Does Interdisciplinary Integration Affect LIS Doctoral Students' Publishing Productivity and Quality in North America?

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This study investigated LIS doctoral students' publication in North America since the 1960s and measured the impact of interdisciplinarity such as doctoral advisors' disciplinary background and collaboration network on their publication productivity and quality. After analyzing the LIS doctoral graduates' publications since the 1960s, this study indicates that the interdisciplinarity integration of LIS has a positive impact on LIS doctoral students' publishing productivity but no impact on their publishing quality.

Keywords: academic publication, advisor, collaboration, doctoral student, interdisciplinary integration, LIS, research outputs

Library and Information Science (LIS) has been undergoing a radical change since the 1980s, when some universities closed their traditional library schools (Wiggins & Sawyer, 2010) and the iSchool movement initiated (Shu & Mongeon, 2016). With the interdisciplinary integration of LIS schools in terms of faculty members' background (Luo, 2013; Wiggins & Sawyer, 2012), academic research (Holmberg, Tsou, & Sugimoto, 2013; Wu, He, Jiang, Dong, & Vo, 2012), and graduate education (Chu, 2012; Wedgeworth, 2013; Wu et al., 2012), LIS is currently expanding to become an interdisciplinary field (Shu, Larivière, Mongeon, Julien, & Piper, 2016; Shu & Mongeon, 2016) incorporating library science, information science, computer science, and other fields (Bruce, 2011). Previous studies report that this interdisciplinary integration influences the interdisciplinary research topics of LIS doctoral dissertations (Shu et al., 2016; Sugimoto, Ni, Russell, & Bychowski, 2011), but we know little about whether it also affects LIS doctoral students' publishing behavior.

The purpose of this study is to investigate LIS doctoral students' publication in North America since the 1960s and to measure the impact of the interdisciplinarity of LIS in terms of doctoral advisors' disciplinary background and collaboration network on their publication productivity and quality.

Literature review

Scholars are under pressure to publish throughout their academic career, and doctoral students feel this pressure before entering academia.

Although publishing is not a mandatory requirement of most doctoral degrees, publishing plays a crucial role in doctoral education to prepare students to enter academia (Kamler, 2008; Lee & Kamler, 2008), since it has a positive impact on their future research performance (Horta & Santos, 2016; Larivière, 2012). Doctoral graduates must demonstrate their ability to conduct independent research (Hatch & Skipper, 2016; Johnson, 2009; O'Connor & Park, 2001), but most of them receive inadequate publishing mentoring from their advisors to publish their research (Dinham & Scott, 2001; Engstrom, 1999).

Research collaboration between doctoral students and their advisors has been explored by previous studies. Kamler (2008) reports that co-authorship with advisors can improve doctoral students' publishing competency, and Larivière (2012) indicates that collaborations with more experienced and established researchers can improve doctoral students' publication productivity. Although Chang and Huang (2012) report an increase in collaborations between LIS doctoral students and researchers affiliated with non-LIS institutes, we still know little about whether interdisciplinary collaboration can improve LIS doctoral students' publishing productivity and quality.

Prior studies report that LIS doctoral advisors' disciplinary background influences the interdisciplinarity of the LIS doctoral dissertation (Shu et al., 2016; Sugimoto et al., 2011). Based on an analysis of all LIS dissertations between 1960 and 2013, Shu et al. report that LIS doctoral students whose advisors obtained a degree from other fields than LIS are more likely to produce an interdisciplinary dissertation. However, the impact of LIS doctoral advisors' disciplinary background on their students' publication activities has never been investigated.

Methodology

A manually validated list of doctoral students who graduated between 1960 and 2013 and their advisors was compiled first from the MPACT database (MPACT, 2010), which records all LIS doctoral graduates in North America from 1930 to 2009, and second, by searching the ProQuest Thesis and Dissertation Database and corresponding university websites for LIS doctoral students who graduated after 2010. This process produced a list of 3,561 LIS doctoral graduates and 928 LIS doctoral advisors. As a result, 3,172 student–advisor pairs (including co-supervision) were formed.

Based on the list of LIS doctoral graduates, all their papers (with the same affiliation as their university) published between six years before and two years after their graduation, defined as the period of their supervised doctoral studies considering possible publication delays, were retrieved from the Web of Science (WoS). WoS includes the Science Citation Index Expanded, the Social Science Citation Index, and the Arts and Humanities Citation Index, which annually index documents published in about

12,000 journals, covering all areas of research. Advisors' publications during the same periods were also retrieved. Based on the journals in which the papers were published, all publications were categorized into 144 disciplines (of which LIS is one) according to the National Science Foundation (NSF) classification system, which assigns each journal to a single discipline.

Since the publication and citation data are extremely skewed in the power law distribution, the geometric mean, comparing to the arithmetic mean, is the most precise and accurate indicator for citation-based comparison (Thelwall, 2016), which is used to measure the average in this study. To allow the geometric mean to include the uncited articles, 1 is added to the citation counts before calculating the geometric mean and then 1 is subtracted from the result. The shift of 1 is a standard method for calculating the geometric mean of citation data (Thelwall, 2016). In addition, since the citation rate varies among different disciplines, to avoid disciplinary bias, all citations were normalized in this study before counting when the comparison was among different disciplines.

Findings

From 1960 to 2013, 3,561 doctoral students graduated from 44 LIS programs, with the University of Pittsburgh as the largest source with 406 graduates. The number of LIS doctoral graduates increased from 18 in 1960 to 114 in 2013 and reached its highest number of graduates (116) in 2010. Except for 128 students whose advisors were not identified, 3,433 LIS doctoral students were supervised by 928 advisors. Of these, 469 advisors (50.5%) who obtained a doctoral degree in LIS (hereafter referred to as LIS advisors) supervised 2,097 LIS doctoral students (61.1%), while the remaining 459 advisors (49.5%) graduated from other non-LIS fields (hereafter referred to as non-LIS advisors) and supervised 1,336 students (38.9%).

Only 26.1% (n = 930) of LIS doctoral graduates published at least one paper indexed by the WoS during their doctoral studies. The percentage of students having publications has increased from 3.5% in the 1960s to 42.8% in the 2010s. These 930 LIS doctoral graduates contributed 1,804 papers, of which 75.2% (n = 1,357) were published in a LIS journal; they also published papers in journals in computers (8.0%), law (2.6%), management (2.4%), communication (2.1%), and 36 other disciplines. As Figure 1 shows, LIS doctoral graduates have published more papers in disciplines other than LIS since the 1960s; the percentage of papers published in an LIS journal decreased from 90.0% in the 1960s to 59.9% in the 2010s. LIS doctoral students supervised by non-LIS advisors published 61.5% of their papers in non-LIS journals, while those supervised by LIS advisors published 87.1% of their papers in LIS journals. The difference is more significant in the 2010s, when the percentages of papers published in LIS journals are 43.9% and 82.8%, respectively, for these two groups.

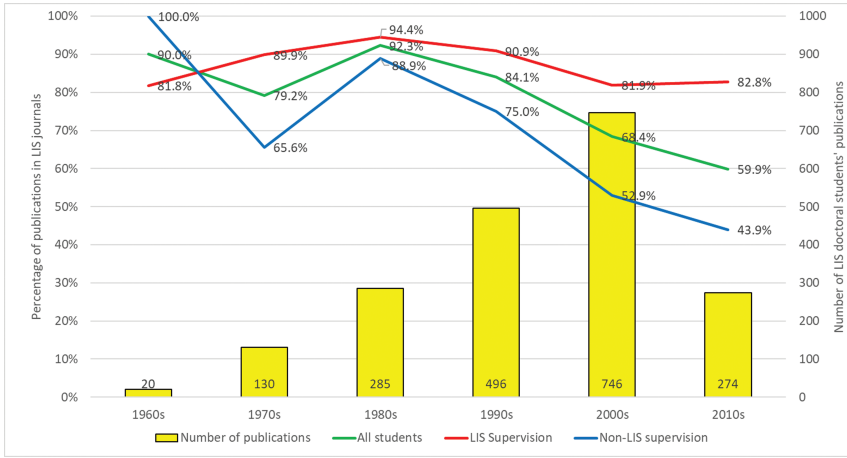

Figure 1: Percentage of LIS PhD publication in LIS journals

Of the 1,804 papers, 1,218 are co-authored, including 667 papers showing collaborations within the same institution (hereafter referred to as internal collaboration) and 551 papers between different institutions (hereafter referred to as external collaboration). Among the 984 external collaborators, 39.8% (n = 392) are affiliated with a university having ALA-accredited programs (hereafter referred to LIS collaborators), while the remaining 60.2% (n = 592) are affiliated with other institutions (hereafter referred to non-LIS collaborators). LIS doctoral students collaborated more with non-LIS collaborators (78.9%, n = 232) when publishing a paper in non-LIS journals; on the other hand, the percentage of non-LIS collaborators is only 52.3% (n = 361) when the co-authored papers were published in an LIS journal.

As Table 1 indicates, co-authored papers receive more citations compared to single-authored papers; the average relative citation rates of co-authored papers and single-authored papers are 1.288 and 0.894, respectively. External collaboration does not bring more citations than internal collaboration, with the latter group having a higher relative citation rate (1.251 vs. 1.316). Within the internal collaboration group, co-authored papers with advisor(s) are more often cited; the relative citation rate of co-authorship with advisors (1.397) is higher than for co-authorship with other collaborators within the same institution (1.210). Collaborating externally with non-LIS scholars does not have any citation advantage but rather a slight citation disadvantage compared to external collaboration with LIS scholars (1.160 vs. 1.286).

Table 2 compares LIS doctoral graduates supervised by LIS advisors to those supervised by non-LIS advisors. It shows that the latter group has a higher ratio of published students (23.5% vs. 31.1%), a higher average number of publications per student (0.274 vs. 0.404), but a lower relative

Table 1: Relative citation rate of LIS PhD publications by collaboration

Type of publication	Relative citation rate
Single-authored papers	0.984
Co-authored papers	1.288
Internal collaboration	1.316
Co-authorship with advisors	1.397
Co-authorship with others	1.210
External collaboration	1.251
Co-authorship with LIS scholars	1.286
Co-authorship with non-LIS scholars	1.160

Table 2: LIS PhD publications by advisors' disciplinary background

	Advisor with LIS degree	Advisor with non-LIS degree
LIS PhDs	2,097	1,336
LIS PhDs having publications	493	416
Percentage of LIS PhDs having publications	23.5%	31.1%
Number of publications	966	834
Average number of publications	0.274	0.404
Number of citations received	7,312	6,972
Average number of citation received	1.189	1.160
LIS PhDs (at least one co-authorship with advisor)	178	170
Number of co-authorships with advisors	270	314

citation rate (1.189 vs. 1.160) during their doctoral studies. Compared with LIS doctoral graduates supervised by LIS advisors, those supervised by non-LIS advisors had more chance of co-authoring with their advisors (8.5% of LIS advisor students vs. 12.7% of non-LIS advisor students).

Conclusion and Implication

This study presents an analysis of LIS doctoral graduates' published papers since the 1960s and shows both a clear increase in the relative number of LIS doctoral students who publish during their studies and the fact that advisors' disciplinary background has an impact on students' publishing

productivity but no impact on quality. Specifically, comparing to LIS doctoral students supervised by LIS advisors, those supervised by advisors with a non-LIS background publish more research, especially more interdisciplinary research, but receive fewer citations on average. In addition, this study did not find any citation advantage for external collaboration when compared with internal collaboration, that is, within the same institution.

In summary, the interdisciplinary integration of LIS influences LIS doctoral students' publishing behavior, encouraging them to conduct more interdisciplinary research and publish more papers in non-LIS journals, but it has no impact on publishing quality as measured by the number of citations received. Indeed, LIS doctoral students do not benefit from interdisciplinary integration (collaborating with non-LIS scholars or being supervised by non-LIS advisors), which leads to the lower citation impact of their publications.

In the past few decades, as part of interdisciplinary integration, the educational background of LIS faculty members has been becoming increasingly diverse, while the share of faculty members holding an LIS doctoral degree has been decreasing (Sugimoto, Russell, & Grant, 2009; Zhu, Yan, & Song, 2016). For the purpose of developing a successful LIS doctoral program, LIS schools try to promote interdisciplinary integration by hiring more and more scholars holding a doctoral degree in other disciplines. However, this interdisciplinary integration does not bring any advantage in terms of LIS doctoral students' research impact but can reduce their career job opportunities in academia. This will lead to unsuccessful LIS doctoral education when more and more LIS doctoral graduates cannot find a faculty job and stay in the field. This antinomy should be considered by our deans or chairs as part of the faculty-hiring process and therefore needs further investigation.

Fei Shu is a PhD candidate in the School of Information Studies at McGill University. His research interests focus on bibliometrics, informetrics, scholarly communication, and research evaluation. He also works with Dr Vincent Larivière at the Université de Montréal on various research projects regarding the transformations of scholarly communication.

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