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The state of iSchools: an analysis of academic research and graduate education

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Abstract
The emergence of the iSchool movement and the establishment of iSchools have helped to reshape the landscape of the library and information science (LIS) discipline. In this article, based on a set of research questions focusing around the research and education efforts of about 25 iSchools, we performed a study using both quantitative and qualitative methods on publically available data obtained from the web. Our results show that iSchools share the same vision and mission of working on relationships between information, people and technology, and have established themselves as the appropriate institutions for researchers from diverse subject areas to study this interdisciplinary integration. Overall, we are seeing an emerging iSchool identity and a defining iField, but there are still many important developments to make.

Keywords
academic research; graduate education; interdisciplinary; iSchools

1. Introduction

Along with the rapid development of computer and network technologies, accessing and using information has become more important in people's work and everyday life. Increasingly, studying information from a theoretical aspect and examining the creation, organization, retrieval, dissemination and utilization of information have evolved to be the core of research activities conducted by many researchers, scholars and scientists. Around this core, we have witnessed the emergence and the development of the field of information science. At the same time, the discipline of library studies and library science – a subject area closely related to information science – has been gradually integrating information science topics into its domain. This melding of the disciplines has taken place under the leadership of several visionary

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researchers within the field in response to the growth of external technology and financial pressure. For example, Olson and Grudin [1] pointed out that the Graduate Library School at the University of Pittsburgh became the Graduate School of Library and Information Sciences in 1964; Syracuse University added telecommunications and computing into its newly rechristened School of Information Studies in 1974. During the 1970s and 1980s, approximately 15 library schools were closed when they failed to meet the academic standards of leading research universities and when they were overshadowed by the rapidly expanding, highly paid information technology profession [1]. In the 1990s, the spread of digital and web-based technologies put further emphasis on information science and thus pressure on programmes dealing only with library studies. It is from this backgound that we saw the development of a field for information science and information schools.

Therefore, although the general discussion of information science and several individual information schools has a longer history [2–5], the so-called information school movement started in 2005, when an organization called the iSchools (www.ischools.org) was established. The disciplinary origins of the iSchools include computer science, business and management, but the majority of the members were founded from the library and information science tradition.

The iSchool is significant because it represents a timely response to the fact that we are in an information exploration era. Library science and library schools do look at similar information-related issues, but they still view librarians and libraries as the major forces and places for providing professional information services. In contrast, iSchools explicitly regard the study of information as the core mission and think that information science is interdisciplinary, drawing from the influences of not only library science, but also computer science, education, psychology, business, management, and medical and health-related sciences. This interdisciplinary view of information science is consistent with Van House and Sutton's speculations about the future of LIS schools; they recommended that LIS schools should expand their focus at the institutional level, be more information-centred, and focus on specialization and hybridization [6].

In the past five years, iSchools have collectively been exploring their own identity and defining their own field as well as those of corresponding professions. Some of the traditional strengths have been deepened, new research directions have been undertaken, and some obsolete areas have been reshaped. Overall, iSchools are on the fast track to changing, defining and redefining themselves. As reflected in their vision (as stated on the homepage www.ischools.org/site/about), the iSchools focus on 'the intersection of information, technology and people, which requires a broad interdisciplinary approach to those phenomena, the relationship between them, and their relationships to other aspects of culture and human endeavor'.

However, just as with other newly formed, rapidly developing disciplines, there are still debates about the core of information science and iSchools (e.g. the discussion between Wobbrock et al. [7] and Pollack [8]), concerns about whether the statements presented in the iSchools.org websites actually truly reflect the reality of the individual iSchool, about confusions regarding the connections between information science and library science, and the effects of the iSchools movement on the library programmes in these information schools and other library schools.

In this article, we report on a study examining the state of academic research and graduate education at iSchools between 2005 and 2010. Specifically, on the academic research side, our examination includes aspects such as the educational background of the iSchool faculty, their research interests, research projects and publications, the research funding agencies and collaborations among iSchools. With regard to graduate education programmes, our research questions explore the core values in iSchools' education such as missions and visions, the degree structure and the core course design, doctoral students' research interests and their career choices. The goal of the entire study is to create a snapshot of the research efforts and education programmes at the iSchools over the initial five-year period, and to reflect on the formation of iSchools' identity, the connections among iSchools and beyond, and emerging research areas and directions. Our study used multiple research methods and concentrated on using publicly available online resources.

The significance of this study is that this is the first comprehensive examination of the iSchools over a wide range of data points. As shown in our review of related work, many studies examined the iSchools and its members about certain aspects, but none of them looked at both research and education at the same time. We aim to provide a comprehensive understanding of the current state of the iSchools. Another critical element of this study is that we used openly available first-hand data, the authenticity of which can be maintained; at the same time, these data demonstrate the self-reflection and self-presentation of the iSchools' members for potential students, researchers and scholars in other disciplines.

The remainder of the article is organized as follows. We first review related work on the iSchools in Section 2, and then discuss our research questions and research design in Sections 3 and 4. In Sections 5 and 6, we present the results of a study on academic research and graduate education in iSchools, respectively. In Section 7, we discuss the insights we gained from the study, and conclude with ideas for future work in Section 8.

2. Related work

The study of research and education programmes for information science has a long history. As early as in 1978, there were several discussions about information science programmes [2–5]. Since the formation of the iSchools movement, the identity and mission of iSchools have been the central points of the discussion. Olson and Grudin [6] revisited the history of what they called 'the information school phenomenon', and identified a set of major events that led to the formation of iSchools. Although it became a consensus within iSchools that only a solid interdisciplinary approach would make the iSchools movement successful, there is still debate on the core of the interdisciplinary focus in iSchools. For example, Wobbrock et al. [7] think that humans and technology should be the core, whereas Pollack [8] argues that information should be the third aspect in addition to humans and technology at the iSchool core. Fonseca et al. [9] point out that iSchools should develop information science as a sustainability science by staying at the intersection of more traditional research areas as well as by developing ways to understand, integrate and model the interaction between nature and society. The authors also opt to use a philosophical point of view to understand the implications of combining society and nature in a single model for iSchools. Day and Ma [10] employ a philosophical–historical approach towards understanding LIS as both a social and a technological science. Wiggins [11] proposes an empirical study of the interdisciplinary diversity within iSchools with the expectation of providing insights into the relationship between the interdisciplinarity of intellectual inputs and scholarly outputs in iSchools. Wiggins et al. [12] examine a hiring network for iSchools and find that the lack of prestige, as may be perceived from the *US News & World Report* (USNWR) graduate school rankings, may be improved by strengthening connections within iSchools and increasing the diversity of sources for new faculties. They also explore the relationship between peer prestige and community identity by comparing hiring networks for iSchools to the academic hiring network for the more-established computer science discipline.

As a developing community, it is necessary to analyse iSchools in terms of scholarly communications and emerging (as well as established) specialties associated with each individual iSchool. Chen [13] uses author-concept maps to depict topics published by iSchools authors, and uses citation maps to reveal the highly regarded publications from faculties in iSchools. Karunakaran et al. [14] analyse the co-authorship network within iSchools by grouping the faculty members into different clusters according to parameters such as educational backgrounds, affiliations with research centres/labs, and *h*-indices. Based on this classification, they try to understand the relationships between social identity, group affiliation and academic collaborations. Bar-Ilan [15] also studies those iSchools' publications which were indexed by Thomson Reuters' *Web of Science* under the information science and library science categories between 2000 and 2009.

iSchools represent an international mixture of schools with remarkably diverse core disciplines. Some of the members offer library and information science degrees, some come from computer science and information technology backgrounds, and others have business and management-oriented focuses. Owing to this interdisciplinary mixture, there has been concern that iSchools may be paying less attention to librarianship. To address this concern, Wallace [16] conducts a survey on ALA-accredited master's programmes. By using data from 1979 to 2008, he proves that library and information studies education does not appear to be declining, and opportunities to broaden and extend the field are decidedly more beneficial than harmful. He concludes that the future of LIS-related programmes appears to be quite secure.

Curriculum design, an important component in iSchools, is often the focus of iSchool studies. Seadle and Greifeneder [17] propose an iSchool curriculum model and three associated key principles: (1) all information services now revolve around human–computer interaction (HCI); (2) students should be taught to think like anthropologists and look at the problems and issues from multiple viewpoints, multiple cultures and multiple ecologies; and (3) students need to remember that language both enables and limits our ability to communicate with contemporary information systems. Thompson [18] defines curricular 'depth' and 'width', and explores his thinking that an iSchool's role as a 'professional school' differentiates itself from its neighbouring disciplines at different levels and should expand its curricular width. Caicedo et al. [19] argue that, as one of their mission-critical goals, iSchools have to create learning experiences that imitate the collaborative nature of the information professions. For example, they discuss how their networking lab and the accompanying courses should be designed to address a key aspect in working in the information field – how to work as a team to solve a problem. Yang and Chung [20] analyse the computing topics taught in iSchools and describe the similarities between the Living In the KnowlEdge Society (LIKES) project and iSchools, both of which focus on the information field.

There are also papers discussing curriculum design within iSchools. For example, Heckman and Snyder [21] argue that experience and interaction with the arts – an aesthetic experience – should play an important role in the education of information professionals. Lyons [22] argues that the discipline of service science, in search of an academic home, should be situated within an iSchool's curriculum and research community. Wildemuth and Yang [23] examine the existing roles that iSchools play in digital library education from two different vantage points: the offering of digital

Table 1. iSchools categories (* indicates that the school is accredited by the American Library Association)

Category	No.	School	Category	No.	School
	1*	University of California, Los Angeles		15*	University of Toronto (Canada)
	2*	Drexel University		16	Wuhan University (China)
	3*	Florida State University		17	Humboldt-Universität zu Berlin (Germany)
	4*	University of Illinois	Library and Information Science (LIS iSchools)	18	Royal School of Library and Information Science (Denmark)
	5*	Indiana University (School of Library and Information Science)		19	University of Sheffield (UK)
	6*	University of Maryland		20	University of California, Irvine
Library and Information Science (LIS iSchools)	7*	University of Michigan		21	Georgia Institute of Technology
	8*	University of North Carolina at Chapel Hill	Computer Science (CS iSchools)	22	Indiana University (School of Informatics and Computing)
	9*	University of North Texas		23	The Pennsylvania State University
	10*	University of Pittsburgh		24	Carnegie Mellon University
	11*	Rutgers, the State University of New Jersey		25	University of California, Berkeley
	12*	Syracuse University	Management (BM iSchools)	26	University of Maryland, Baltimore County
	13*	University of Texas, Austin		27	Singapore Management University (Singapore)
	14*	University of Washington			

library courses and participation in digital library curriculum development projects [24]. They suggest that, as digital libraries bring together technology, information and the people using that information, iSchools should play a central role in educating digital library professionals. Costello [25] identifies the core concepts and curriculum development for digital preservation courses to be offered in iSchools. Kampov-Polevoi and Mostafa [26] explore the current status of online education in iSchools, and discuss the business models, technological platforms and delivery formats as well as barriers for establishing or expanding online programmes.

The tracking of the careers of graduates can help iSchools in strategic planning and engagement activities. Rathbun-Grubb [27] and Marshall et al. [28] present the results of a large-scale retrospective career survey of graduates of North Carolina LIS programmes. Naughton et al. [29] design an online doctoral student community that offers a single place for doctoral students to manage their daily graduate life from administration and course work to research and collaboration.

Although extensive in numbers, the aforementioned works are either limited to theoretical discussions or focus on only one aspect of iSchools. Our study is innovative because we work on a variety of data and aim to establish a comprehensive picture of research and education in iSchools.

3. Research questions

The goal of our research is to determine the state of research and education in iSchools. Specifically, we developed the following two research questions with concrete observable aspects for both research and education:

- RQ1: What is the state of research at iSchools in terms of educational background of the faculty, their research interests, research projects and publications, research funding agencies and collaborations, respectively?
- RQ2: What is the state of iSchools' graduate education in terms of missions and visions, programme and core course design, PhD students' research interests and students' career choices, respectively?

As of September 2010, the iSchools movement had 27 members. According to their history as well as their major research and education focuses, these members of the iSchools can be classified into three categories: library and information science iSchools (LIS iSchools), computer science iSchools (CS iSchools), and business and management iSchools (BM iSchools). As shown in Table 1, 19 iSchools belong to the LIS iSchools, of which 14 are US schools and one is a Canadian school. All of these 15 iSchools are accredited by the American Library Association (ALA). The remaining iSchools in the LIS category are top LIS schools in China, Germany, Denmark and the United Kingdom. Next, we have four iSchools belonging to CS iSchools, all of which have strong computer science programmes. The last four iSchools are those that mainly focus on business and management (BM iSchools).

Therefore, the third research question examines the potential influence of the categories:

- RQ3: Are some aspects of the research and/or education states influenced by the three iSchool categories (LIS, CS and BM)?

Finally, our research focuses on what we can contribute to the development of the iSchools, so our fourth research question is:

- RQ4: Based on the analysis of iSchools' research and education, what insights can be gleaned about the future of iSchools?

4. Research design

4.1. Data sources

As stated in Section 1, the data used in our study were public data coming from two major sources. The first source included iSchools' web pages, which contained most of the information we needed about research and education programmes in iSchools. We also visited faculty members' personal homepages and CVs, when they were available. All these resources represent openly available highlights of the iSchools. They are first-hand primary data and are mostly up-to-date and authentic by the stated update time. In our study, a total of 1140 faculty members' homepages were collected and analysed.

The data used for studying RQ1 – the state of academic research of the iSchools – included parts of the web pages that presented the faculty's research interests, research funding and research collaboration. Owing to language difficulties, we could not find adequate faculty information for the Royal School of Library and Information Science, Denmark and Humboldt-Universität zu Berlin. Therefore, the data source for the academic research section only examines the remaining 25 iSchools.

The data sources used for studying RQ2 – the state of graduate education of the iSchools – contain data about iSchools' mission and vision, education programme design, core course design, research interests of doctoral students and careers of graduate students.

The second source was the Thompson Reuters *Web of Science* collection, in which we searched the Science Citation Index (SCI) and Social Science Citation Index (SSCI) databases for iSchool faculties' journal publications between 2005 and 2009. Compared to conferences and books, the journal articles in these two databases represented research publications of a high quality that were relatively up-to-date. These data were used for studying the research productivity and research collaboration in RQ1.

All these data were downloaded by two undergraduate students between 1 July 2010 and 31 August 2010.

We acknowledge the following limitations in our data resources: (1) these openly available data resources, while easy to obtain, may suffer from missing data where there is no guarantee of data completeness. However, we consider that it would be even more difficult to obtain unpublished data from all 27 iSchools, and think that this actually gives us more data than alternative data sources. (2) Although it is part of our research focus to study the connections between iSchools and LIS, our primary research goal is about the iSchools. Therefore, our examination has been at the iSchool level, no matter whether the LIS-related unit is the whole school or a department within the school. This means that our study cannot always be at the exact level due to the variety among different iSchools. For example, our analysis on the iSchools of UCLA and North Texas was based on whole schools, in which LIS is just one department and each has a strong education department. (3) We acknowledge that removing the Royal School of Library and Information Science, Denmark and Humboldt-Universität zu Berlin from our study owing to language issues might deprive it of some important international aspects, but there are no adequate resources for us to cover all the aspects.

4.2. Research methods

Owing to the complexity of our research questions, we employed both qualitative and quantitative research methods. During the qualitative part of our study, the data collection method was based on using existing documents as data, and the data analysis method was content analysis. In the following paragraphs, we present the details of our research methods based on the discussion of corresponding parts of research questions.

During the study of iSchool faculties' educational background (part of RQ1 and RQ3), our analysis concentrated on their research interests. We believed that this would reveal to us the diversity and focuses of research topics at iSchools. Only the faculty's doctoral degree was counted in the data collection stage. To aggregate among different domains, we used a content analysis method to identify 13 categories (library and information science, computer science, education, arts and humanities, business and economics, engineering, communication, psychology, social science, mathematics and physics, other science, law, medical and public health) to cover the possible interdisciplinary educational backgrounds. In this part of the study, the sampling unit was the webpage of each faculty, and the recording unit was the stated education degree.

A similar research method was applied in studying the iSchool faculty's research interests (RQ1 and RQ3). Again using the existing homepages, we performed content analysis on the obtained homepages. Through the bottom-up fashion of coding on each faculty's research interest statement and grouping each comma-separated research topic, we identified a total of 46 different areas to capture the research focuses of iSchools (see Appendix 1).

A content analysis method was used in our study of iSchools' research funding (RQ1 and RQ3). We concentrated on the faculty's funded projects. Here, we collected data on funded projects between 2005 and 2010 from faculties' homepages and CVs, and divided the 25 iSchools into 21 US schools, and four schools from China, Canada, Singapore and the UK. In total, the funded projects' names, PIs, funded agencies, etc. of 1140 faculty members were collected and coded to reveal the types of funding agencies.

Quantitative methods were used for studying the remainder of the aspects of RQ1 and RQ3. Our study of iSchools' research productivity only concentrated on the journal articles published by the faculty. We believe that research papers published in top-quality journals (such as those indexed by SCI and SSCI of Thompson ISI) are an important factor reflecting the faculty's research productivity. We therefore searched inside SCI and SSCI databases to locate papers whose first author was within an iSchool faculty and which were published between January 2005 and June 2010. In total, we collected 1934 papers as our study samples. We used the simple counts of articles as the measure of the research productivity. We acknowledge that books, book chapters, conference papers, workshop papers and presentations are also important factors to evaluate research productivity, but because of the quantity of data we only analysed the top-quality journal articles. Our studies of iSchools' research collaboration (RQ1) concentrated on the collaborative relationships expressed as co-author relationships in publications and co-PI relationships in research projects. We used the 1934 papers indexed by SCI and SSCI of Thompson ISI and the 1140 faculties' funded projects as our samples. Co-author information was extracted from the 1934 papers, and co-PI information was acquired from the 1140 faculties' funded projects.

The research methods used for studying the education side of the iSchools were qualitative; the data collected were still those of the existing documents described above, and the data analysis method was content analysis. As only 19 of the 27 iSchools have clearly identified mission and vision statements (related to RQ2) available on their websites, we quoted and summarized some common statements from elsewhere on the remainders' websites to determine the core mission and vision of iSchools. Our study of iSchools' education programme design (part of RQ2 and RQ3) concentrated on the master's programmes and doctoral programmes. We collected programme information from iSchools' websites. The results came from only 26 schools due to the fact that we could not find relevant information for Humboldt-Universität zu Berlin. Our study of iSchools' core course design (part of RQ2 and RQ3) only concentrated on master's programmes. This helped to focus our study because most master's programmes in iSchools are course-oriented, in which core courses help to define the key characteristics of the programmes. The doctoral programmes, on the other hand, are research-oriented, so courses play less of a central role. We obtained core course information for the master's programmes (part of RQ2 and RQ3) from 26 schools' websites (not for Humboldt-Universität zu Berlin). Our study of iSchools' research interests of doctoral students (part of RQ2) only concentrated on doctoral students' dissertation topics. Although some doctoral students have their own websites which may mention their research interests, their dissertations are most representative of the doctoral students' research field. The analysis in our survey contained those doctoral students' dissertations at University of Pittsburgh and Wuhan University published between 2006 and 2010 as they were the only sources of data we could find. Then we used the same categories of classifying research interests in the iSchool faculty for iSchool doctoral students (see Appendix 1). Our study of careers of iSchool graduate students (part of RQ2 and RQ3) concentrated on the employers of master's graduates. Based on the available career information on iSchools' websites, only career information from four iSchools was obtained, and it just happens that the four are included in each of the three iSchool categories: University of Michigan and Indiana University School of Library and Information Science (IU-LIS) are LIS-type iSchools; Indiana University School of Informatics and Computing is a CS-type iSchool; and the University of Berkeley is a BM-type iSchool.

All the qualitative content analysis was conducted by two undergraduate students under initial training. One dealt with the research side, and the other worked on the education side. The quantitative study was conducted by a doctoral student.

We acknowledge that our research procedure has limitations regarding the encoding quality for content analysis. We only had one person who analysed the content, and there is no verification of the consistency of the annotation, even though we had initial training for the annotators.

5. Results analysis

5.1. Research interests

5.1.1. Faculty backgrounds. Table 2 shows that iSchools, indeed, are interdisciplinary institutions. Of the total number of 815 faculties in this study, many faculties join iSchools with backgrounds in computer science, business, engineering or education.

In all 25 iSchools, the number of faculties with a CS degree is equal to those with a LIS degree (see the far right-hand column of Table 2). In total, degrees in CS and LIS account for 56% of faculty degrees in iSchools. The remaining top disciplines are business and management, engineering, education, and arts and humanities.

However, among the 19 LIS iSchools, LIS degrees are clearly the dominant degrees (42%) earned by faculty, whereas CS is a distant second (13%). Education (9%), and arts and humanities (7%) are even less represented within the faculty. As for CS iSchools, it is no surprise that the majority have CS backgrounds (59%). Then, the other disciplines represented are mathematics and physics, engineering, psychology, business and economics, and LIS. Inside BM iSchools, CS (48%) is again predominant; then, business and economics (25%), and engineering (13%).

Overall, each iSchool has its own unique educational background distribution.

5.1.2. Research focuses. Because of space limitations, only the top 10 research areas for each iSchool category – as well as for the group as a whole – are shown in Table 3. When considering all iSchools, 'HCI and human-centred design' is the most-mentioned research area. This can be seen as a commitment from the whole iSchool faculty to exploring and understanding the role of information in human endeavours. 'Information theory, culture, reading, information literacy', which is a traditional social science area in iSchools, is in the second place. Then the third most popular, 'social web, collaborative work', is an emerging area related to Web 2.0.

Within LIS iSchools, 'education theory and practice, LIS education' is the most popular topic. However, we do acknowledge that this might be greatly influenced by the fact that we did not know how to further categorize the research areas for the iSchools at University of California Los Angeles and University of North Texas, which both have a strong education department as well as a LIS department. 'Information theory, culture, reading, information literacy' is in second place, followed by core LIS research focuses such as 'library management, information resource management, organizational management' and 'information retrieval'.

Within CS iSchools, 'intelligent systems, adaptive systems, user modeling, decision support systems, neural networks' is the most noted subject area, with 'HCI, human-centred design' as the next. Since both topics are related to users, it shows that CS iSchools are different from more traditional computer science schools, which often have more systems-related topics for their research areas. BM iSchools list the most popular topics as 'e-commence', 'HCI, human-centred design' and 'social web, collaborative work'.

These results confirm that iSchool research topics are indeed focused on the relationship between information, people and technology. Researchers in iSchools are interested in all forms of information required for advancing science, business, education and culture. This includes understanding the uses of information and the users of information, as well as information technologies and their applications.

5.2. Research productivity

5.2.1. Number of journal publications. The journal articles indexed by SCI and SSCI of Thompson ISI between Jan 2005 and June 2010 were analysed in this section. The results show that there were a total of 285 papers published in 2005. The number increased to 322 in 2006, and then to 367 in 2007. For the next two years, the number is relatively stable at 364 in 2008 and 365 in 2009. Although the number for 2010 is incomplete, that number is already in excess of 231. It is interesting to see that this time frame coincides with the establishment of the iSchool Caucus. Overall, the trend is that the number of research papers published within the iSchools increased initially and now seems relatively stable.

Table 2. Common backgrounds of iSchool faculty members (No. indicates the number of faculty members in the category; % indicates the percentage of faculty members in the category)

LIS iSchools (17 schools)		CS iSchools (4 schools)		BM iSchools (4 schools)		All iSchools (25 schools)	
Background	No. (%)	Background	No. (%)	Background	No. (%)	Background	No. (%)
library and information science	223 (42%)	computer science	129 (59%)	computer science	33 (48%)	computer science	232 (28%)
computer science	70 (13%)	mathematics and physics	22 (10%)	business and economics	17 (25%)	library and information science	231 (28%)
education	49 (9%)	engineering	20 (9%)	engineering	9 (13%)	business and economics	58 (7%)
arts and humanities	36 (7%)	psychology	8 (4%)	psychology	2 (3%)	engineering	55 (7%)
business and economics	33 (6%)	business and economics	8 (4%)	other science	2 (3%)	education	51 (6%)
engineering	26 (5%)	arts and humanities	8 (4%)	law	2 (3%)	arts and humanities	45 (6%)
communication	26 (5%)	library and information science	7 (3%)	library and information science	1 (1%)	psychology	31 (4%)
psychology	21 (4%)	medical and public health	4 (2%)	social science	1 (1%)	mathematics and physics	30 (4%)
social science	15 (3%)	other science	4 (2%)	medical and public health	1 (1%)	communication	28 (3%)
mathematics and physics	8 (2%)	social science	3 (1%)	arts and humanities	1 (1%)	social science	19 (2%)
other science	8 (2%)	law	3 (1%)	education	0 (0%)	other science	14 (2%)
law	7 (1%)	education	2 (1%)	mathematics and physics	0 (0%)	law	12 (2%)
medical and public health	4 (1%)	communication	2 (1%)	communication	0 (0%)	medical and public health	9 (1%)
Total	526 (100%)	Total	220 (100%)	Total	69 (100%)	Total	815 (100%)

Table 3. Ten most common research focuses of iSchool faculty (*N* indicates the number of faculty members)

R	LIS iSchools (17 schools)		CS iSchools (4 schools)		BM iSchools (4 schools)		All iSchools (25 schools)	
	Research focuses	*N*	Research focuses	*N*	Research focuses	*N*	Research focuses	*N*
1	education theory and practice, LIS education (in short, *Education*)	78	intelligent systems, adaptive systems, user modelling, decision support systems, neural networks (in short, *Intelligence Related*)	48	e-commence	18	HCI, human-centred design	111
2	information theory, culture, reading, information literacy (in short, *Information Theory*)	71	HCI, human-centred design	45	HCI, human-centred design	13	*Information Theory*	90
3	Library & organization management, information resource management (in short, *Library Management*)	65	network technology	42	social web, computer supported cooperative work (CSCW)	12	social web, CSCW	89
4	information retrieval	58	medical informatics	34	*Intelligence Related*	11	*Education*	87
5	social web, CSCW	54	software engineering	31	security	10	*Intelligence Related*	82
6	HCI, human-centred design	53	security	26	software engineering	9	medical informatics	71
7	information organization	48	social web, CSCW	23	information retrieval	8	information retrieval	70
8	information behaviour	46	visualization	18	network technology	7	network technology	68
9	digital library	42	data mining, text mining	17	data mining, text mining	7	*Library Management*	66
10	information policy	38	*Information Theory*	16	database	6	security	52

Table 4. Twenty SCI and SSCI journals in which most iSchool faculties publish (Freq. indicates the number of articles)

Journal name	Freq.	Journal name	Freq.
Journal of the American Society for Information Science and Technology	140	*Concurrency and Computation: Practice and Experience*	20
Library & Information Science Research	49	*Computer*	19
Information Processing & Management	46	*IEEE Transactions on Visualization and Computer Graphics*	19
Communications of the ACM	37	*Journal of Information Science*	19
Library Trends	34	*IEEE Security & Privacy*	18
Library Quarterly	28	*Information Research: an international electronic journal*	18
Journal of Documentation	26	*Proceedings of the National Academy of Sciences*	17
Journal of Chemical Information and Modeling	24	*Decision Support Systems*	17
IEEE Transactions on Knowledge and Data Engineering	23	*Scientometrics*	17
Government Information Quarterly	21	*Bioinformatics*	17

Table 5. Twenty most associated ISI Web of Science journal categories for iSchool faculty's journal articles (Freq. indicates the number of articles)

Journal category	Freq.	Journal category	Freq.
information science & library science	308	electronic	58
science	292	computer science, cybernetics	55
engineering	129	computer science, interdisciplinary applications	53
computer science, theory & methods	127	methods	52
computer science, software engineering	106	operations research & management science	49
telecommunications	90	computer science, artificial intelligence	44
information systems	85	ergonomics	40
communication	80	physics, atomic, molecular & chemical	34
computer science, information systems	72	mathematics, applied	29
engineering, electrical & electronic	69	medical informatics	29
management	59	multidisciplinary sciences	29

5.2.2. Top journals in which iSchool faculties commonly publish. Using the journals indexed by SCI and SSCI, we studied the journal publication venues for iSchool faculty members. As shown in Table 4, the journal most frequently published in by iSchool faculty is the *Journal of the American Society for Information Science and Technology* (JASIST), with *Library and Information Science Research* and *Information Processing and Management* in second and third place. Among the top 20 ranked journals, nine of them are clearly related to library and information science; six are related to computer science. This shows that iSchool researchers mainly publish articles in journals which focus on these two areas.

5.2.3. Categories of journals. Using the category information provided by SCI and SSCI databases for each journal, we group journals in Table 4 to their corresponding categories. A journal can be classified into multiple categories. As shown in Table 5, it is not surprising that the most frequent category identifying iSchool research is 'information science and library science', but there are many other categories as well. This confirms again that iSchools are conducting research in a variety of areas. Another interesting observation is that iSchool researchers also work in multiple subcategories of computer science. In fact, combining all of the computer science subcategories would generate the category with the highest number of iSchool journal articles (total 457). This confirms that most iSchool research is related to computer science and information science & library science.

5.2.4. Frequently identified keywords. SCI and SSCI databases store the keywords assigned by the authors of each paper. Using these keywords, we can see which research topics have been written about by iSchool researchers. We directly extracted those keywords without any processing. Table 6 shows a very diverse range of research topics. For example, the top 50 keywords not only cover a very wide range of topics, but their frequency counts are relatively low considering that they are generated from approximately 2000 articles. While 'information retrieval', 'algorithms', 'knowledge

Table 6. Fifty most frequently used keywords in iSchool faculty's journal articles

Keywords	Freq.	Keywords	Freq.	Keywords	Freq.	Keywords	Freq.
performance	27	theory	12	game theory	8	semantic web	7
design	27	evaluation	12	digital libraries	8	technology	7
information retrieval	25	measurement	11	worldwide web	8	qualitative research	7
security	24	data mining	11	human factors	8	distributed systems	7
privacy	24	visualization	10	citation analysis	8	China	7
algorithms	24	languages	10	spatial databases	8	peer-to-peer networks	7
internet	19	Markov chain Monte Carlo	10	e-government	8	human-robot interaction	7
knowledge management	14	collaboration	10	bibliometrics	7	digital divide	7
human-computer interaction	13	grid computing	9	access control	7	information management	7
query processing	13	ontology	9	algorithm	7	trust	6
web services	13	authentication	9	networks	7	ethnography	6
social networks	13	information technology	9	children	7		
experimentation	13	information visualization	8	search engines	7		

Table 7. Major US funding agencies that support iSchool's research

	Funding agency	No.		Funding agency	No.
Federal funding agency	NSF	369	NGO	MacArthur Foundation	11
	IMLS	62		Andrew W. Mellon Foundation	6
	NIH/NLM	61		OCLC	5
	Department of Education	13		ALA	4
	Department of Homeland Security	11		The Bill & Melinda Gates Foundation	3
	DARPA	8		Media Democracy Fund	3
	Library of Congress	7	Private company	Microsoft	16
	NASA	6		IBM	15
	Department of Defense	6		Google	11
	National Cancer Institute	6		Intel	9
State funding agency	North Carolina Office of the President	2		HP	5
	Maryland State Board of Election	2		Nokia	5
	PA Department of Education, school libraries	2	Outside United States		22

management' and 'human–computer interaction' are traditional LIS and CS topics, we do see 'security', 'privacy' and 'social networks' becoming very popular as well.

5.3. Research funding

iSchools are attracting external funding from diverse sources, which has incentivized faculties and allowed the iSchools to create signature research areas to attract more funding. In order to achieve such a goal, the faculty and administration have to carefully consider the long-term priorities of the federal agencies, emerging research directions and the needs expressed by industry.

We classified the US funding agencies into federal funding agencies, state funding agencies, non-governmental organizations (NGOs), individual companies and organizations outside the United States. It is no surprise that funding from federal agencies is the primary source (604 projects), with private companies at a distant second (98 projects) and NGOs in third (87 projects). Funding from outside the US (22 projects) and from states (18 projects) is relatively small.

Table 7 shows the top agencies in each category. The National Science Foundation (NSF) supports the greatest number of research projects. Institute of Museum and Library Services (IMLS) and National Institutes of Health/National Library of Medicine (NIH/NLM) are in second and third places, respectively, in terms of the number of projects. There are also many federal agencies related to military/defence and medical/health that fund research projects at iSchools. In

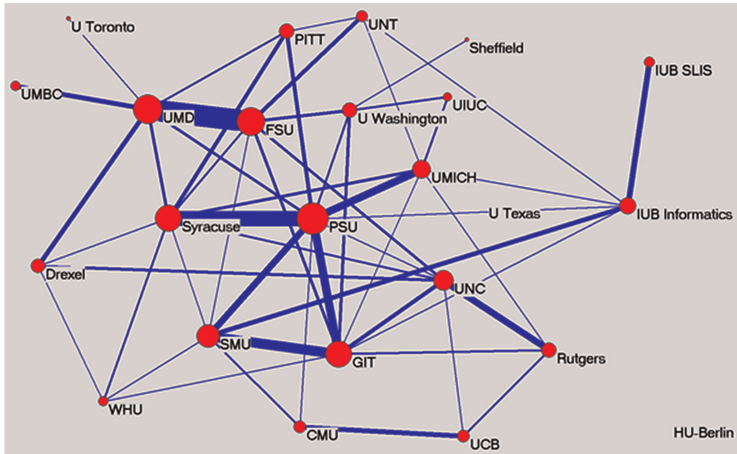

Figure 1. Co-author graph among iSchools.

total, 54 non-governmental organizations appeared in our results, the top six of which are well-known foundations and LIS associations. There are also 35 individual companies supporting iSchool research. Most of them are prominent IT companies such as Microsoft, IBM, Google, Intel, HP, etc. US iSchools have also been successful in attracting foreign funding. A total of 22 projects are supported by foreign funding – much higher number than that of the state-supported projects.

With regard to the four iSchools from China, Canada, Singapore and UK, Wuhan University hosted approximately 150 funded projects over the past five years. One-third of them are funded by the National Natural Science Foundation of China (NSFC) and National Social Science Foundation (China); another third are from the Ministry of Education, and the rest are from other national departments, provincial governments and enterprises. In Canada, the University of Toronto received a majority of research funds from agencies such as Social Sciences and Humanities, Research Council of Canada, and several US foundations such as IMLS and ALISE. Singapore Management University has 13 projects funded by the Singapore government, and the rest are funded by private companies such as Microsoft, IBM and Nokia. In the UK, Sheffield University receives most of its funding from UK organizations such as HEA, AHRC, AHB, MLA.

5.4. Research collaboration

Using the 1934 articles we found from SCI and SSCI databases, we try to visualize the collaborations among different iSchools. Figure 1 shows that all of the iSchools are connected via co-author relationships, which indicates that there are strong collaborative ties between the iSchools. In addition, some iSchools have established stronger connections, such as between University of Maryland and Florida State University, and between Syracuse University and Penn State University, etc.

Through the resources we collected online, we found in total 75 research projects. Figure 2 visualizes research collaborations by looking at the co-PI relationship in these research projects. This diagram shows that there are strong collaborations between iSchools. Compared to the network shown in Figure 1, because fewer data (note that this does not mean incomplete data) are available for analysis, it appears that some of the iSchools are isolated.

6. Results of analysis on graduate education

6.1. Mission and vision

The quoted excerpts below were drawn from the 19 iSchools that have mission and vision statements on their websites:

- *Strong emphasis on both education and research*. A common theme often mentioned in the mission and vision statements of the iSchools is that there is a balanced and strong emphasis on both research and education. Commonly used phrases are 'research and education community', 'gifted teaching, significant research', 'support and advance the broader education, research', 'further and higher education and run research within LIS up to the highest educational level', 'innovative research and education'. In addition, 'service', 'proactive outreach',

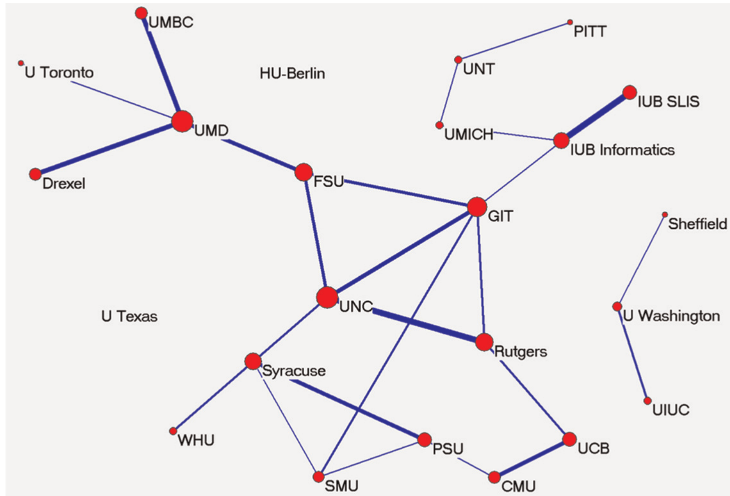

Figure 2. Co-PI graph among iSchools.

'scholarly activities' and 'pragmatism' are the words used to represent the relationships that the iSchools want to establish with professional communities.

- *Clear awareness of the impact of information revolution*. The majority of the statements recognize the 'information revolution' or 'digital revolution' that we are experiencing, and the 'fast-paced changes' occurring around us. Therefore, there is a clear sense of preparing 'information leaders' and making 'an important contribution to satisfying society's requirements'.
- *Emphasis on the relationships among people, information and technology*. There is a clear recognition that it is important for iSchools to work on relationships among people, information and technology. Statements often mention 'expanding access to information' for 'all people', leading in 'the understanding and use of information', helping to 'integrate and disseminate knowledge', optimizing 'the interplay between producers and users of information and knowledge', so that to 'define, study, and evaluate interactions among people, information and information technology in a pluralistic society'.
- *Establish the core values of iSchools*. The work of iSchools is guided by 'the principles of individual responsibility and social justice, an ethic of caring, and commitment to the communities we serve', to making 'a fundamental difference in tomorrow's knowledge society', for 'human and social benefit', to improve the 'usability, reliability, and credibility' of information 'while preserving security and privacy'.
- *Recognize the connections with related disciplines*. The iSchools' missions and visions often recognize the connections with related disciplines. The often-mentioned areas include computer science, social science, management, law, policy, humanities and so on. The iSchools are also viewed as helping to reshape education, arts and entertainment, business, environment, biological systems, health care and medicine, and to play essential roles at libraries and archives.

6.2. Education programme design

The iSchools promote an interdisciplinary approach to understanding the opportunities and challenges of information management, with a core commitment to concepts such as universal access and user-centred organization of information. Therefore, many different degree programmes are offered within iSchools.

6.2.1. Master's programmes. Table 8 shows the commonly available master's programmes among the iSchools. We can see that Library and information science and Information science are the two most widely offered programmes among all iSchools and LIS iSchools. Information management, Information systems and Telecommunications & networking are also offered by at least two LIS iSchools. Then, there is a long list of diverse master's programmes, each of which is provided by one LIS iSchool. The list includes Student affairs, Higher education & organizational change, Principal leadership, Psychological studies in education, Social research methodology, Social sciences & comparative education, Teacher education programme, Arts, Bioinformatics, Computer education & cognitive systems, Education in applied technology & performance improvement, Communication & information studies, Health informatics, Information

Table 8. Common master's programmes in 26 iSchools (*N* indicates the number of iSchools)

LIS iSchools (18 schools)	*N*	CS iSchools (4 schools)	*N*	BM iSchools (4 schools)	*N*
Library and information science	8	Computer science	2	Information systems	3
Information science	8	Human–computer interaction	2	Information management and systems	2
Library science	6			Library and information science	2
Information management	4				
Information systems	3				
Telecommunications & networking	2				

literacy, Electronic & digital library management, Multilingual information management, Museum studies, Archives, Publishing, Management science, Electronic commerce and so on.

The four CS iSchools are very similar to one other. Computer science and HCI are the two most common programmes. Other less common programmes that appear in only one of the CS iSchools include Information and computer science, Networked systems, Statistics, Information security, Computational science and engineering, Bioengineering, Bioinformatics, Chemical informatics, Health informatics, Media arts & science and Information sciences & technology.

BM iSchools have programmes relatively similar those in LIS iSchools. The three most common programmes at BM iSchools are also offered by LIS iSchools. Other less common programmes include Information security policy & management, Information technology, Software engineering, Human-centred computing, IT in business, Information management, and Telecommunications & network management.

6.2.2. Doctoral programmes. Table 9 illustrates the doctoral programmes in the iSchools. Similar to what we found in the master's programmes, Information science is the most widely available doctoral programme in LIS iSchools, with Library & information science and Information management being second and third, respectively. Other less common programmes include Library science, Archive science, Publishing science, Management science, Electronic commerce, Telecommunications & networking, Urban schooling, Educational leadership, Higher education & organizational change, Psychological studies in education, Social research methodology, Advanced quantitative methods in education research, Social sciences & comparative education, Learning science, Educational computing and Education in applied technology & performance improvement.

CS iSchools still have Computer science as the most common programme. Other less common programmes include Information & computer science, Human-centred computing, Informatics, and Information science & technology. The distributions of programmes and the topics demonstrate that CS iSchools put an emphasis on information, technology and people.

BM iSchools provide doctoral degrees in Information systems, Public policy & management and Human-centred computing.

6.3. Core course design

Tables 8 and 9 show that iSchools have diverse programme structures and offer many different degree programmes. We first classified the identified master's programmes into three groups, and then assigned an iSchool to one or multiple categories based on the categories of its master's programmes. The results of this categorization show that 16 iSchools offer

Table 9. Common doctoral programmes among the 26 iSchools (*N* indicates the number of iSchools)

R	LIS iSchools (18 schools)	*N*	CS iSchools (4 schools)	*N*	BM iSchools (4 schools)	*N*
1	Information science	9	Computer science	3	Information systems	2
2	Library and information science	3	Information and computer science	1	Public policy and management	1
3	Information management	2	Networked systems	1	Human-centred computing	1
4			Statistics	1		
5			Human-centred computing	1		
6			Robotics	1		
7			Computational science and engineering	1		
8			Algorithms, combinatorics and optimization	1		
9			Bioengineering	1		
10			Informatics	1		
11			Information sciences and technology	1		

LIS-related degrees, 11 iSchools offer various information technology (IT)-related degrees, and six iSchools offer information management (IM)-related degrees.

Table 10 shows the most popular core courses for each group of master's programmes. Within the group of LIS-related degrees, there is a strong emphasis on the basic topics for library services such as 'information organization, retrieval and access', 'cataloguing and classification', 'management of information and knowledge', 'social informatics' and 'information behaviour'. They also demonstrate the strength of the connections to the profession, such as 'library, information and society', 'library services and management', 'references', 'collection development and management', 'digital libraries' and 'information policy'. Finally, technology is included in the curriculum with courses on topics such as 'networked computing', 'web-based systems' and 'design of human-centred systems'.

IT-related degree programmes, on the other hand, pay a great deal of attention to the underlying technologies, with courses such as 'data management', 'databases', 'information systems analysis and design', 'networks', 'telecommunications', 'software engineering', 'object-oriented programming', 'security', etc. However, IT-related degrees in iSchools still focus on the intersection of humans, information and technology as the basis of study; so many core courses examine these connections, such as 'human–computer interactions', 'human–information interactions', 'organizational informatics' and 'decision technology'. Finally, there are also courses introducing the field, e.g. 'introduction to information science', and related research issues, e.g. 'research methods'.

BM-related degrees have fewer data to reveal a pattern, so the results are rather arbitrary at this time. However, they do show a strong emphasis on management-related topics such as 'management of information organization', 'information management', 'social organizational issues of information' and 'information law and policy'. At the same time, there is a strong emphasis on 'databases' and 'distributed computing applications'.

In general, it seems that the core courses all reflect the basic competencies that students in each degree programme should have, and this includes awareness of the issues facing the profession, information processing techniques, resources and collections challenges, the underlying internet and communication systems, and management of information organizations or systems.

6.4. Research interests of doctoral students

Figure 3 shows the average ratio of the number of doctoral students to that of full-time faculty members in each iSchool. Among the three types of iSchools, CS iSchools have the highest ratio, where one faculty member advises about five PhD students. Each faculty member in LIS iSchools has just over one student, and a faculty member in BM iSchools has less than one student on average.

Our study of doctoral students' research interests focused on their dissertations from the University of Pittsburgh and Wuhan University published between 2006 and 2010. Table 11 shows the top-ranked research interests of the doctoral students who graduated within that five-year-period.

Again, the results obtained show that the relationship between information, technology and people is at the core of research areas at iSchools. Information-related subjects such as information retrieval, information organization, information theory, information systems and information economics are widely studied. Technology is another widely studied area by iSchool doctoral students. Commonly studied technology topics include intelligent systems, data mining, natural language processing, visualization, multimedia, as well as some new technologies including the social web and the semantic web. User studies on information behaviour and information service were staples of research at iSchools. Traditional library-related topics, such as library management, archives and reference services, are common in doctoral students' interests as well.

As shown in Table 11, the University of Pittsburgh (Pitt) has more technology-oriented doctoral dissertations than Wuhan University; at Pitt, network technology is the most common topic. This could be because there is a telecommunications programme in the iSchool at Pitt. Wuhan University has more doctoral students interested in social science related research topics, and e-government is the most common topic.

6.5. Careers of iSchools' graduate students

Data on the graduates' initial careers was found for only four iSchools: University of Michigan and Indiana University School of Library and Information Science (IU-LIS) (LIS-types); Indiana University School of Informatics and Computing (CS-type); and the University of Berkeley (BM-type).

As shown in Figure 4, we divided the jobs into continuing studies (enrolling in doctoral studies), entering corporations, obtaining academic jobs, entering library and other non-profit institutions, joining government agencies and others. Across all four of the schools, corporate jobs and library/non-profit jobs comprised the two major types of work that

Table 10. Core courses in the master's programmes in iSchools

Top core courses in LIS related degrees	No. of schools (out of 16)	Top core courses in IT related degrees	No. of schools (out of 11)	Top core courses in BM related degrees	No. of schools (out of 6)
Information organization, retrieval and access	11	Human–computer interaction	7	Management of information organization	3
Library, information and society	9	Data management, database	6	Information law and policy	3
Research methods	7	Intro to information science	4	Database	2
Library services and management	7	Human–information interaction	4	Information management	2
Management of information and knowledge	5	Information system analysis and design	4	Distributed computing applications	2
Networked computing, web based systems	5	Object-oriented programming language	4	Social organizational issues of information	2
Collection development and management	5	Networks, telecommunications	3		
Cataloguing and classification	4	Research methods	3		
Information policy	3	Decision technology	2		
Information behaviour	2	Organizational informatics	2		
Digital libraries	2	Software engineering	2		
Reference	2	Security	2		
Social informatics	2				
Design of human–centred systems	2				

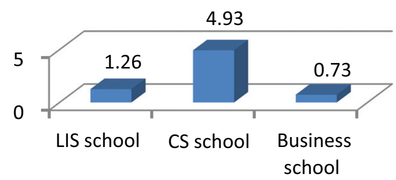

Figure 3. Ratio of doctoral student and faculty.

Table 11. Top doctoral dissertation topics at University of Pittsburgh and Wuhan University (*N* indicates the number of dissertations)

R	University of Pittsburgh	*N*	Wuhan University	*N*
1	network technology	24	e-government	20
2	information behaviour	5	e-publishing	16
3	intelligent systems, adaptive systems, user modeling, decision support systems, neural network	5	scientometrics	16
4	archives and preservation	4	knowledge management	15
5	information retrieval	4	library management, information resource management, organizational management	14
6	information theory, culture, reading, information literacy	3	information services, user services	13
7	knowledge representation	3	digital library	11
8	medical informatics	3	e-commence	9
9	security	3	data mining, text mining	7
10	web services	3	knowledge representation	7
11	academic library	2	legal issues, copyright, fair use	7
12	HCI, human centred design	2	archives and preservation	6
13	information systems design and management	2	information retrieval	6
14	multimedia technology	2	reference services	5
15	reference services	2	visualization	5
16	semantic web	2	information systems design and management	4
17	social web, CSCW	2	security	4
18			social web, CSCW	4

iSchool graduates had secured. It is interesting to note that LIS iSchools still funnel students to library and other non-profit jobs, whereas students from CS and BM iSchools primarily go to corporations.

We then specifically looked at the changes in the distribution of jobs among the different categories over the years for which such information is available. As shown in Figure 5, both Michigan data (from 2006 to 2008) and IU-LIS data (from 2006 to 2009) show that there is an increase in iSchool graduates taking jobs in library and non-profit organizations; at the same time, there is a decrease in those taking jobs in corporations. Berkeley data from 2006 to 2009 also show that there is a similar decrease in students taking jobs in corporations as well, although this is not as obvious as in the Michigan and IU-LIS data.

7. Discussion

7.1. Insights from the results

7.1.1. State of research at iSchools. In light of this study's results, we can confidently make the following statements about the current state of research at iSchools:

1. as reflected in the diversity of the faculties' educational backgrounds, iSchools are the appropriate institutions to integrate researchers from diverse disciplines;
2. as revealed by the investigation of faculties' research interests, the relationships between information, technology and users have been established as the core research focuses of iSchools;

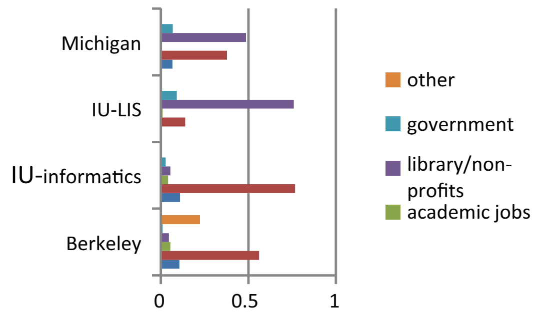

Figure 4. Master's student career information summary.

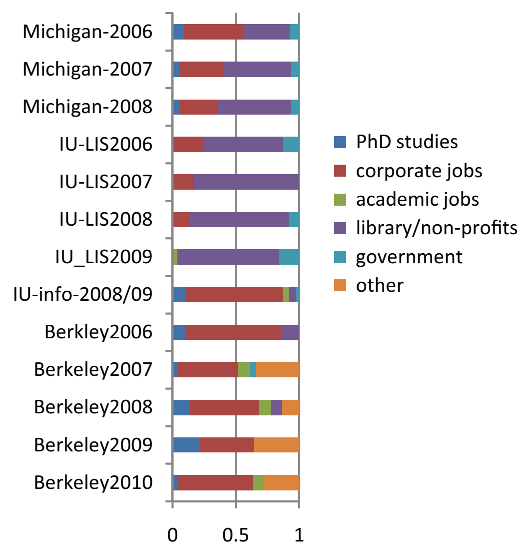

Figure 5. Master's students' career information in detail.

3. based on journal categories and keywords, iSchools are again found to conduct research that is related to several key disciplines;
4. JASIST seems to be the primary venue for publication of iSchools research;
5. iSchools are attracting funding from an array of external sources; however, federal agencies are still playing the major funding role; and
6. although iSchools can be classified into three categories based on their history and specific research fields, they have crafted strong connections and collaborations to build one discipline.

Thus, in spite of the diverse challenges and opportunities specific to each iSchool, the core focus of iSchools as a whole will still be the relationships between information, technology and the user. This helps to define the identity of our profession.

7.1.2. State of iSchools' graduate education. In terms of graduate education, our study shows that iSchools as a community share the mission of exploring the relationships between people, information and technology. However, individual iSchools offer many different degrees: this may be an indication of the diverse disciplinary foundation of each school or it might signify that iSchools are still at the stage of exploring and coping with the changes in the environment in their curricula. The core courses reflect the essential competencies that students in each degree programme should acquire, including an awareness of the contemporary issues related to the professions within the iField. Our study of doctoral students' research interests confirms that the relationship between people, information and technology continues to be the core research area for the next generation of iSchool researchers: it also reveals that some new and emerging research fields have evolved. The structure of the degree programmes and the content of the core courses also reveal the fact that an iSchool's emphasis is influenced by its type (LIS, CS or BM). Private companies and libraries are still the primary employers of iSchool graduates. Therefore, an iSchool's education programme should meet the requirements of the job market: to strengthen the student's technical abilities while imparting traditional library knowledge and trying to adapt that knowledge to the new environment.

7.1.3. Influences of the three iSchool categories. There are three categories of iSchools: LIS, CS and BM. The category does have an impact on many aspects of research and education, as explained in our analysis above. For example, on the research side, the faculty's education backgrounds, research interests and publication outlets clearly differ between the three categories; the programme and core course design vary educationally as well. However, their connection can also be considered to be quite strong in that our analysis of the vision and mission statements demonstrates that all of the iSchools share the same understanding and same core vision. Irrespective of the research interests and publication outlets, the most common themes are still related to the interactions between information, technology and the users across each of the three categories.

7.1.4. The forming of iField. From the analysis on academic research and graduate education, we can clearly identify important aspects of the current state of the iSchools:

- information plays an essential part in iSchools;
- the LIS field is still the top provider of faculty members at iSchools;
- information theory, information resource management and information retrieval are the top-ranked research interests;
- information science & library science is the most common journal category; and
- 'information' is part of the programme name for the most popular master's and doctoral programmes in iSchools.

Here, 'people' are defined as those who create and use information, and 'technology' is the tool for people to use and interact with information. Therefore, different iSchools, through sharing and building this core focus of people, information and technology, are collaborating with each other to form the collaborative iField.

7.1.5. iSchools and LIS. In the review of the literature, we indicated that there are concerns that iSchools may be paying less attention to librarianship. Our results show that iSchools are indeed an interdisciplinary mixture, where some iSchools do not emphasize library professional training, and many faculties come from outside the LIS discipline. However, overall (and certainly within the group of LIS iSchools), there is still a strong LIS-related faculty and the research interests of the faculty and students are still focused on LIS-related topics such as LIS education, library & organization management, information retrieval, information organization, information behaviour and digital libraries. Among the 20 SCI and SSCI journals in which most iSchool faculties publish, eight are clearly LIS-related journals. In both master's and doctoral programmes, LIS is among the most offered training programme in LIS iSchools. Even looking at the graduate's career choices, libraries are still among the top employers.

7.2. Limitations of the study

There are two limitations to our study. In order to examine all the iSchools which were members of the caucus, we made a methodological decision that we would only rely on openly available data to draw our conclusions about the iSchools. This helped us to obtain data for the broadest possible number of schools without having to depend on assistance from the schools themselves. However, this did limit our ability to obtain some more authoritative data that could be useful for analysis.

The second limitation is that, although we tried to provide an overall picture of the state of iSchools' research and education programme, and thus many aspects of the research and education of iSchools were examined in our study, owing to the limitations of space in this article, we do not provide an in-depth analysis on each individual aspect.

8. Conclusions and future work

In this article, we have presented a study on academic research and graduate education in iSchools by examining publically available online data. The conclusions can be drawn from two viewpoints:

1. When discussing the name of iSchools, 'i' is often viewed as representing *information*; therefore, iSchools are information schools and they study the development and usage of technology to manipulate information. Our

results show that iSchools are, indeed, information schools. The research interests of both iSchool faculties and students are focused on topics such as HCI, intelligent systems, information theory and network technology. The journals in which iSchools' research work is published are mostly in the information science & library science categories, and both the master's programmes and doctoral programmes in iSchools have a strong emphasis on information science and information systems.

2. The 'i' in iSchools is also often interpreted as *interdisciplinary*, where faculties with different disciplinary backgrounds work together and students are familiarized with multidisciplinary knowledge and skills. Our results also demonstrate this interdisciplinary characteristic. iSchool faculty members come from different educational backgrounds, including computer science, LIS, business & economics, engineering, education, arts & humanities, psychology, and so on. In addition, the journal categories in which most iSchool faculties publish their research work clearly support this multidisciplinary pattern. These categories are: information science & library science, science, engineering, computer science (theory and methods) and computer science (software engineering).

For future work we plan to include consideration of faculty participation in high-quality conferences, especially for those who work in areas related to HCI, CSCW or ICSE. Another direction is to conduct more citation analysis of the publications, as well as more detailed examination of the collaboration, not only within but also outside iSchools.

Although the challenges and opportunities facing each iSchool will be increasingly diverse and different, the relationships between information, technology and the user will always be the foundation in our profession.

Acknowledgement

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9. Appendix 1: Different areas of the research focuses of iSchools (in alphabetical order)

(1) academic library;
(2) archive and preservation;
(3) communication theory;
(4) computer hardware;
(5) cyber-scholarship, cyber-infrastructure;
(6) data mining, text mining;
(7) database;
(8) digital library;
(9) e-commence;
(10) education theory and practice, LIS education;
(11) e-government;
(12) e-learning;
(13) e-publishing;
(14) GIS;

(15) HCI, human-centred design;
(16) information architecture;
(17) information behaviour;
(18) information economics;
(19) information organization;
(20) information policy;
(21) information retrieval;
(22) information service, user service;
(23) information system design and management;
(24) information theory, culture, reading, information literacy;
(25) intelligent systems, adaptive systems, user modeling, decision support system, neural network;
(26) knowledge management;
(27) knowledge representation;
(28) legal issues, copyright, fair use;
(29) library management, information resource management, organizational management;
(30) medical informatics;
(31) MIS;
(32) mobile computing;
(33) multimedia technology;
(34) museum technology and service;
(35) network technology;
(36) NLP;
(37) public library;
(38) reference service;
(39) school library, children's library, children's service;
(40) scientometrics;
(41) security;
(42) semantic web;
(43) social web, CSCW;
(44) software engineering;
(45) visualization;
(46) web service.