreation/sport	GV
30	General science	Q, QH1–278.5

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