# PUBLICATION AND CITATION ANALYSIS OF DISCIPLINARY CONNECTIONS OF LIBRARY AND INFORMATION SCIENCE FACULTY IN ACCREDITED SCHOOLS

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**ABSTRACT**

Multidisciplinarity of LIS faculty is one the prominent trends in LIS education. 37% of faculty members in ALA accredited programs hold advanced degrees in disciplines other than LIS. Little is known about the role these migrants from other fields of study play in LIS research and education. This study strives to fill in this gap by analyzing publication and citation patterns of LIS faculty using citation analysis as a primary method and the Thomson Scientific Web of Knowledge as a main data source. The findings lead to the conclusion that LIS schools' faculty members with non-LIS doctorates do maintain stronger connections with other disciplines than their colleagues with LIS doctorates. They publish more often in journals from other disciplines and get cited more often by scholars from other fields of study. At the same time, faculty with non-LIS doctorates are active in LIS research as well. Significant fractions of their works are published in LIS journals and they get cited often in LIS scholarly periodicals. Thirty six percent of faculty with non-LIS doctorates hold a Master's degree in LIS. They maintain less strong connections with other disciplines than those faculty who hold neither a doctorate nor a Master's degree in LIS. Faculty with LIS doctorates also maintain connections with other disciplines. Not as much as faculty with non-LIS doctorates, but they publish in non-LIS periodicals and receive citations from scholars in other disciplines. The field of LIS has connections with a wide variety of disciplines. Disciplines of doctorates of LIS educators represent a wide variety of knowledge domains with prevalence of professional fields, social sciences, humanities, and computer science. Faculty members with either LIS or non-LIS doctorates receive citations from all major knowledge domains. This might signify "exporting" qualities of LIS as a discipline. The presence of faculty with non-LIS doctorates has a noticeable impact on the level of multidisciplinarity of the schools' research production. The ratio between faculty with LIS and non-LIS doctorates is a less significant factor than the actual number of faculty members with non-LIS doctorates in regard to multidisciplinarity of schools' publications and citations to them.

To my family

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## CHAPTER 1: INTRODUCTION

The shifting relationships between knowledge as a whole and the disciplines of which it is composed as they develop over time is one of the most intriguing and important of all epistemological issues. "The map of knowledge with its various disciplinary boundaries is not static" (Prentice, 1990, xiv). She compared this map with the modern map of Europe which has undergone many changes. These changes are not easy for those who are involved and may cause a lot of confusion and even pain but changes in boundaries, both geographical and disciplinary, seem to be unavoidable. Palmer writes,

> "We have an idea of the function of disciplines and subdisciplines – they bring order to researchers, students, methods, journals, and the like. And, while they commonly take form in academic departments and curricula, professional organizations, textbooks, and systems for classifying knowledge, it is nearly impossible to discern what exactly falls inside or outside a discipline at any given point in time" (Palmer, 2001, ix).

The degree of disciplinary independence and inter-dependence changes along with growth in the body of knowledge and paradigmatic changes. In the course of scientific knowledge development, centrifugal forces take the place of centripetal ones and vice versa. For a long time, centripetal forces prevailed as each discipline paid primary attention to establishing their cores and borders. "The rapid growth of scholarly activity over the past two centuries has been accompanied by its increased differentiation into disciplines, specialties, and even subspecialties" (Hargens, 1986, 145). Scholars did not seem to be interested much in other disciplines. The situation has changed in the 1960-70s when a strong interest in interdisciplinarity generated an avalanche of publications on the topic (Latucca, 2001).

Interdisciplinarity is one of the most visible trends and is manifested in all forms and at all levels of academic life: research, publishing, teaching, and administration. As Palmer puts it, "Interdisciplinarity has become a topic of wide interest, penetrating the sciences, social sciences, and the humanities. Many researchers practice it, and others study it" (Palmer, 1996, 130). The literature on interdisciplinary approaches, projects and curricula, supporting this statement, is plentiful and will be presented in greater detail in chapter 2.

Disciplinary interactions can take different forms. The degree of two or more disciplines' integration basically draws the line between multidisciplinarity, which "signifies

the juxtaposition of disciplines", and interdisciplinarity, which "represents an integration of material from various fields of knowledge into a new, coherent entity" (Smith, 1992, 261). There is more than one approach to understanding the differentiation between the two concepts. The most common ones will be reviewed in the section 2.1.2.

The perception of the trend by different scholars and within different disciplines varies a great deal. Many welcome the signs of growing interdisciplinarity enthusiastically, some seem to resist it, but most researchers who write on the issue of interdisciplinarity emphasize its great importance for modern science in terms of re-grouping the disciplines on their way to holistic science.

> "Establishing contacts in other fields promotes understanding and integration across fields. Researchers consult with contacts from different backgrounds to explore the various ways a problem can be approached, to grasp the long-term hopes for a solution, and to learn how their research relates to other work on the topic. The exchanges that take place in these multidisciplinary networks are small steps toward scientific convergence" (Palmer, 2001, 33).

Such multidisciplinary networks can be organized in a variety of ways, from "invisible colleges" (Crane, 1972) to social networks which may be distributed in space and time and multidisciplinary departments. The latter trend has become visible in Library and Information Science (LIS) schools lately (KALIPER Project, 2001).

## 1.1 Problem statement

LIS is among those disciplines which are strongly interested in interdisciplinarity. Interdisciplinarity has been the topic of numerous conferences, including those organized by ALISE, ALA, and ISKO. Strong interest, of course, does not mean consensus. On the contrary, discussions about the role of multi- and interdisciplinarity and their importance in LIS research and education continue. There is no unity in the LIS community even in regard to the relationship between the two components of LIS -- library science and information science[1]. While some LIS researchers and educators look for better ways to make their multidisciplinary schools, programs, curricula etc. more efficient and responsive to a

[1] Different stances toward the issue of coexisting library science and information science will be discussed in greater detail in section 2.3.2.

changing and increasingly complex information environment, others strive to keep the "purity" of librarianship by attacking every inch of disciplinary grounds that librarianship has "lost" to information science and/or other fields of study. It is difficult to assess how many LIS scholars and practitioners share the latter attitude toward multidisciplinarity but it is a part of modern LIS discourse.

The actual presence of scholars from other disciplines in LIS schools, one of the most visible examples of "disciplinary invasion", naturally provokes discussions. The debates on the JESSE listserv[2] in spring 2003 were followed by editorial publications by former ALA president Michael Gorman expressing concern about librarianship being pushed out by information science in LIS schools (Gorman, 2006). These editorials heralded a new wave of debate about LIS education and the disciplinary foundations of LIS as a discipline (Dillon & Norris, 2005; Estabrook, 2005; Malone et al., 2005).

LIS schools, according to the ALISE statistical reports, have always been multidisciplinary. At the dawn of LIS as an area of doctoral study, the multidisciplinary nature of each school reflected the reality that, along with growing their own faculty, each school relied heavily on instructors with doctorates in other disciplines, mostly, in Education and History. It has been a common practice for library schools since the Graduate Library School at the University of Chicago was established, as this was the first program to grant degrees in the field of LIS, for the obvious reason of lack of faculty with LIS doctorate[3]. Today, significant numbers of LIS faculty members have non-LIS doctorates from a variety of disciplines. Interestingly enough, over the decades after establishment of LIS doctoral programs, LIS schools' faculty not only retain their multidisciplinary character but the level of multidisciplinarity increases, according to the KALIPER report (KALIPER Project, 2001; Sutton, 2001). According to ALISE statistical reports, the number of non-LIS degrees are quite substantial in number. As of 2003, at 56 schools, there were 315 out of 758 (or 42%) full-time faculty members holding doctorates in 34 disciplines other than LIS (ALISE Statistical Report, 2003). The fact that more than one-third of all LIS faculty members hold advanced degrees in disciplines other than LIS deserves special attention.

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[2] JESSE is a listserv designed for LIS educators. JESSE archive is available at http://listserv.utk.edu/cgi-bin/wa?A0=jesse

[3] See more on this in section 2.3.5.1

The high percentage of scholars with non-LIS doctorates among LIS schools' faculty members suggests that the migration to LIS from other fields cannot be accidental. It would appear that LIS welcomes scholars from other knowledge domains. What is the nature of the connections between LIS and other disciplines and how strong are they? Are they strong enough to make LIS dissolve in or be absorbed by other disciplines or will it instead turn into a metascience hosting a wide variety of theoretical frameworks and methodologies? To answer these questions we must know with some degree of certainty what exactly LIS faculty members with doctorates in other disciplines bring into LIS research and education, whether or not they enhance LIS research agendas and curricula with perspectives from other disciplines and whether or not they integrate successfully into their new field.

Disciplinary uncertainty is not new to LIS and it has never been resolved. "The eternal existence, imaginary or otherwise, of crisis in LIS education must itself be indicative of some underlying state of affairs that shows no sign of fading" (Dillon & Norris, 2005, 293). This uncertainty will continue to produce discussions that have often little to do with the foundations of LIS as a discipline and by no means will foster its evolution. When it comes to such a serious issue for the discipline as its identity, there is no place for guesswork. The situation should be analyzed rigorously and valid conclusions should be made about the role of LIS educators with non-LIS degrees in the field. Their "scholarly parameters" should be identified. Since publishing is one of the most prominent activities of any scholar and by far the most visible one, studying publishing and citation patterns of faculty in LIS schools and comparing those with LIS doctorates to those with doctorates from other disciplines may be one approach. For the sake of consistency, in this text, doctorates in Library Science, Library and Information Science, Information Science, and the like are considered and called throughout the text doctorates in LIS.

Of course, numbers by themselves will not decide these discussions because numbers can always be interpreted in a variety of ways. But the evidence which this study strives to provide can direct the discussions into a more constructive mode and constitute some solid grounds for futher, more elaborate, data collection.

There are other dimensions of understanding the phenomenon of multidisciplinarity of LIS faculty that are beyond the scope of this study but are worth mentioning. Some LIS educators think that it would be helpful to compare practices in our field with those in other

disciplines as a way to shed light on more general and deep processes in modern universities and the process of knowledge development. If it is common practice for other university departments to hire faculty with advanced degrees in other disciplines, it might be reassuring. At the other extreme, if LIS schools are quite unique in hiring people from other disciplines to teach their graduate students, it would not necessarily imply that hiring non-LIS faculty is a bad practice. It could mean just that LIS is a pioneer discipline in exploring new ways to foster interdisciplinarity. Neither answer would give us a better understanding of what is going on in the discipline of LIS. In order to obtain that kind of knowledge we have to take a close look at the field and to analyze the research and publishing patterns of LIS educators, especially those who do not hold a doctorate in LIS. No one single study can "resolve the crisis" of disciplinary uncertainty. Instead of comparing LIS with other disciplines, this study will focus on LIS itself, by striving to identify some significant parameters of scholarly activities of LIS faculty members with different disciplinary backgrounds.

### 1.2 Research questions

This study focuses on two aspects of the multidisciplinarity of LIS faculty members holding non-LIS doctorates: (1) their research connections with other disciplines, and (2) their involvement with the field of LIS, i.e. publishing in LIS journals. Two forms of such connections were studied, borrowing and boundary crossing. The former manifests itself in citing works from other disciplines. The latter implies publishing in journals from other disciplines.

Faculty members with non-LIS doctorates constitute 42% of the population of educators at the schools with ALA accredited programs, according to ALISE statistical reports. Their research agendas might have a noticeable influence on the evolution of LIS as a discipline. Based on literature on multidisciplinarity in general, one can make an assumption that faculty with non-LIS doctorates bring to LIS research topics perspectives from their disciplines and that faculty-migrants might be more open to interdisciplinary research and collaboration with researchers from a variety of disciplines than some of their colleagues. The role of LIS educators with non-LIS advanced degrees is an interesting and important issue in regard to the future development and self-identification of LIS as a discipline.

Since publishing is one of the most important activities of any scholar, this issue can be addressed by analyzing publishing and citation patterns of LIS schools' faculty members with LIS and non-LIS disciplinary backgrounds.

The main research questions, therefore, are as follows:

1. Do LIS school faculty members with non-LIS doctorate maintain stronger research connections with other disciplines than their colleagues with LIS doctorates?
2. Are they as a group well established as researchers in the field of LIS?
3. Does LIS as a field of study maintain connections with other disciplines through borrowing and boundary crossing?
4. What disciplines more than others "express interest" in LIS through citing publications by LIS faculty?
5. What is the relationship between the number of faculty members with non-LIS doctorates in a particular school and the level of multidisciplinarity of its faculty's publications and citations those publications receive?

Answers to those questions may help to shed some light on the role of LIS schools' faculty members with non-LIS advanced degrees in enriching LIS schools' research agenda.

**1.3 Hypotheses**

I hypothesize that:

1. LIS faculty members with non-LIS doctorates have stronger connections with other disciplines than faculty with LIS doctorates. In particular, they publish more in non-LIS scholarly periodicals and receive more citations from non-LIS publications than their colleagues with LIS doctorates.

2. Faculty members with advanced degrees in disciplines other than LIS are well established in their new field and maintain strong connections with LIS i.e. actively publish in LIS journals and get cited by scholars publishing in LIS journals.

3. LIS as a field has strong connections with a variety of disciplines by exchanging and sharing with them research topics and methodologies.

4. Presence of faculty with non-LIS doctorates at the LIS schools has an impact on the level of multidisciplinarity of the overall publications by those school's faculty members.

The strength of the disciplinary connections can be identified based on a faculty member's publishing patterns, i.e., by (1) number of works published in non-LIS journals and (2) number of his/her publications cited by researchers from other fields. Whether or not a journal is LIS or non-LIS will be determined by using the subject categories assigned to the journal in the Web of Knowledge. The same subject categories can be used to determine inter- and multidisciplinary citations to their works. More detailed information on the means of testing these hypotheses will be provided in the section on data collection and analysis.

### 1.4 Significance

Interdisciplinarity and multidisciplinarity are among the most visible trends in modern higher education. LIS schools may need to identify their stance toward those trends to secure and advance their positions at their universities. It is safe to assume that the latter will depend more and more on LIS schools' ability to maintain connections with other university departments through participating in or, better still, initiating interdisciplinary projects and programs. LIS students often have very diverse educational backgrounds and many of them are interested in building upon their existing areas of expertise by obtaining new knowledge and skills in LIS. When they graduate, they serve more and more diverse populations. Future academic librarians benefit from a better understanding of different disciplines. Those who work in public, school, or special libraries also benefit from an exposure to a variety of disciplinary approaches to the most important issues that face modern libraries. An objective estimate of the level of interdisciplinarity of LIS schools is important in order to make informed decisions about the future development of an LIS school, and to choose the strategy that will allow each LIS school to benefit from their multidisciplinarity on both research and administrative levels. Every school is unique and multidisciplinarity is only one of the multiple facets of its composition, nevertheless, as an important and highly visible trend in modern higher education, it is worth careful consideration.

The study strives to shed some light on the disciplinary architecture of the LIS research contribution. Its main goal is to identify the connections that LIS schools' faculty

members maintain with other disciplines as these are revealed through their publishing and citing patterns. Therefore, its significance is threefold, based on three important dimensions of the field: (1) knowledge organization, (2) sustaining professional and disciplinary self-identity, and (3) maintaining connections with other disciplines.

### 1.4.1 Providing access to knowledge

The ultimate goal of the field of LIS is providing access to knowledge in all its complexity. Interdisciplinarity is becoming one of the most prominent features of modern scholarship. It is a critical issue in regard to access to information. Graduates of LIS schools have to be well prepared to deal with interdisciplinary requests from their patrons. It is not an easy task and it appears that libraries are not ready to serve interdisciplinary researchers efficiently. Klein notes "a lack of fit between interdisciplinary needs and existing knowledge taxonomies and classification schemas" (Klein, 1996, 134). Szostak states that no classification schemas serve interdisciplinary researchers adequately (Szostak, 2004). Librarians and information professionals are concerned about this. LIS practitioners and educators, responsible for educating new generations of practitioners and shaping the future of the field, should also understand the structure of modern disciplines and the connections between them. This will help their students understand how to serve diverse communities of users, especially those who are involved in interdisciplinary research activities. Many disciplines are showing interest in multidisciplinary projects and educational programs. The borders of many sciences are changing. Understanding the logic and dynamic of those changes is of crucial importance for librarians who as professionals seek "to organize knowledge and make it accessible" (Klein, 1996, 135). Palmer writes:

> "As preservers and purveyors of cultural and intellectual materials, librarians will need to resist superficial solutions to the complex problems of knowledge exchange. Constructing a strong and useful foundation for research and education depends on in-depth understanding of knowledge structures and how people interact with information and produce new knowledge" (Palmer, 1996, 130).

It is vitally important to understand the difference between information and knowledge in this context as a variety of interpretations and, sometimes, misinterpretations,

exist. Burke says, "We also need to distinguish knowledge from information, 'knowing how' from 'knowing that'. And what is explicit and what is taken for granted" (Burke, 2000, 11). Emphasizing the fact that the distinction is relative, he uses "the term 'information' to refer to what is relatively 'raw', specific and practical while 'knowledge' denotes what has been 'cooked', processed or systematized by thought" (Burke, 2000, 11). Brookes, stressing the distinction between "raw data" and "structured data" refers to knowledge as "a structure of concepts linked by their relations and information as a small part of such a structure" (Brookes, 1980, 131).

Moreover, there are different schemas of knowledge. For instance, Eriksson names three kinds of knowledge – "a class of every-day knowledge, a class of what might be called 'ideological' knowledge and a class of scientific knowledge" (Eriksson, 1975, 8). Gurvitch divides knowledge in 7 categories: perceptual, social, everyday, technical, political, scientific and philosophical (Gurvitch, 1971). None of these classifications is discipline-based. In order to provide access to knowledge, information professionals cannot limit themselves to knowledge in one discipline. Zins argues that information science "should be called "knowledge science", rather than "information science" (Zins, 2006, 447-448).

Due to the fluidity of definitions, it is simpler to provide access to information than to knowledge. Modern LIS professionals sometimes seem to focus on the task of providing access to information rather than introducing their patrons to contemporary knowledge through the most appropriate and up-to-date systems of classification and categorization, along with teaching them how to use these systems. Emphasizing the role of libraries in the process of knowledge acquisition, Burke writes, "The sociology as well as the geography of libraries is also relevant to the history of the acquisition of knowledge" (Burke, 2000, 178). The way librarians organize and present information[4] can facilitate or hinder the process of learning and research. This is why awareness of new disciplinary connections might be considered important both for LIS practitioners and LIS theoreticians.

[4] Information organization and representation imply a variety of activities, such as reference, indexing, and cataloging. All of them require clear understanding of the structure of modern knowledge domains.

### 1.4.2 Maintaining identity

The study can provide objective data about LIS professional and disciplinary identity. As LIS practitioners are interested in understanding the nature and structure of knowledge as a whole, the discipline should pay close attention to the structure of the LIS domain and its connections with other disciplines. Modern LIS is a very dynamic field. Its subjects and objects are changing. Above all, LIS is a relatively young discipline still building its disciplinary identity and self-image. According to Borgman, disciplinary 'self-awareness' is important to every field of study because it "marks any maturing field" (Borgman, 1990, 12).

The fact that LIS schools hire faculty without advanced degrees in LIS concerns the community of LIS educators[5]. Some of them consider it the only way for the field to evolve, while others do not see any positive effects in the presence of scholars with non-LIS Ph.D.'s. But the very fact is an important indicator of some processes ongoing within the field.

The publishing patterns of faculty members with non-LIS doctorate can potentially lead to better understanding scholarly processes in LIS in general. As human beings can understand themselves and see their idiosyncratic features through communication with other human beings, so can disciplines better "understand" themselves through comparison with other disciplines because "when one inhabits a system, it generally looks like 'common sense'. Only by comparison can one see it as one system among others" (Burke, 2000, 2). As Knorr Cetina states, "Using a comparative optics as a framework for seeing, one may look at one science through the lens of the other. This 'visualizes' the invisible; each pattern detailed in one science serves as a sensor for identifying and mapping (equivalent, analog, conflicting) patterns in the other" (Knorr Cetina, 1999, 4).

This study proposes to identify linkages between LIS and other knowledge domains through bibliometrics so as to identify and/or clarify the disciplinary and professional identity of the field of LIS.

### 1.4.3 Collaboration with other disciplines

The study is not limited to the question whether or not LIS educators without doctorates in LIS research and publish primarily in other disciplines or build connections

[5] The discussion on JESSE in May 2003 shows that this issue is of serious concern to a number of LIS educators.

between those disciplines and LIS. The study seeks to answer more general questions about connections between our field of study and other knowledge domains.

Disciplinary boundaries are not carved in stone. Scholars do migrate between different fields in the course of their careers. Such "field switchers" "play a particularly important role in the transfer of knowledge from one discipline to another" and therefore constitute "an interesting group to study" (Van Houten et al., 1983). Identifying the paths taken by such scholars may help situate the position of the discipline of LIS within the circle of other fields. Hargens states:

> "Migration patterns should reflect cognitive relations among fields. For example, when two fields exchange large numbers of scholars, the fields probably share important cognitive commonalities. Similarly, when large numbers of scholars trained in one field migrate to a second, but few from the second migrate to the first, it is likely that the theories or methods of the first have significant applications in the second but not vice versa. Thus, the flow of ideas from one field to another is often accompanied by the movement of scholars in the same direction. Indeed, such movement appears to be a common factor in the emergence of new fields" (Hargens, 1986, 147).

Thus, mapping migrations of scholars from different disciplines to LIS schools and tracing the publishing patterns of those scholars, according to Hargens, may establish "cognitive commonalities" of different disciplines, and may predict the future development of LIS as a knowledge domain. As Small writes, "Studying the nature of pathways through science can suggest mechanisms for specialty growth... Links within specialties often involve incremental extensions of knowledge based on shared themes, while interdisciplinary links involve imaginative leaps based more subtly on analogy. The exploration of these pathways raises intriguing philosophical questions about how different knowledge domains are connected, what Wilson (1998) calls the consilience of science" (Small, 2003, 396). William Whewell came up with the term in 1840, "literally a 'jumping together' of knowledge by the linking of facts and fact-based theory across disciplines to create a common groundwork of explanation" (Wilson, 1998, 8). Wilson explains his choice of the word, "Consilience is the key to unification. I prefer this word over 'coherence' because its

rarity has preserved its precision, whereas coherence has several possible meanings, only one of which is consilience" (Wilson, 1998, 8).

A study of a particular group of migrant researchers (from other disciplines to LIS), who make "a jumping together of knowledge" possible, might provide answers to some of those "intriguing questions" Small mentions. Van House and Sutton, using the ecological model for analyzing the situation in the LIS field, emphasize the importance of being aware of the processes going on in the discipline as the very first step to survival in rapidly changing environments:

> "The first step in changing one's habitus[6], especially in the face of changes in one's field, is to become aware of one's own habitus and to realize that one's competitors may not share one's assumptions about the rules of the game and the capital that is valued, interpretations of the situation, and assessment of possible strategies" (Van House & Sutton, 1996, 145).

We are living in an information society (Burke, 2000). It makes interest in the field of LIS and its "players" even more acute. Clear understanding of what migrants from other disciplines bring into LIS may help practitioners and scholars keep in touch with the new reality of the information society. It is especially important for professional schools because they must quickly respond to widening or changing research agendas in order to educate practitioners. King and Brownell state that occupational training should be supplemented with broader education, liberal, in particular. They write, "Without more extensive liberal education ...the professions will not carry out their most responsible roles in society" (King & Brownell, 1966, 7).

[6] The concept of "habitus" was developed by Pierre Bourdieu (See Bourdieu, P. & Passeron, J.-C. in Reproduction in Education, Society and Culture, 1977).

## CHAPTER 2: LITERATURE REVIEW

The process of researchers migrating from one discipline to another has a dual nature. These migrations are complex social processes, reflecting changes in different spheres of society, including science. On the other hand, they mirror epistemological changes in the process of knowledge evolution. This review outlines the terms, theories, and phenomena relevant to both. Section 2.1 outlines the study's terminological framework, presenting definitions of such concepts as "discipline", "interdisciplinarity", "multidisciplinarity" and those closely connected with the former. Section 2.2 reviews interdisciplinarity and multidisciplinarity as current trends in research and higher education. Finally, section 2.3 shows how those trends manifest themselves in LIS.

### 2.1 Defining interdisciplinarity and multidisciplinarity: The study's terminological framework

The term "discipline" and the ones that derive from it, including "interdisciplinarity" and "multidisciplinarity", have been interpreted by different authors in a number of ways. In this section some of those definitions are reviewed. Section 2.1.1 focuses on the notion of discipline. Section 2.1.2 provides definitions of multidisciplinarity and interdisciplinarity.

#### 2.1.1 Discipline

Before considering inter- and multidisciplinarity, it is necessary to define the concept of discipline. "To understand the prospects and roles and forms of ID [interdisciplinarity], we need to understand disciplinarity (D)" (Gasper, 2001, 2). "The term "discipline" is central to academic life. Everything in academia is shaped by disciplinary boundaries. Scholarly activities take place within disciplines, across disciplines, and in a mysterious "interdisciplinary" space as if the research conducted within this space and the problems this research focuses on do not have their own identity.

Different scholars define discipline in different ways. Some focus mostly on its epistemological dimension, emphasizing ideas, concepts, and methodologies. For example, Szostak emphasizes a combination of phenomena, theories, and methods: "Disciplines can be identified at any point in time in terms of a bundle of phenomena studied and theories and methods applied" (Szostak, 2002, 108). Others include a wider array of components, which

could include value systems, specialized language ("...academic vocabularies operate within disciplinary constraints..." (Downing, 2005, 64)), syntactic structures (Dressel & Marcus, 1982; King & Brownell, 1966) as well as objects, tools, level of theoretical integration, and laws (Boisot, 1972).

Though the term "discipline" is often used as a synonym of "science", some authors clearly distinguish between science as a research activity and discipline as a teaching activity (Heckhausen, 1972, 83). As Fuller states, "disciplines mark the point at which methods are institutionalized..." (Fuller, 1991, 302). Berger defines discipline as "a specific body of teachable knowledge with its own background of education, training, procedures, methods and content areas" (Berger, 1972, 25). As one can see from these definitions, focus on the educational aspect signifies the difference between discipline and science.

The degree of inclusion of a community of scholars in definitions of discipline varies. On one end of the scale is Kuhn's approach, grounded in such elements as underlying theory, models, analogies, and exemplars (Kuhn, 1970). Kuhn talks about "scientific communities" but they are paradigm-based, rather than discipline-based. Whitley's definition of discipline "as a unit of scientific organization" emphasizing the role of scientific communities (Whitley, 1976, 472) can be put on the other end of the scale.

Latucca takes the same stance, stating that disciplines can be defined not only "as sets of problems, methods, and research practices or as bodies of knowledge that are unified by any of these" but also "as social networks of individuals interested in related problems or ideas" (Latucca, 2001, 23). She also emphasizes two layers in the notion, epistemological and social ones.

She defines disciplines as cultures "which have in turn been defined as sets of shared meanings or understandings about a group or organization and its problems, goals, and practices" (Latucca, 2001, 35). Bauer finds this approach important because perceiving disciplines as cultures, "one recognizes that a field or subject – its knowledge, methods, theoretical approaches – cannot be separated from its practitioners" (Bauer, 1990, 111).

Pierce gives a definition of disciplines as "closed communities, separated by boundaries that bar outsiders from participation" and argues that "[this] model is accepted in research on multidisciplinarity in library and information science, as in other fields" (Pierce,

1999, 271). This approach to defining discipline explains why some scholars consider "barring outsiders" a normative disciplinary practice.

Turner puts the main stress on the "actors" rather than on the epistemological foundations. "Disciplines are kinds of collectivities that include a large proportion of persons holding degrees with the same differentiating specialization name, which are organized in part into degree-granting units..." (Turner, 2000, 47). This is an especially interesting approach in the context of this study. Following the logic of this definition, faculty members of "degree-granting units" holding degrees from different disciplines do not belong to the discipline of this particular "degree-granting unit", i.e. LIS faculty with non-LIS doctorates do not belong to the discipline of LIS.

Dervin's approach explains this dilemma to some degree. She says that "...'disciplinarity', more properly, is applied to academic discourse communities than to what are commonly called disciplines" (Dervin, 2003, 7). Such duality is possible because they are just one form of possible organization of knowledge production and transmission. They do not exist as something inherent in the process of what we call knowledge discovery or knowledge construction. Kline argues that "[f]rom a historical view, dividing the part of scholarly knowledge which deals with truth assertions into a large number of separate disciplines is a recent development" (Kline, 1995, 194).

Over centuries, thinking in terms of disciplines became a second nature of researchers and educators. "Our world now seems so naturally divided into, say, biology, sociology, and musicology that when we try to imagine alternatives to these disciplines, we think merely of combining them: biochemistry, sociolinguistics, ethnomusicology" (Messer-Davidow et al., 1993, vii).

This study employs the following definition of discipline: Discipline is a system of phenomena, methods to study them, and research and social environment organized according to principles shared by the majority of scholars working in this environment. This definition covers both the phenomenological and social aspects of the notion. Those two are critical to the study which focuses on connections between disciplines over shared phenomena under study and methodologies, through borrowing and boundary crossing. The latter implies either publishing in journals of other disciplines or actual migration from one disciplinary unit to another.

So many generations of scholars and laypersons were educated and trained within the contemporary system of disciplines and were "disciplined by disciplines" (Messer-Davidow et al., 1993, vii). It may not be easy for them to step into "no-discipline land". This is why a basic understanding of the notion of disciplinarity is critical, especially now, when multi- and interdisciplinary activities become especially visible.

According to Hegel's dialectical principle, along with disciplinary "border guards", there are "border crossers" and "border changers" who tend to ignore lines between disciplines or regard them as something subject to change. Because interdisciplinarity has become one of the most visible trends in the modern process of knowledge production and education, disciplinary divisions are sometimes given a negative connotation. Weingart writes, "Disciplines carry the connotation of and are valued... as being static, rigid, conservative, and averse to innovation. Interdisciplinarity carries the connotation of and is valued as being dynamic, flexible, liberal, and innovative" (Weingart, 2000, 29).

The disciplinary structure of the academic world was more rigid before the 1960-70s when strong interest in interdisciplinary research arose. In 1974, emphasizing the role of disciplines in dividing the academic universe into separate communities, Light wrote, "....The 'academic profession' does not exist. In the world of scholarship, the activities which accompany the five characteristics of a profession[7] center on each discipline. Thus, theoretically at least, we have the academic professions, one for each discipline" (Light, 1974, 12).

Bauer takes as well a rather pessimistic stance toward a possibility of interaction between different disciplinary cultures due to the differences in disciplinary languages. He writes, "Outsiders cannot properly practice an intellectual discipline just as foreigners find it difficult to assimilate into a national culture" (Bauer, 1990, 111). He argues that single elements of culture cannot be transferred into another one. "Shintoism fits just as little with the English way of life as cricket does with the American" (Bauer, 1990, 111). It is a very extreme position. There is much evidence that cultures can "exchange", borrow, and

[7] According to Light, a profession has 5 main "characteristics": "exclusive powers to recruit and train new members" and "to judge who is qualified"; responsibility "for regulating the quality of professional work"; "high social prestige" and "esoteric and complex body of knowledge". Light emphasizes that other authors add more characteristics to this list but they "derive from these five" (Light, 1974, 10).

assimilate each other's elements. So do disciplines. The growing interdisciplinarity in research and education supports this statement.

At the same time interdisciplinarity does not rule out disciplines as such. Disciplines, according to Webber, provide "a context for research, the intellectual background which helps to determine what research methods are used and how research problems are identified" (Webber, 2003, 315). Borders of disciplines may blur and change configuration, and, though some authors consider them "separately identifiable cultures" (Bauer, 1990, 110), there are significant overlaps between those cultures.

What is especially interesting, interdisciplinary trends seem to be an integral part of the process of "disciplinarization". Interdisciplinarity can be viewed as a means of reorganizing disciplines. Weingart points out the paradoxical nature of the relationships between the discourses of disciplinarity and interdisciplinarity, "The seemingly paradoxical mechanism that the more differentiation of knowledge production the more intense will be the call for interdisciplinarity" (Weingart, 2000, 30). Discipline and interdisciplinarity cannot be separated because the changes that lead to shifting disciplinary identity and its "interdisciplinarization" grow within the discipline itself and are results of it inner logic. As Klein writes, "Interdisciplinary activities are the results of historical and contemporary developments in disciplines, professions, and new interdisciplinary fields" (Klein, 1996, 134).

"Disciplines will not vanish", argues Dervin. She maintains that it is necessary to make them "more able to find relevancies from discourses outside their boundaries, more able to talk across these boundaries in ways that can lead to more productive and more useful inquiry" (Dervin, 2003, 7). Perhaps, the growing multidisciplinarity of LIS educators is one of the ways of accomplishing this.

### 2.1.2 Multidisciplinarity and interdisciplinarity

Multidisciplinarity and interdisciplinarity are buzzwords with inconsistent usage. The variety of approaches, for example, to the dichotomy "multidisciplinarity - interdisciplinarity" is quite significant. Some authors emphasize the difference between these two terms while others use them interchangeably. In some cases, a compound term "inter-multidisciplinarity" is used, but this approach is relatively rare. Most authors make a

distinction between these two terms. The following sections provide the most common definitions of interdisciplinarity and multidisciplinarity, and outline different approaches to the phenomenon of interdisciplinarity.

#### 2.1.2.1 Multidisciplinarity

Multidisciplinarity can be considered the very first step away from a single-discipline mode to what may be the final destination of academia's evolution, transdisciplinarity. Multidisciplinarity is a bridge from pure disciplinary activities to activities in an environment characterized by presence of a variety of disciplines. The term does not imply significant epistemological connections between those disciplines but instead indicates that a group of disciplines share space and time, without interactions.

According to Jantsch, multidisciplinarity is "a variety of disciplines, offered simultaneously, but without making explicit possible relationships between them" (Jantsch, 1972, 106). Nicolescu maintains that "the multidisciplinary approach overflows disciplinary boundaries while its goal remains limited to the framework of disciplinary research" (Nicolescu, 2002, 43). Guy Berger defines multidisciplinarity as "juxtaposition of various disciplines, sometimes with no apparent connection between them" (Berger, 1972, 25). Here, multidisciplinarity is presented as a stage of knowledge production, a much more complex phenomenon than just a collection of unrelated disciplines.

Multidisciplinarity can exist on many different levels (university departments, research teams, educational programs, or in the context of a single course). LIS seems to be affected by multidisciplinary activities at all levels. LIS schools provide multidisciplinary classes, offer multidisciplinary programs of study, and have faculty members with a wide variety of disciplinary backgrounds.

As was mentioned before, though some authors do not distinguish between multidisciplinarity and interdisciplinarity, the former is only a preamble to the latter. It implies coexistence of several disciplines without explicit interaction between them.

### 2.1.2.2 Interdisciplinarity

> "The term 'interdisciplinarity' is not a scientific term which has a unique and universally accepted definition. The content of the concept may be interpreted in different ways, and in writings on this subject we encounter a great number of terms which introduce nuances into the interpretations but which, unfortunately, do not always lie in the same dimension and are sometimes contradictory" (D'Hainaut, 1986, 7).

D'Hainaut captures the fluidity of the term. Interdisciplinarity is one of the concepts that have different degrees of "completeness", and is open to a multitude of interpretations. The plurality of definitions of interdisciplinarity is caused not only by different interpretations. Interdisciplinarity itself as phenomenon has many faces, thus, as Bailis observes, the term "...refers to numerous practices that, mixing different sets of specialties, only resemble each other in a family way – variously, not uniformly, with respect to their identifying traits" (Bailis, 1990, 1). Bailis observes that those "practices are always emerging as fresh combinations of materials usually seen separately in specialized fields" (Bailis, 1990, 1). Klein emphasizes the plurality of interdisciplinary practices as well, "Given the diversity of interdisciplinary activities, there are considerable differences of opinion about their nature and epistemological status" (Klein, 1990b, 37).

Interdisciplinarity is often a buzz word, a "secret ingredient", that can serve to magically transform a paper, a school's web site, a presentation. This certainly increases the use of the term "interdisciplinarity" in relevant as well as in irrelevant contexts.

According to Klein, not only the concept of interdisciplinarity is understood in different ways but its origin as well.

> "For some it is quite old, rooted in the ideas of Plato, Aristotle, Rabelais, Kant, Hegel, and other historical figures who have been described as 'interdisciplinary thinkers'. For others it is entirely a phenomenon of the twentieth century, rooted in modern educational reforms, applied research, and movement across disciplinary boundaries" (Klein, 1990a, 19).

Abbott notices that "like most good ideas in social sciences, interdisciplinarity is old news" (Abbott, 2001, 131). According to Klein, the roots of interdisciplinarity reach back in time: the "ancient Romans did not make explicit contributions to the ideas of

interdisciplinarity, but their influence on our conceptualization of humanities was profound" (Klein, 2005, 15).

The term itself has existed since the mid 20th century and has been evolving since. Most scholars, defining interdisciplinarity, emphasize interactions and overlaps between disciplines, as distinct from multidisciplinarity, which does not imply such interaction. The degree of interaction (in a qualitative and quantitative sense) is variable. As Berger claims, "this interaction may range from simple communication of ideas to the mutual integration of organizing concepts, methodology, procedures, epistemology, terminology, data, and organization of research and education in a fairly large field" (Berger, 1972, 25). Jantsch emphasizes that interdisciplinary relationships are possible between related disciplines with common theoretical frameworks "at the next higher hierarchical level or sub-level" (Jantsch, 1972, 106). Bunge argues that this is not the only way of disciplinary convergence. He writes that the "convergence of disciplines can be either horizontal or vertical. The former occurs when two or more disciplines merge on an equal footing..." (Bunge, 2003, 130).

Nicolescu claims that interdisciplinarity means "the transfer of methods from one discipline to another" and describes "three degrees of interdisciplinarity: (a) degree of application [...]; (b) epistemological degree [...]; (c) degree of the generation of new disciplines" (Nicolescu, 2002, 43). Szostak stresses that researchers involved in interdisciplinary studies "do not, in fact, integrate across disciplines *per se*, but across phenomena, theories, methods, and perspectives (while eschewing various biases -- disciplinary and other)" (Szostak, 2002, 119).

The manner in which one discipline ventures into the intellectual territory of another discipline can be very complex and hard to comprehend. "[D]ifferent disciplines may use different terminology to describe the same phenomenon, process, or even theory" (Szostak, 2002, 107). Interdisciplinarity cannot be simply presented as a Venn diagram. It is not just an overlap of disciplines including all their aspects (social, cognitive, administrative etc.). It is much more complex. Palmer states that there is more than one way for disciplines to integrate. She writes that "there are many ways that people and information move across boundaries and interact effectively during the course of complex and integrative scientific work" (Palmer, 2001, ix). Migrating from one field to another is one such way, as in the case of LIS schools hiring faculty members with non-LIS degrees. The goal of this study is to

find out if this practice results in establishing new connections between LIS and other disciplines.

Not all disciplines demonstrate equally strong tendencies for interdisciplinarity. Prentice argues that well-established disciplines are "inherently stable and somewhat resistant to change from outside influence, those activities that do cross disciplinary lines often have limited success" (Prentice, 1990, xvii). "Young" disciplines are more mutable because they have not completed the process of self-identification (Abbott, 2001).

This brief review of different points of view on the issue of disciplinarity shows the variety of approaches to defining the interactions and different degrees of integration among disciplines. The very notion of discipline seems to become more and more difficult to fathom for many reasons, but especially because of the introduction of new information technologies into virtually all knowledge domains. Thus, the problem area addressed by this study consists of ill-defined domains and a certain degree of "fuzziness" in research methodology. The means of addressing this problem is described in the section on data collection and analysis.

Interdisciplinary and multidisciplinary activities become common in all spheres of society. Education deserves special attention in this regard because educational programs are often starting points for those involved in interdisciplinary and multidisciplinary research and practice. Efficient interdisciplinary education is a basis for successful interdisciplinary projects. The following section describes interdisciplinarity and multidisciplinarity as a modern trend in higher education.

### 2.2 Interdisciplinarity and multidisciplinarity as a modern trend in higher education

There are many examples of changes in departmental environments that are multidisciplinary by nature. Interdisciplinary courses, projects, and programs became very popular in different disciplines and on different educational levels (Pirrie et al., 1998; Seal, 1998; Forest & Keith, 2003; Stefani & Matthew, 2002).

This section shows that interdisciplinarity and its predecessor, multidisciplinarity, are one of the most visible trends in modern science. These days, the concept of interdisciplinarity is as legitimate as the notion of discipline. Interdisciplinarity is not something foreign to the established disciplines, not "nothing between something" but rather

"something between something" applying the expression which famous Russian-American actor and theater director Michael Chekhov used to describe the role of pause in the theatrical performance (Chekhov, 1999). Interdisciplinary zones of science reflect the changes in the relationship between the current paradigm and the real world. Klein maintains that interdisciplinarity is a necessary stage of knowledge development. She writes, "Recent accounts indicate that interdisciplinarity is no longer peripheral to the academy but is regarded in many quarters as essential to the knowledge system" (Klein, 1996, 134).

The idea of enrichment of the disciplinary nature of educational institutions is not new. Plato emphasized the importance of synthesizing knowledge. Roman educators, according to Klein, were concerned about sufficiency of one discipline based higher education (Klein, 1990a).

Experts on the subject note waves of interest in interdisciplinarity research and education over the 20th century (Klein, 1990a), and point to the late 60s and early 70s as the start of the contemporary trend (Latucca, 2001; Prentice, 1990; Sá, 2006). Interest never faded completely but its strength decreased significantly over the years. "After an emphasis on general education and interdisciplinary studies in the late 1960s and early 1970s, the academic curriculum settled back into the earlier discipline related mold" (Prentice, 1990, xx). In 1990, Prentice writes, "Despite several decades of efforts in support of interdisciplinary study, it continues to be the stepchild of the university" (Prentice, 1990, xxiii).

Interest in interdisciplinarity increased again at the turn of the 20th century. The current borders between traditional disciplines, sciences, professions started to blur as knowledge continues to evolve, but the final destination of scientific and educational organizations, and their future shapes are unclear. Unbiased understanding of the process taking place within the disciplines and between them might help university departments to choose the right strategies for keeping their programs up-to-date and design new ones reflecting the current state of knowledge development. It is especially critical because of the strong impact of new information technologies on all spheres of the society.

Technological changes contributed to the holistic approach to research and education and blurring or redefining disciplinary boundaries a great deal.

> "The fracturing or fissioning of disciplines into new specialties has been the dominant pattern of knowledge growth in the twentieth century. Yet there have been more breakups and recombinations throughout the sciences over the past three decades than in the previous millennium" (Klein, 1993, 192).

First of all, new computer technology provides entirely new possibilities for scholars to communicate and create virtual interdisciplinary research teams. Second, the necessity of keeping up with new technology has been imposed on all disciplines so that they involuntarily had to add some technological components to their curricula.

Mission- or user-orientedness became another general trend that contributed to reshaping many professions and occupations. Consequently, there are two basic ways of creating new interdisciplinary programs, mission-oriented and user-centered. They reflect two general tendencies in society and science. Roy argues that "the structure of all major research universities of the twenty-first century will include a permanent organizational framework accommodating both discipline-oriented and mission-oriented entities" (Roy, 1979, 192). He claims that there are "some permanent missions that will be with society far beyond any discipline. They correspond to the basic human needs..." (Roy, 1979, 193), such as information.

Roy states "that interdisciplinarity is inherent in the nature of reality, and that a major part of its *raison d'etre* is the university's responsibility for dealing with the problems of society" (Roy, 1979, 195). Growing interdisciplinarity is a complicated process that, most likely, will be undertaken by different sets of disciplines grouping around particular social needs in a variety of ways. The process of "interdisciplinarization" of universities can take different forms. Van House and Sutton maintain that "hybridization (interdisciplinarity)" includes "interdisciplinary faculty and joint appointments, cooperative research ventures, joint degrees, and cross-listing of courses" (Van House & Sutton, 1996, 143).

Universities are well established institutions with highly sustainable, sometimes, rigid, structures. Universities can be compared with a complex organism that maintains its structure and "homeostasis" as a result of a complex combination of processes. Departments (or schools, or colleges) are the main units of universities. According to Prentice, their primary task is to guard their disciplinary identity and "to discourage formal research and activities that cross disciplinary lines" (Prentice, 1990, xxi). She cites Sears, "The rise of

disciplines ...is inextricably linked with the growth of bureaucracy within academic institutions and outside of them in diverse professions relating in various degrees to particular disciplines" (Prentice, 1990, xxii). Sá states that "recent evidence points to a growing questioning of the traditional university structures, policies, and practices that pose obstacles to interdisciplinary research" (Sá, 2006, 1). But university structure is flexible enough to foster interdisciplinarity when facing complex social problems which cannot be solved within any single discipline.

University administrations have to prioritize future development. No one can predict how knowledge production will change over the next decades. This is one of the core reasons why universities are interested in multi- and interdisciplinarity. Weingart writes, "The discourse on interdisciplinarity is, in effect, a discourse on innovation in knowledge production. ....The hope is in the future, but the future is unknown, without structure" (Weingart, 2000, 30).

Jantsch names universities among those key social institutions that will shape the future. Pointing out the importance of "the capacity for dealing effectively with systems in an integrative way, cutting across social, economic, political, technological, psychological, anthropological and other dimensions", he writes, "Instead of training for well-defined, single-track careers and professions (by duplicating existing skills), we will need a type of education which fosters judgment in complex and dynamically changing situations" (Jantsch, 1972, 102).

This approach is extremely important for LIS schools. Like all professional schools, they are responsible for keeping strong connections between research in the field and its praxis. Prentice argues that "professional schools are less threatened by interdisciplinary study than are the discipline-based departments" (Prentice, 1990, xxii), because they always had to maintain disciplinary and interdisciplinary approaches to their curriculum. Paisley maintains that professional schools often provide multidisciplinary training (Paisley, 1990, 5), probably, because, "[i]nterdisciplinarity is considered the best way to face practical research topics since synergy between traditional disciplines has proved very fruitful" (Morillo et al., 2003, 1237).

In professional schools, social requests change research agendas while new scientific discoveries enrich professional practice. Bunge emphasizes the importance of

interdisciplinarity in the social sciences and maintains that "because social facts are multifaceted, social issues are best tackled in either a multidisciplinary or an interdisciplinary manner" (Bunge, 2003, 176). Kavaloski emphasizes several advantages of interdisciplinary education, which provides "an intrinsically integrative learning experience for the students; i.e., it encourages the student to perceive the various components of human knowledge within some larger holistic framework" and "freedom of inquiry" across the borders of several disciplines that prepare students to deal with the real world and its real problems (Kavaloski, 1979, 224). The latter is especially important when change becomes the only constant as in the world of libraries and librarians, and, when putting it in a broader context, information professionals prepare themselves for the unexpected. Sá points to "widespread adoption of interdisciplinarity as an institutional goal or strategy among research universities over the past 6-10 years" (Sá, 2006, 1). She states that many leading universities "boast commitments to fostering interdisciplinary activity on their campuses...promoting interdisciplinarity is viewed as an organizational problem – enabling collaborative research among faculty from different disciplines" (Sá, 2006, 1).

The word "interdisciplinarity" signifies a complex combination of activities, processes, tasks, levels of inquiry, and problems. It is not easy to make bridges between different knowledge domains. They overlap sometimes, but do not constitute a continuity of ideas, theories and methodologies. Because of that, broadening a disciplinary terrain is not an easy task and not all scholars are equally interested in interdisciplinary research and teaching. Brenda Dervin writes,

> "In our insular communities it is easy to move happily along missing the growing and generalized state of disarray in our work. It is also easier when brushing the edges of the chaos to build larger moots [sic] and thicker walls to protect our discourse from exterior invasion and the mind-wrenching task of having to attend to the chaos that is, in actuality, the state of human studies" (Dervin, 2003).

Dervin, referring to Brewer, names the obstacles to communication across disciplines: (1) different cultures and frames of reference, (2) different methods and operational objectives, (3) different 'languages' within [discourses] and between [discourses and the world at large], (4) challenges related to gaining the trust and respect of others working in

different [discourses] and fields; (5) institutional impediments related to incentives, funding, and priorities given to disciplinary [discourse] versus interdisciplinary [inter-discourse] work; (6) professional impediments related to hiring, promotion, status, and recognition (Dervin, 2003, 7-8).

Within interdisciplinary or multidisciplinary teams of researchers or educators the problems start, first of all, at the level of language. Scholars from different fields of studies sometimes cannot communicate their ideas to each other efficiently because they speak in different disciplinary languages. This can prevent some interdisciplinary projects from further development. In other cases contributions from different disciplines do not blend well enough to make them cohesive enough to move the project forward. Such projects or programs can be called interdisciplinary only at the stage of planning. Some authors do not believe at all that the problem of different disciplinary languages can be overcome. Bauer, for example, argues, "The difficulty of interdisciplinarity strikes home as one tries to imagine what Interlingua speaking might mean" (Bauer, 1990, 114). He points out that the results of any attempt to create an interdisciplinary language can be compared with short-lived universal languages such as Esperanto or Volapuk (Bauer, 1990).

Personality matters too. As some people never travel to other countries preferring to stay within the comfort of their own cultures, some scholars are quite reluctant to make a journey to another knowledge domain. Differences between disciplines can be compared with the ones between countries. Sometimes they are nearly imperceptible, sometimes they may be difficult to ignore. As Hollinger points out, "Nowhere did the theory wars and the identity debates proceed more fiercely than where academics confronted each other across disciplinary lines" (Hollinger, 1997, 354).

There are scholars who are not afraid of the "mind-wrenching task" of interdisciplinarity, as Dervin puts it; on the contrary, they are interested in moving towards new knowledge domains. Some of them not only participate in inter- or multidisciplinary projects with scholars from other disciplines but actually change their field of study as a result.

Van Houten and his colleagues studied migration of physicists to other academic disciplines in the Netherlands and came to several important conclusions. In particular, scholars-migrants "seem to render a useful and important service" and wanted their discipline

(physics) to "have more influence in their present fields" (Van Houten et al., 1983, 266). His conclusions might be applicable to the LIS discipline as well since there are many faculty members at LIS schools with non-LIS doctorates. The reasons to move from one field of study to another are not limited by scientific curiosity. Scholars can have a number of different motives for moving to other disciplines but this issue is beyond the scope of this study.

Some university departments are more likely to attract interdisciplinary scholars and foster multidisciplinarity, such as sociology departments (Seal, 1998). There are multiple examples of multidisciplinary approaches in the fields of Engineering (Norman & Frederick, 2000), Health Care (Pirrie et al., 1998; Richardson, 2003), Business (Hill, 1990), and Statistics (Ojeda & Sahai, 2003).

Sá points to the emergence of "new departures from traditional academic models". The LIS schools' model might be one of them. The multidisciplinarity of LIS schools is a well established fact (KALIPER Project, 2001). LIS is a hybrid discipline. Klein describes "two basic types of hybrids: an *institutionalized form*, which become a recognized subfield or permanent cross-disciplinary committee or program, and informal hybrids, disciplinary exchanges that remain at the level of topics and cross-disciplinary contacts" (Klein, 1993, 192). Both hybrid forms can be found in modern LIS. First, a substantial percentage (37%) of LIS faculty members hold advanced degrees in disciplines other than LIS[8]. Second, data shows a significant amount of "disciplinary exchange ....at the level of topics" (Klein, 1993, 192). The next section focuses on the possible reasons for this phenomenon.

## 2.3 Interdisciplinarity and multidisciplinarity in LIS

This section first focuses on the importance of the idea of interdisciplinarity for LIS researchers, practitioners, and educators. Section 2.3.1 describes the concept of interdisciplinarity in the context of LIS. Section 2.3.2 outlines the composition of the discipline of LIS. Section 2.3.3 presents the notion of information and its contribution to the growing interdisciplinarity of the field of LIS. The intrinsic interdisciplinarity of IS as a discipline is described in section 2.3.4. Section 2.3.5 outlines the relationships of LIS with

[8] See Chapter 5: Results, section 5.3.1.1 "Ratio between faculty members with LIS and non-LIS doctorates"

other disciplines. Finally, section 2.3.6 focuses on "exporting" and "importing" features of LIS.

### 2.3.1 The concept of interdisciplinarity and LIS

For those who professionally associate themselves within the discipline of LIS in general, and LIS education, in particular, the interest in interdisciplinarity and multidisciplinarity is twofold. First, multidisciplinarity of LIS is increasing. According to the KALIPER Report, LIS educators constitute a very multidisciplinary group of scholars representing such disciplines as history, education, psychology, political science, English literature etc. Second, LIS' primary goal as a profession and a field of study is providing access to knowledge. As Fallis puts it, "LIS is primarily concerned with .... increasing the amount of knowledge possession ... through the storage, retrieval and dissemination of recorded information" (Fallis, 2000, 305-306). In order to "store, retrieve, and disseminate" knowledge efficiently, LIS researchers and practitioners have to understand its organization. Section 2.2 described multidisciplinarity and interdisciplinarity as important trends in modern research and education. The LIS community is well aware of these trends. LIS researchers have new opportunities for broadening their research agendas. It is important for LIS practitioners to know how to deal with increasingly interdisciplinary requests; and LIS educators' responsibility is to help the former to work in interdisciplinary environments. Finally, administrators have more chances than before to make connections with other university units by increasing their schools' involvement in all-campus academic life, or, to make existing connections with other departments stronger and more elaborate. The latter, according to Paris (1990), is one of the ways to prevent schools' closures and secure the future[9].

Today, LIS practitioners have to deal more and more often with interdisciplinary requests. Are they up to the task yet? Apparently, the level of effectiveness of library services for interdisciplinary scholars varies and there must be some libraries and information centers that handle interdisciplinary requests well, but, as a whole, librarians have a longstanding tradition of performing their services in discipline-structured environments. The whole idea

[9] Paris studied the LIS schools' closures in the 1980s and came to the conclusion that isolation from other academic departments was one of the reasons that LIS schools were closed (Paris, 1990).

of hierarchical classifications is inseparable from the idea of disciplinarity of knowledge. Perhaps, it is not an accident that more fluid or "disaggregated" systems, such as faceted classification, are associated with interdisciplinary search (Feeney & Bozeman, 2005).

The field as a whole might not be ready to move to higher level of interdisciplinary information services, because the current classification systems are not as suitable for tackling interdisciplinary problems as for the ones dealing with only one discipline. Those schemas evolve over time but, perhaps, not fast enough to accommodate the growing interdisciplinarity. Information professionals, especially academic librarians and librarians serving researchers in special libraries, might face an issue of their current classification schemas becoming obsolete, or, at least, not efficient enough to perform interdisciplinary searches. "Present methods of document classification in libraries serve the interdisciplinary researcher poorly...", maintains Szostak, an economist by training (Szostak, 2002, 108). Reforming existing classification schemas or designing new ones would take not only expertise in knowledge organization but understanding the system of knowledge as well.

Szostak notes that it takes more effort to perform a literature search for an interdisciplinary project than for one conducted within a single discipline. He writes, "The responsibility of performing an extensive literature review is greater for interdisciplinarians than for disciplinarians..." (Szostak, 2002, 108). This means that the scholars involved in interdisciplinary projects might need more assistance from information professionals. Yet, "[t]he disconnection between librarians and faculty is evident in several ways, and for many inside academia, this disconnection is not surprising" (Christiansen et al., 2004, 118). The analysis of the reasons of this disconnectedness is beyond the scope of this study, but it is necessary to note that the lack of in-depth understanding of research process and information seeking in different disciplines on the part of librarians might be one of them. It might increase if librarians will not follow the most current trends in knowledge evolution.

Clearly, preparing the field to serve more culturally and disciplinarily diverse communities is a responsibility which must be shared by LIS practitioners, researchers, and educators. LIS scholars, working on various systems of information retrieval, need to find the most efficient ways to provide quality service for interdisciplinarians. Information professionals, especially academic librarians and librarians serving researchers in special libraries, have to have a solid interdisciplinary training and full awareness of the modern

multi- and interdisciplinary trends in research. It is the task for LIS educators to provide up-to-date training for the future information professionals who will unavoidably work in highly multicultural and multidisciplinary environments. Detailed analysis of such training is out of the scope of this study, but it is safe to assume that the presence of faculty with non-LIS doctorates might be a basis for fostering interdisciplinarity of LIS education.

Collaboration has become one of the key issues in academia. Through collaborating with other university departments and a variety of other educational scientific institutions, and within the LIS schools themselves, librarians strengthen their scholarly and administrative positions. Budd notes, "Within the realm of social epistemology, the time is ripe, given the evolving nature of higher education in curricula and in access, for us in librarianship to place the library into the social context within which knowledge is possible" (Budd, 2004, 362).

The legitimate question is what part of LIS is "responsible" for attracting scholars from other disciplines to the field and, consequently, to its education. In order to answer this question, it is necessary to take at least a brief look at the relationship between librarianship and information science, which, despite numerous discussions, remains unresolved, and is still understood in a variety of ways.

### 2.3.2 LIS as a compound discipline: Library Science and Information Science

By definition, LIS is a compound field. It combines two disciplines, Library Science and Information Science, and the relationships between the two have been always complicated and interpreted in a variety of ways (Rayward, 1983b; Shera, 1972; Shera, 1983), and sometimes perceived as conflicting: "Two conflicting paradigms, the Library Service and the Information paradigm, are competing for acceptance by the professional library community..." (Apostle & Raymond, 1997, ix). As Harris put it, "Despite the widespread use of this term [information science], however, considerable confusion remains about exactly what distinguishes librarianship or library science from information science" (Harris, 1992, 35). Gorman even called information science "librarianship practiced by men" (Gorman, 1990, 463). Even a quick review of the literature on the matter shows that almost every author writing on the history of LIS has his own story, his own interpretation of the process of librarianship and information science getting together (Rayward, 1983a,b;

Kochen, 1983; Shera, 1983). These interpretations are individual and reflect each author's professional and research experience. One thing that most LIS practitioners and researchers agree upon, is the fact that coexistence of library science and information science was unavoidable (Robbins, 1998).

Though they happened to coexist in LIS schools, in terms of methodology and theoretical framework, library science and information science are not always perceived as "peers". Robert Taylor characterizes the shift from a "Ptolemaic information universe with the library at its center to a dynamic, Copernican universe with information at its center and with libraries playing a significant, but not necessarily central, role" (Van House & Sutton, 1996, 134). Information Science appears to be more complex, its structure is better developed, it has more solid connections with other disciplines (Computer Science, Communications, Education). As Shera warned, "...We who are librarians must constantly remind ourselves that information science is an area of inquiry, of research. It is not, as is librarianship, a service or a practice" (Shera, 1983, 387). At the same time, there are doubts whether or not information science has reached the stage of a science/discipline. Rayward maintains that "[t]here is a fundamental problem for some in the use of the word 'science' in this connection. Is information science really a 'science'?" (Rayward, 1996, 3). Webber observes that the question "is IS a discipline at all?" "has been posed since the birth of IS" (Webber, 2003, 311). And those who consider IS a discipline define it in a variety of quite different ways.

Nevertheless, many authors think that the merger of library science and information science is a natural process because the underlying "Library Service and the Information paradigms have many areas of convergence" (Raymond, 1997, 33). The relationships between the parts of LIS seem to be too complex to define clearly what kind of convergence is applicable, vertical or horizontal[10]. Perhaps the convergence has not been complete and the two fields have not blended well enough to constitute one discipline. The fact that both disciplines are relatively young and some even do not consider them disciplines at all, as was mentioned before, complicates the situation even more.

[10] Bunge states that the "convergence of disciplines can be either horizontal or vertical" (Bunge, 2003, 129). The former implies merging "on an equal footing" while the latter takes place in case of reduction of one discipline to another.

The debates over the relationship between library science and information science seemed to become more intense because of growing multidisciplinarity of the field and its education as was stated in the KALIPER report (KALIPER Project, 2001; Sutton, 2001). The recent wave of discussions was triggered by Michael Gorman's concerns over the shifting focus from library science to information science, that the former "has been pushed out or otherwise negatively affected by the incursion of information studies or information science-oriented faculty into most LIS programs" (Dillon & Norris, 2005, 281). A number of LIS scholars responded to Gorman's editorial stating their disagreement with Gorman's position. Dillon & Norris write that the "claim to unravel relates to paradigmatic dominance, which implies that information science has taken over library education, and in so doing, had pushed the concerns of libraries aside. This casting of the field into two divided camps is nothing new, but it is no longer clear that this division reflects the reality of many LIS programs" (Dillon & Norris, 2005, 283).

Indeed, these debates over relationships between library science and information science are important in the context of LIS education. Stieg argues that "the relationship between librarianship and information science is probably the most complex intellectual problem education for library and information science faces today" (Stieg, 1991, 10). Commenting on the idea of Apostle and Raymond (Apostle & Raymond, 1997) about the necessity of the convergence of library and information science education, Buckland argues that "this assumption is being increasingly seen as overstated". He points out that "[t]here is scope for the recognition of underlying similarities and for technology transfer. Some techniques may well be widely applicable, but each application area, each island of professional art, remains richly and complexly different if examined carefully" (Buckland, 1999, 973). Difference between the languages of different disciplines are also evident within LIS. According to Dingle, these differences might cause problems in LIS education. She writes, "The vocabularies of library science and information science have some shared terms, some unique terms, and some similar but not truly synonymous terms" (Dingle, 1986, 18).

Capurro and Hjørland emphasize the key position of information both for library science and information science and its significance for both thus providing solid grounds for interdisciplinary connections, "As we have seen, the word *information* has a much richer history than the fields of inquiry known as library science, documentation, and information

science, which are largely products of the 20th century. Tracing the influence of this term and the very complex net of disciplines connected with it is indeed difficult" (Capurro & Hjørland, 2003, 377-378).

### 2.3.3 Notion of information and LIS

LIS is responsible for educating those who will accumulate, store, sorting, organize, and provide access to information and study these processes[11]. Though at first librarians apparently did not think in such terms, they certainly accumulated, stored, organized, and provided access to information by all means which were at their disposal in any given library in any given era. They might have focused on different parts of the continuum but the nature of their work was based on the concept of information whether they were familiar with it or not.

LIS is built upon the phenomenon of information. Not on the concept, because it was formulated rather late, but on the phenomenon itself which exists according to its inner logic whether those dealing with it could name it and define it or not. Modern librarians seem to have some advantage over their predecessors because they are aware of the concept of information; only the concept is so elusive that familiarity with it helps members of modern LIS communities perhaps as much as confuses them.

Information is an extremely complex notion. As Williams put it, "It's a phenomenon, a process, a system, a product, and a service" (Williams, 1997, 3). No one so far could formulate an ultimate definition. Buckland states, "'Information' has multiple meanings" (Buckland, 1999, 972).

Webber maintains that "[t]here has been much discussion of the meaning of 'information', probing alternative interpretations of the word" (Webber, 2003, 312). The recent article of Bates (Bates, 2006), providing a comprehensive overview of the term, does not resolve this. The term is too elusive to be interpreted so that it would be equally useful in any knowledge domain. What is meant by "information" varies so widely according to the backgrounds and perspectives of individual investigators that it may be more appropriately referred to, as Machlup and Mansfield suggest, in the plural (Machlup & Mansfield, 1983).

[11] Borko states that information science "is concerned with that body of knowledge relating to the origination, collection, organization, storage, retrieval, interpretation, transmission, transformation, and utilization of information" (Borko, 1968, 3)

Plurality of understanding the concept of information leads to plurality of its definitions. "It has been estimated that several hundred definitions of the word 'information' exist. This simply reflects the fact that information is a complex idea, used by different people in different ways" (Meadows, 2001, 15).

The definitions vary in the degree of generalization and their focus on particular elements of the phenomenon. Most of the definitions of information are domain-dependent. Those of them that are general enough are not very useful. Rayward observes,

> "At one extreme, almost everything could be argued to be information. The history of the universe would then become the history of information processing. The history of humanity becomes the history of information processing within a social context. If everything is information, then not only is all history the history of information, all scientific work is information science..." (Rayward, 1996, 4).

All this means that information is an extremely difficult thing to "take care of" (to organize, to store and to provide access to). Given a phenomenon with this level of generalization and yet so central to modern society, the result is that it can be difficult to draw the line between different domains. In fact, everyone, both individuals and organizations, can accumulate, store, organize information and even provide access to it. This makes the LIS field very sensitive to the issue of its identity and its borders because of the ubiquity of those proceses. On the other hand, information relates LIS with virtually all other fields. Such links can be especially important now when, as Kaplan puts it, "enormous changes at every level of modern society can be associated with the concept of information" (Kaplan, 1965,7).

Since the notion of information penetrates all knowledge domains to some extent, information-seeking scholars might occasionally travel from one knowledge domain to another without noticing it. Perhaps it is the universality of information as a research object, that accounts for the fact that scholars with non-LIS doctorates work at LIS schools.

Despite its elusive nature or, more probably, because of it, information is absolutely ubiquitous. It provides the basis for LIS' connections (e.g., cross-references) with practically all other disciplines and professional fields. These connections may strengthen with the increasing importance of information in society. As Saracevic puts it, "As the importance of

information is increasing in society, more and more resources and expenditures are channeled into various information-related activities" (Saracevic, 1999, 1054). For LIS researchers and practitioners it may expand research fields and opportunities to work with researchers from other domains. Interestingly enough, the first line of interdisciplinary interactions takes place within the heritage of LIS itself. The history of the complicated, intricate, sometimes painful, relationships between library science and information science continues to be one of the most salient issues in LIS. The best minds in the field discuss information science and its status as a discipline but piling up publications does not seem to bring a relief or an ultimate solution. The field keeps mobilizing its best intellectual resources for the quest of LIS identity.

The full complexity of the topic is beyond the scope of this study so the following section, rather than describing information science and its relationships with library science, provides a brief outline of the topic with a special focus on the interdisciplinary potential of LIS.

### 2.3.4 Interdisciplinarity of information science

> "The interdisciplinarity of information science is a continuing theme in attempts to define it" (Rayward, 1996, 4).

First of all, while speaking of information science it is important to remember that even though the expression "information science" is standard, and LIS schools grant doctoral degrees in information science, the expression is still under scrutiny by the LIS community. Moreover, because information science research covers a wide array of problems, topics, and phenomena, some authors are not even sure that information science is just one discipline. Zins writes,

> "Apparently, there is not a uniform concept of 'information science'. The field seems to follow different approaches and traditions; for example, objective approaches vs [sic] cognitive approaches, the library tradition vs [sic] the documentation tradition vs [sic] the computation tradition, and so on. The concept has different meanings. Different meanings imply differ knowledge domains. Different knowledge domains imply different fields. Nevertheless, all of them are represented by the same name, 'information

science'. No wonder that even scholars and practitioners are subject to confusion" (Zins, 2006, 447).

Webber writes, "One issue which has been debated is whether IS is one discipline, albeit with many specialisms, or whether there are many IS disciplines" (Webber, 2003, 321). The speculations on the composition of information science as a set of disciplines are important and interesting not only for theoreticians. The intrinsic interdisciplinarity of information science is especially evident in the research agenda and methodology of IS.

Some authors make one more step toward dismantling the term information science and "declare that diversity of research problems indicates such a lack of cohesion that IS cannot be called a discipline at all" (Webber, 2003, 314). On the other hand, Rayward, surveying some definitions of information science, comments on a very broad one, "The breadth of this kind of approach only makes sense if information science is seen as a metadiscipline directed at understanding the explanatory strategies of other disciplines" (Rayward, 1996, 4).

This is quite a wide array of opinions. The lack of an ultimate definition adds to the confusion. As in the case of information, its derivative, information science, has many definitions as well. Flexibility, elusiveness, and inclusiveness of information science are fascinating. After some four decades since it was declared a science, in 1999, Saracevic calls "debates over 'proper' definition of information science" (Saracevic, 1999, 1051) fruitless. He argues that "[information] science, as a science and as a profession, is defined by the problems it has addressed and the methods it has used for their solutions over time" (Saracevic, 1999, 1051). He argues that "information science is interdisciplinary in nature; however, the relations with various disciplines are changing. The interdisciplinary evolution is far from over" (Saracevic, 1999, 1052). Zins echoes Saracevic's statement about interdisciplinarity of information science, "'Information science' is a generic name of an interdisciplinary field. It is a warehouse of fields related to information and knowledge" (Zins, 2006, 457).

Information science flourished with the rise of new computer technologies. Being one of the youngest among the disciplines, it is growing rapidly and actively penetrating into other fields of study. The discipline is closely interconnected with computer science, education, sociology, cognitive psychology, mathematics, philosophy, engineering. The issue

of the relationships of information science with other disciplines has been always a very interesting and difficult one. As Rayward writes,

> "A major question arises for the historian, as for the disciplinary expert, when one discusses the 'chunks' of disciplines that might be said to fall within the ambit of information science – cybernetics, computer science, library science, cognitive sciences, artificial intelligence, general systems theory, linguistics, information theory and so on" (Rayward, 1996, 7).

Farradane's approach seems to be especially interesting in the context of this study. He argues that "in a large part of its scope information science is a cognitive science... It is of course a part of the wider field of communication, teaching and learning" (Farradane, 1980, 75). Since 1980, when these words were published, information science has become much more than a part of the fields of communication, teaching, and learning. But the fact that connections with such fields of study as communication and education have been explicitly stated and emphasized is important. The approach of Hjørland and Albrechtsen states that "the best way to understand information in information science is to study the knowledge-domains as thought or discourse communities, which are parts of society's division of labor" (Hjørland & Albrechtsen, 1995, 400). They argue that since the "domain-analytical paradigm" is "firstly a social paradigm", information science can be considered one of the social sciences, related to social psychology, sociolinguistics, sociology of knowledge, and sociology of science. In contrast to Farradane, they write, "IS should be ...seen as a social science rather than as a cognitive science". Hjørland and Albrechtsen point out "transdisciplinary tendencies in the understanding of knowledge" (Hjørland & Albrechtsen, 1995, 404) that shape the scope of information science. They compare the domain-analytic paradigm with other paradigms used in IS such as the physical paradigm and relate to it the systems-driven paradigm, the communication paradigm, and the cognitive and behavioral ones (Hjørland & Albrechtsen, 1995). The detailed analysis of these paradigms is beyond the scope of this study; but the very list of different frameworks demonstrates complexity of IS as a field of study, intimately related to a number of very different knowledge domains.

### 2.3.5 LIS and other disciplines

LIS schools hold a somewhat unique position among other multi-and inter-disciplinary departments. According to Dervin, it "always had multi-disciplinary sources" (Dervin, 2003). Librarianship used to teach not only cataloging, reference, and collection development, pure library science topics, but courses containing relevant to LIS aspects of management, literature, and education.

Disciplinary cooperation in LIS research has a long history as well. According to Richardson, in 1931 Pierce Butler emphasized the importance of cooperation in research. He pointed out that "'none of us is competent to study it alone' and some problems were so vast that only 'cooperative research over a long period of years' was likely to succeed" (Richardson, 1992, 82). Even then the research problems in librarianship seemed to be broad enough to seek collaboration in order to solve them. Now, when the range of the problems facing the LIS field is much broader, the competence, the expertise that can be brought from other disciplines can be absolutely essential for solving fundamental problems of the information society.

First of all, despite plentiful debates over the issue of the relationship between library science and information science, many in the LIS community believe that harmonious coexistence of "L" and "I" is important for the field and its educational structures. For example, Kaplan emphasizes the strong and deep connections of library science with the concept of information and the importance of understanding these connections for the field's educators. He wrote,

> "...I insisted earlier that the intellectual foundation for library science must be fundamentally this group of metasciences – logic, linguistics, mathematics, theory of information, and so on. Now I believe that they have this centrality, not because they underline the new computer technology or related technologies like miniaturization, but for an intellectual reason, because there is central to them the concept of structure, of order, of form, which seems to me to be precisely the central concern also of library science" (Kaplan, 1965, 14).

By adding the words "information science" to their names, schools of library science assumed an even more interdisciplinary approach. "Information science requires a synthesis

and integration of knowledge, skills, and attitudes from a number of disciplines such as computer science, cognitive science, engineering, mathematics, and library science" (Williams, 1997, 10). Williams emphasizes that "each of these disciplines offers theories, principles, models, and techniques that are relevant to the study of information as a phenomenon, the creation of information products, and the building of usable information systems" (Williams, 1997, 10).

Paisley considers information science a "part of a constellation of disciplines and interdisciplinary research that have a common focus: human communication" (Paisley, 1990, 6). This focus on human communication shared with a variety of disciplines and professions means not only strong connections between LIS and communication, but, through communication, with a wider spectrum of fields. The strong ties between LIS and communication and their importance were emphasized by Borgman (1990), Ruben (Ruben, 1990), and others. Shera as well emphasized the salient connections between LIS and communication calling the library "an element of the total communication system by which a society is held together and a culture is created and maintained" (Shera, 1972, 1).

Connections between LIS and humanities are less clear though LIS scholars and practitioners always paid noticeable attention to the history of the book and librarianship, which made history one of the disciplines in LIS curricula. Philology is another humanistic discipline relevant to LIS. It contributed to the courses focusing on literature for particular groups of readers. These connections have strengthened significantly in recent years due to the impetus within the field to develop systems in support of those doing research and teaching in humanities. Before the emergence of humanities computing, the links between Humanities and LIS were not that visible and perceived as less important than the connections between LIS and social sciences or computer science. Stieg writes, "The importance of the humanities to information science is perhaps on a somewhat less grand scale, but it is nonetheless real" (Stieg, 1990, 65). She calls LIS and humanities "the odd couple", but, nevertheless, emphasizes that the relationships within this "odd couple" exist and "can take many forms" (Stieg, 1990, 63).

LIS has connections of different degrees of strength with many other disciplines and professional fields such as education, psychology, literature, linguistics, computer science, etc. While connections between LIS and social sciences and professional disciplines

(communication, education, political science) are quite visible and can be relatively easily explained, connections between LIS and basic sciences exist due to the fact that "[m]any of the founders of information science had backgrounds in these disciplines or in physical science" (Paisley, 1990, 12).

Naturally, most of those connections are organized around the notion of information. Capurro & Hjørland state that "Almost every scientific discipline uses the concept of information within its own context and with regard to specific phenomena" (Capurro & Hjørland, 2003, 356).

All these interdisciplinary connections manifest themselves not only in LIS research but in education as well.

#### 2.3.5.1 Multidisciplinarity of LIS schools

Williams argues that LIS education must provide interdisciplinary courses that integrate elements of knowledge and methodologies from different relevant disciplines (Williams, 1997). This approach to teaching can help LIS students become interdisciplinary thinkers. He concludes that it would not be easy to achieve but that, from a practitioner's point of view, "the results are rewarding because the skills, knowledge, and attitudes acquired are applicable across a wide range of systems and jobs" (Williams, 1997, 10). From a researcher's point of view, such an approach can help to establish a true niche for the knowledge domain of LIS.

When the first graduate library school was established, it "didn't mean, however, that it should stand apart from related disciplines. Several other UC [University of Chicago] faculty ... anticipated a unified social science composed of sociology, anthropology, psychology, certain aspects of economics, and history, and presumably library work" (Richardson, 1992, 81). This arrangement seems to be a very logical one. Library science could never separate itself from the surrounding disciplines either in its practice or in its research agenda. As a professional practice, librarianship could never survive without "borrowing" from such disciplines as education and business and administration. In terms of librarianship's research agenda, Shera (1972) named the areas of library administration, knowledge and society, education and communication, and man-machine relationships. As early as 1972, Shera emphasized the importance of the profession of librarianship connected

with other disciplines in the library school curriculum. He warned those who tend to hold what they call 'traditional' views,

> "Failure in the past to understand the importance of this fundamental principle [awareness of the relations with other disciplines] has narrowed professional vision, sent into library practice graduates with inadequate intellectual breadth, and thus threatened librarianship with the loss of social responsibilities naturally its own. Such attrition is, perhaps, best seen in the rise of information science which threatens to go its own way with a resulting serious loss both to information science and to librarianship" (Shera, 1972, 438).

Today, at the very beginning of the 21st century, we know that the L-IS tandem retained its status over the years and that both the LS and IS of LIS continue to be represented in all LIS schools independent of their exact name; though the ratio between courses in library science and information science may vary from school to school.

For a long period of time LIS schools worked in the mode of "duplicating existing skills" (Jantsch, 1972, 101). With the rise of computers, new skills and attitudes for librarians came into demand. Higgins and Chaudhry point out that "new combinations of knowledge, attitudes, and skills in the workplace may require something more of library and information science (LIS) educators" (Higgins & Chaudhry, 2003, 2). According to Eisenbeis, library schools were not ready to change their curricula to accommodate new technological needs of future librarians. She writes that in the 70s, "[d]issatisfaction with library education became obvious as library schools struggled with curricula poorly designed for the impact of technology" (Eisenbeis, 1990, 155). Educational systems responded to new demands by broadening their curricula (KALIPER Project, 2001; Sutton, 2001), establishing more connections with other departments, and hiring faculty with doctorates in other disciplines.

New information technologies, that have drawn the attention of virtually everyone to information and the issue of effective and safe ways of its dissemination in society as never before, have changed every field and have forced each discipline to seek connections with others. New technologies triggered some changes in the disciplinary structure of LIS education. As Cox writes, "The impact of information technology is often cited as a reason for implementing changes to library and information science education, in an attempt to

educate professions about the rapidly changing information needs of society and its institutions" (Cox et al., 1997, 256).

Computer technologies brought such topics as human-computer interaction, computer-mediated communications, information literacy, and social informatics into the mainstream LIS courses. Budd names philosophy and sociology as "fields that are directly related to the kinds of questions and concerns we [in LIS] have " (Budd, 2001, 313). New technologies seemed to emphasize the inner, potential multi- and interdisciplinarity of librarianship that manifest themselves not only by the introduction of the courses that covered not only "traditional" library topics but also through dual master's programs (Huber & Snyder, 2003) and hiring faculty with non-LIS backgrounds and broadening departmental research agendas.

LIS has become a very complex field of practice and research, with shifting and uncertain boundaries. The main task is to find disciplines that can be linked in LIS relevant scientific inquiry. Since LIS is a rapidly evolving field, who will decide what disciplines would provide "the most appropriate" links? Every researcher has his/her unique combination of knowledge, preferable methodologies, and research agendas, shaped by disciplinary training and experience, including interdisciplinary collaboration. He or she can decide if there are enough links to LIS to become an LIS faculty member. At the same time, the field might seek to incorporate more new disciplines by experimenting with new programs. Hiring researchers from other disciplines, who gravitate to LIS, must be an integral part of this experiment.

Shera stressed the importance of not just adding elements from other relevant disciplines to the curricula of library schools, but also making the connections between those disciplines and librarianship clear to the students. He writes, "the one basic consideration that must always be kept in mind is that the student must be made aware of the relation of these disciplines to the profession and practice of librarianship" (Shera, 1972, 438). The awareness of disciplinary standing of the field is a foundation for its healthy development.

Maintaining connections between LIS schools and other academic departments is crucial, especially because other university departments, such as computer science and business and administration, provide education in information science (Saracevic, 1999) and compete with LIS schools for students. Academic disconnectedness can cause stagnation in

research. Paris argues that isolation of LIS schools from other academic units in their universities was one reason why those schools were closed (Paris, 1990).

Considering LIS education and its connections with other university departments, it is important to remember that other departments are undergoing changes as well. Reflecting the growing interdisciplinarity in higher education in general, other departments might be more open to building partnerships with LIS schools than previously, when LIS schools as professional schools were perceived by discipline-based departments as inferior.

Hiring faculty members with non-LIS doctorates is one of the ways of maintaining broader and stronger connections with other academic units though it may have the opposite effect. Paris writes, "A problem facing any program that is as interdisciplinary as library and information science is the extent to which it can expand and grow into new areas without being perceived as threatening to faculty and established curricula into whose instructional frame of reference the program is seen to intrude" (Paris, 1990, 99).

#### 2.3.5.2 Multidisciplinarity of LIS faculty

The success of every educational institution depends on many things, including visionary management, well balanced programs, research facilities, and a location. But there is one component that every school depends upon most of all, its faculty. "Faculty are the critical component in any educational program" (Gregory & De la Peña McCook, 1998, 33). Shera emphasized the importance of faculty as well, "The faculty not only makes a school great or mediocre, it *is* the school, and there is no more important responsibility of the dean... than that of building the faculty" (Shera, 1972, 442). Faculty members provide scholarly depth and spectrum of the curriculum; they make the evolution of educational programs within the school possible. So, it is no wonder that ALISE pays a lot of attention to the LIS schools' faculty, collecting data on its characteristics in the annual statistical reports. Multidisciplinarity of a field cannot exist without multidisciplinary faculty.

Graduate library schools started with multidisciplinary faculty. The doctorate in library science was established only when the Chicago Graduate Library School came into existence. Naturally, the school had to rely on faculty with non-LIS doctorates since a doctorate in library science did not yet exist. But even now, when LIS schools have been preparing doctorates in LIS for decades, LIS schools' faculty is multidisciplinary more than

ever. Though the majority of LIS faculty hold doctorates in LIS, about 25% [12] of LIS faculty, according to Gregory & De la Peña McCook, have PhDs in other disciplines, namely, education, history, computer science, communication, engineering, psychology and other disciplines (Gregory & De la Peña McCook, 1998).

They attribute this situation to the intrinsic interdisciplinarity of the field. "The number and diversity of doctoral disciplines of LIS faculty demonstrate the increasingly interdisciplinary nature of the field and the greater receptiveness of many LIS programs to faculty with doctoral degrees in other disciplines" (Gregory & De la Peña McCook, 1998, 38). White observes, "Library and information science has always been easy to enter by persons trained in other disciplines, particularly if they bring quantitative skills" (White, 1999, 1052).

Gathering faculty with different disciplinary backgrounds might be very efficient in terms of fostering interdisciplinarity. Multidisciplinary departments offer "interdisciplinary nourishment" in a natural way. They create some sort of intellectual "oversaturated solution" in which the probability of "crystallizations" of ideas is high. At the same time, they do not "make" faculty go interdisciplinary if they are not ready for this step. Moreover, multidisciplinary departments and/or schools do not "block" tenure track positions while interdisciplinary units "do not normally control tenure lines nor award degrees, so their intellectual vitality depends on the cooperation of faculty whose academic home is a department that expects members to contribute to the disciplinary mainstream" (Sá, 2006, 2). The latter is especially important because tenure requirements for many departments discourage interdisciplinary activities of faculty members and thus block or re-direct their research interests. It is impossible to determine how many interdisciplinary researchers have been "lost" for the process of knowledge development for the sake of those requirements. To the contrary, in multidisciplinary schools, faculty members are free to explore interdisciplinary ways of conducting research.

Buckland argues that "it is reasonable" for LIS schools to want to teach different aspects of the field of study. "But to do that is likely to require individuals with backgrounds in communications, computer science, economics, information retrieval, librarianship, law, and diverse other fields as well as familiarity with professional practice in the application

[12] Based on this study's findings, the actual number is 37% as of December 2006.

areas to be covered. A great range of expertise is needed if the scope is to be broad *and* superficiality is to be avoided" (Buckland, 1999, 971). The last point seems to be especially interesting. Multidisciplinarity of faculty allows LIS schools not only to cover a wide array of information-related topics, but helps retain quality educational programs while reaching more broadly.

Shera emphasized the interdisciplinary nature of library schools' programs and multidisciplinarity of their faculty. He pointed out that "a broadening of the concept of librarianship" would result in a more prominent position of the field in the society and more complex relationships between librarianship and society. He wrote, "The interdisciplinary relationships of librarianship necessitate educational programs that are interdisciplinary and courses should be taught by faculty qualified in the subject disciplines concerned" (Shera, 1972, 437). He names the disciplines of sociology, anthropology, communication, and linguistics as the ones that should be represented in the library schools' educational programs. Shera suggested inviting faculty members specialized in those disciplines to teach full- or part-time as one of the ways of adding these disciplines to the library schools' programs. He made it clear that faculty members trained in other disciplines did not need to possess any knowledge in librarianship. They should be "adequately prepared for graduate instruction in the non-library subjects... instructors who are specialized in their disciplines without regard to any competence in librarianship per se" (Shera, 1972, 437). Shera noted that library educators ought to be flexible in terms of accomplishing the task of adding new disciplines to their curricula. In his opinion, it is a responsibility of a school's dean to decide which way to choose, depending on available resources (Shera, 1972).

Estabrook points out the positive outcome of faculty with non-LIS degrees coming to LIS schools. She writes,

> "It is not simply that faculty have been educated in other disciplines. This training has an important impact on our research and teaching. Across the country LIS faculty are engaged in multidisciplinary research with colleagues from the sciences, humanities and social sciences. The mergers with other departments sometimes lead to parallel play; but they also lead to joint degrees, jointly edited journals, collaborative teaching and research and new perspectives on the field. I would argue that these links make our schools

more vital, our research deeper, and our work ultimately more valuable to the practice of librarianship" (Estabrook, 2005, 301).

She notes that these "strong connections and ties outside of LIS" helped LIS schools to overcome the isolation which Paris (Paris, 1990) named as one of the probable reasons of closing LIS schools.

The fact that LIS schools are professional schools is important. Paisley argues that professional schools are multidisciplinary, many LIS schools, in particular (Paisley, 1990). Professional schools teach their students to deal with real-life situations many of which cannot be put in the Procrustean bed of one single discipline. "Schools founded to train practitioners must also foster multidisciplinary research" (Paisley, 1990, 7). Paisley finds it natural that "[a] library researcher may have been trained originally as, say, a mathematician, linguist, or psychologist" (Paisley, 1990, 8).

Multidisciplinarity is a positive mode for professional schools but it can cause some problems as well. Hiring too many faculty from one "foreign" discipline can "backfire". First, if there are too many faculty members from one "foreign" discipline, researchers can "reinforce each other's interest in theoretical problems of the discipline rather than applied problems of the professions" (Paisley, 1990, 9).

Second, though multidisciplinarity of faculty might be one of the ways to establish and maintain close connections between the schools and other university units, at the same time, if professional schools have too many faculty members from one particular discipline they may be perceived by other departments as outposts of that discipline (Paisley, 1990).

The process of migration of faculty members to LIS from other disciplines is based on two initiatives. First, the field has a long history of incorporating knowledge from other disciplines. Second, the complex and broad field of LIS appeals to scholars with a wide variety of disciplinary backgrounds. They come to the LIS field with different methodological approaches and different theoretical frameworks. They bring the differing interpretation of the notion of information from their disciplines, thus making a complex approach to information possible within one type of educational unit, i.e. LIS schools. Bringing together faculty from a variety of relevant disciplines might help to solve timely problems that new information technologies have brought into existence. And it looks like

scholars from a variety of disciplines are interested in solving these problems. As Kochen states,

> "To those of us who were educated in mathematics, physics, chemistry, mathematical social sciences, or engineering since the middle of this century, the concept of information was associated with entropy, order, energy, organization, and control. It aroused our scientific curiosity and excited our imagination as being a concept at the frontier of the unknown. We thought its explication might for the first time unlock some deep secret of nature – how organized systems are formed and maintain themselves – and shed light on tantalizing mysteries of life and mind" (Kochen, 1983, 371).

He argues that "to suggest that the primary focus of information science should be library and information *work* is stifling and unproductively restrictive. It is not likely to attract scientists with imagination, ambition, and attitudes similar to those of the best scientists in other areas" (Kochen, 1983, 372).

It seems that the trend of interdisciplinarity reflects not only the general logic of knowledge development but cognitive features of some of the individual LIS scholars as well. In librarianship, the trend manifested itself on the level of individual researchers from the very beginning. Partly, it can be explained by the fact that the first multidisciplinary scholars who started to teach at the Chicago Graduate Library School could have a doctoral degree only in other disciplines. Some of them seemed to be interested in a broader disciplinary approach. Waples is one example of such an approach. He insisted on using quantitative methods in library science. In the early 1940s, he "had become more interested in the fledgling field of communication science than he was in library science. Shortly thereafter, Waples joined the United States Army studying psychological warfare and propaganda" (Richardson, 1992, 94). Later, he headed the Interdisciplinary Committee on Communication (Richardson, 1992, 94). Waples represented a type of researcher whose interests cannot be kept within one discipline and who migrate from one field to another following his meta-interests.

Some think, according to Dervin, that the "call to inter-disciplinarity is what scholarship was meant to be about in the first place and that only institutional arrangements and privileges have steered knowledge-making off course" (Dervin, 2003, 11). Some do not

welcome multidisciplinarity of the LIS schools' faculty. The reasons may vary. Some LIS scholars have well established research agendas in the very core of library science and never have reasons to come any closer to the borders of their discipline. Naturally, faculty with non-LIS doctorates might seem to them threatening because they are foreign to the field and bring foreign ideas and methods. Now, when interdisciplinarity is valued by many, such scholars may feel undervalued. White warns against hiring faculty who know little or nothing about libraries:

> "Perhaps we think we will look more attractive to university administrators as a technology school. It may also be that, as we rush to recruit faculty members who know only technology and have never worked in a library, we inevitably adapt the curriculum to those faculty. University faculty have always taught what they know and ignored as unimportant what they don't know" (White, 2000, 321).

White does not think that hiring faculty members with non-library science doctorates reflects the inner logic of the discipline's evolution. He interprets the practice of hiring faculty with non-LIS advanced degrees as, in a sense, accidental: "We no longer select faculty because they fit the curriculum, we select curriculum because it fits the faculty" (White, 2000, 321).

One of the reasons for not welcoming faculty members from other disciplines might be the fact that the Ph.D. in Library and Information Science is a very young degree. Even in 1972, Shera wrote, "The doctoral degree in librarianship is still enough of a rarity that it imparts a vague sense of professional recognition and honor, conferring at least the outward manifestation of great learning" (Shera, 1972, 443). So, a relatively recently established doctorate tends to take care of its professional territory. But no matter what they think, multidisciplinarity of LIS schools' faculty is a well established fact and the possible advantages and/or disadvantages of this multidisciplinarity for the discipline's theoretical grounds, its praxis and educational programs have to be carefully analyzed. Disciplines and sciences are not just collections of knowledge; they are processes. Curriculum and faculty composition ought to be dynamic and change according to the development of a particular field.

There are three forms of researcher's interdisciplinary activities, or interdisciplinary information transfer: borrowing, collaboration, and boundary crossing (Pierce, 1999). Borrowing implies adopting theories and methods from other disciplines; collaboration takes place when authors from different disciplines work together; and, finally, boundary crossing means publishing in other disciplines. This study focuses only on two types of interdisciplinary information transfer: borrowing and boundary crossing. The former is the type that is more often studied. It "is normally acknowledged by citation, leaving a record available for analysis" (Pierce, 1999, 272). There are powerful means of collecting citations, thus "the study of borrowing is the most common approach to the study of interdisciplinarity" (Pierce, 1999, 272). Borrowing is not as straightforward an activity as it seems to be despite its popularity among those studying interdisciplinarity. It can be misleading. As Pierce points out, "Authors cite work for their own purposes and may misinterpret work written from other disciplinary perspectives" (Pierce, 1999, 272).

The second form this study focuses on is boundary crossing. Pierce calls it "a much more direct form of information transfer than either borrowing or collaboration" because "authors have greater control over the context in which information is presented, and are likely to be more accurate in representing the content and perspectives of their own disciplines" (Pierce, 1999, 272). Pierce argues that boundary crossing is "potentially the most effective means of interdisciplinary information transfer, since presentation and interpretation remains under the control of a member of the discipline in which the information originated" (Pierce, 1999, 272). Pierce's approach makes sense but when we think about faculty with non-LIS doctorates the situation seems to be more complex. Information can originate in the discipline of the faculty member's doctorate or the one of the department where s/he works. These two situations would make two very different scenarios.

The issue of inter-and multidisciplinarity of LIS as a field of study and its scholars should be analyzed from several perspectives. The task of this study is to discover disciplinary connections of LIS scholars with and without LIS doctorates as may be uncovered in their research agendas and manifested by their publications. This approach will not show such important things as motivation of different types of scholars but it would establish their place in LIS research and the disciplinary links of the LIS field with other disciplines as they are carried by LIS faculty with LIS and non-LIS doctorates.

### 2.3.6 LIS and "export of ideas"

Intrinsic inter- and multidisciplinarity of LIS was outlined in the previous section. A high degree of multidisciplinary connections may sound promising but the question about the nature and the directions of those links between LIS and other disciplines arises. So the discussion on what LIS borrows from other fields of study and what it offers in return, is an ongoing one.

In 1990, Cronin and Pearson came up with the "economic analogy... to explore the contributions made by information scientists to other disciplines" (Cronin & Pearson, 1990, 381). They state that the "export : import" ratio is extremely important for evaluating a discipline because it defines "disciplinary robustness". Some disciplines, such as philosophy, psychology, history and linguistics, "lend" ideas and methodology to other disciplines while others, such as education and sociology "are obtaining information from other disciplines" (Cronin & Pearson, 1990, 381).

Defining an export "as the citation of an IS author in a non-IS source journal" (Cronin & Pearson, 1990, 381), Cronin and Pearson came to the conclusion that information science is not a significant exporter of scientific ideas, and even those ideas that it exports do not seem to have a serious impact on the disciplines that import them. Information science exports "some techniques in the areas of information retrieval and bibliometrics, though more than 90% of the ideas generated within the field is not formally acknowledged by, or incorporated into, the scholarly apparatus of other disciplines" (Cronin & Pearson, 1990, 385).

The authors do not answer the question "why doesn't information science export more to other fields?", but they emphasize the importance of the flow of scientific ideas between the fields. They characterize information science as "a youthful and eclectic field" with "academy and practitioner community drawn from a wide array of backgrounds" (Cronin & Pearson, 1990, 385). The latter might be especially important because those academics and practitioners with non-IS backgrounds might customarily use methodology of their original disciplines of training and build upon the ideas of those disciplines.

While information science borrows from other disciplines, library science borrows from information science. Shera wrote,

> "I seriously question whether there is a true interdisciplinary relation between librarianship and information science; rather, it is only a series of borrowings of the technology of one for the use of the other. Because librarianship is much more than the mechanized access to data banks or networks that provides efficient access to institutional borrowing, we must look to other disciplines for its interdisciplinary relations and the core of its theory" (Shera, 1983, 383).

Wilson emphasized the importance of the transfer of research styles in LIS. "The fact is that those newcomers to the bibliographic R & D community from mathematics, physics, and other fields brought their characteristic techniques and expectations and enlarged the available repertory of research styles in the community, styles that were then available for others to borrow or copy" (Wilson, 1983, 389). He argues that newcomers to the discipline first stay as a "distinct group, socially as well as intellectually" but later those distinctions are blurred (Wilson, 1983, 391). In advocating borrowing from other disciplines, he writes,

> "Information science did not gel into a distinctive, coherent research area with its own subject matter and research methods. In particular, it did not arrive at a distinct 'solid corpus' of 'scientifically derived' theoretical and practical knowledge. And it did not replace library science as the disciplinary base for the profession of librarianship. That profession has no unique disciplinary base but draws whatever it finds useful from research anywhere in the bibliographical R&D sector and anywhere outside -- sociology, management science, communication, and other fields" (Wilson, 1983, 396).

Cronin and Pearson emphasize that the flow of ideas between the fields is a natural process. "Ideas flow across disciplinary frontiers, bypassing customs and immigration authoroties...while the growing band of interdisciplinary scholars and research programmes ensures that *de facto* forwarding agents are in place to expedite the inflow of novel consumer goods (ideas) and services (techniques, processes)" (Cronin & Pearson, 1990, 385-386).

Paisley studied "the amount of communication between information science and related fields as indicated by journal citation" (Paisley, 1990, 14). Data on "exporting" and "importing" information between 44 journals, provided by Paisley, shows that exchange of ideas, judged by the number of references and citations between LIS and other journals,

exists. The prevailing direction of this exchange ("export" or "import") varies by title and discipline.

The concepts of disciplinary "export" and "import" are very useful metaphors when evaluating interdisciplinary connections of the field. The secondary goal of this study is to evaluate the ratio between number of disciplines citing LIS and number of disciplines in which journals LIS faculty members publish. The data does not allow quantitative conclusions about "export"-"import" ratio, but it does allow evaluation of qualitative characteristics of the "export" and to estimate the degree of LIS faculty's boundary crossing.

## CHAPTER 3: METHODOLOGY

This study employs citation analysis as its primary method. It is widely used by scientometricians whose main goal is to "measure science scientifically, often on behalf of science policy officals [sic]" through "rating and mapping the sciences, the social sciences, and the humanities with the help of huge databases derived from the scientific literature" (Wouters, 1999, 1). Though Glanzel points out that recently the focus in scientometrics significantly moved toward policy issues from the problems of mapping science (Glanzel et al., 2006), the scientometrician stays not only a policy oriented professional, but also a social scientist, whose goal is to identify significant processes in science.

This chapter focuses briefly on the history of citation analysis, including: applications, applicability to this study, and limitations. It also shows the place of citation analysis as a method in the context of scientometrics and one of its most visible branches, bibliometrics.

### 3.1 Scientometrics

Scientometrics, emerged in the sixties, "is defined as the quantitative study of scientific communications" (Wouters, 1999, 4). It studies and measures scholarly activities. Publishing is one of the most important activities of every scholar, hence "the scientific article is one of the key objects in scientometrics" (Wouters, 1999, 1). Analyzing large collections of scientific publications, scientometricians provide the scholarly community with data on patterns of growth of a particular discipline or a group of disciplines. "The identification of research areas has been a perennial theme in scientometrics" (Small, 2006, 598). It provides insight on the impact of scholars, scientific units and countries on the evolution of the disciplines, as well as on connections, "mutual interests", between different fields of study (Bollen & Van De Sompel, 2006).

### 3.2 Bibliometrics

Bibliometrics is that part of scientometrics which focuses on publications. "Traditionally ...[bibliometricians] have concentrated their efforts on tracking highly visible and objective indicators of scholarly activity; most notably, publications and citations" (Cronin, 2001, 1). Godin defines bibliometrics as "one of the few subfields concerned with

measuring the output side of Science" (Godin, 2006, 109). He states that "among the many statistics on science, called scientometrics, bibliometrics holds a privileged place" (Godin, 2006, 109). One of the main foci of bibliometrics is mapping of science, as Braam put it, "quantitative techniques to display structural and dynamic aspects of scientific research" (Braam, 1991, 3).

Bibliometric data can be used for different purposes: for evaluating performance of individual scholars, scientific units, and also for mapping sciences. It sheds light on the processes going on in different disciplines and groups of disciplines which permits the study of trends and changes in the disciplines or sociology of knowledge [13]. "Bibliometric methods serve three main functions, i.e. description, evaluation, and scientific monitoring" (Gauthier, 1998). The next section outlines one of those tools, citation analysis. As the primary method for this study, citation analysis will be described in greater detail.

### 3.3 Citation analysis

The method of citation analysis has been widely used by those interested in scholarly communications and tracing links between publications by individual researchers, schools of thought, research or educational units, or whole disciplines.

#### 3.3.1 Brief history

Pritchard and Wittig start their bibliography of Bibliometrics with the year 1874 (Pritchard & Wittig, 1981). "Early citation studies frequently were based on lists of references found in articles appearing in a small number of journals. Citations had to be transcribed and manipulated by hand" (Smith, 1981). For obvious reasons, the process of data collection was extremely time consuming and "tedious" work (Smith, 1981; Borgman, 1990). The situation changed dramatically when the citation databases created by the Institute for Scientific Information came into existence. As Cronin puts it, "the significance of citation in the professional lives of career scientists has taken on a new dimension" (Cronin, 1984, 2).

[13] Sociology of science and sociology of knowledge are highly interrelated disciplines but with quite different foci (see Eriksson, 1975).

The Science Citation Index was proposed in 1955 by Eugene Garfield, who thus changed the face of Bibliometrics forever. He published the first "Experimental Citation Index to Genetics with special emphasis on Human Genetics" in 1963. The idea of using citations for information retrieval did not belong to Garfield and goes back to the Shepard's Index. "One Frank Shepard in Illinois deemed it useful to know whether a legal proceeding was still valid. He produced gummed paper with lists of cases which cited the case in hand" (Wouters, 1999, 22). These lists were very popular among lawyers and in 1873 Shepard started Shepard's Citations Inc. which produced Shepard's Citator. William Adair, retiree from the Shepard's Citations, came up with the idea of using a similar index for sciences. He approached Garfield with the idea. Their communications proved to be fruitful and in 1955 Garfield published his seminal work "Citation Indexes for Science", that shaped the future of the Citation Index. The ideas were supported by some scientists and challenged by others. In 1963 the Index finally was introduced to the public. Ever since, Garfield and his Institute for Scientific Information provided leadership in using citation analysis as a bibliographic tool and for science mapping. In Russia, Science Citation Index was known simply as "Garfield's Index" (Marshakova, 1988, 8). Garfield's scientific contribution is hard to overestimate as he "made possible for the first time the study of the global communication network of science, including the critical linkages between disciplines" (Small, 2000, 449). Saracevic maintains that "the idea of mapping of 'literature' that started with exploitation of citation indexes in 1960s, may ...qualify as a powerful idea" (Saracevic, 1999, 1052).

Even the print version of the Science Citation Index was an extremely useful bibliographic tool and provided the means for mapping the sciences. Its significance increased when the online version, developed in late 1960s by the ISI directed by Garfield, became available (Braam, 1991, 6). For years it existed as a set of all three databases, the Science Citation Index, the Social Sciences Citation Index, and the Arts & Humanities Citation Index (Smith, 1981; Borgman, 1990). Electronic format made bibliometric methods in all disciplines more feasible and rigorous but the separation between three knowledge domains set some unfortunate limits for those who would be interested in tracing interdisciplinary connections across three knowledge domains using citation analysis. This drawback was overcome when the Institute for Scientific Information produced the Web of Knowledge, which combines the three preexisting indexes. This truly revolutionary

enhancement allows the users of the Index not only to search across disciplines but to study scholarly communications across all disciplinary domains as well.

### 3.3.2 Applicability

Citation analysis proved to be the most appropriate method for tracing relationships between disciplines and connections within them (Garfield, 1955; Garfield, 1963; Small & Garfield, 1985; McCain, 1990,1991; Smith, 1981). As Chen writes, "Citation analysis takes into account one of the most crucial indicators of scholarship: citations. Citation analysis has a unique position in the history of science mapping..." because it is a means to trace "invisible colleges" (Chen, 2003, 144).

Citation analysis is often used when a question about possible links between disciplines or sub-disciplines arises (Noyons, 2001; White, 2000). It is widely used for mapping sciences. Tracing citations from one discipline to another allows identification of "exporting-importing" qualities of disciplines. "If researchers cite the work they find useful, often cited ('highly cited') work is apparently more useful to scientists than work which receives hardly any citations at all. Hence, the number of times an article is cited, seems to be an accurate measure of its impact, influence or quality. The same is true of the collected articles of one particular scientist, research group, journal or even institution. The more they are cited, the greater their influence" (Wouters, 1999, 3). Citation flows cannot be used as the only indicator of changes in relationships between disciplines. Bollen and Van De Sompel point out that publications are not the only source for evaluating processes in science development.

> "Each phase of the scientific process produces valuable scholarly results, e.g. raw data files, analysis software, technical reports and literature reviews. By studying the structure of science on the basis of publication data only, we ignore the many other products of scientific activity" (Bollen & Van De Sompel, 2006, 228).

It is true, but, nevertheless, publishing remains the most prominent and significant activity of any scholar that represents his/her research and allows evaluation of his/her position in a research institution and his/her field of study in general. Van Raan emphasizes the importance of publications in the process of scholarly communication, "Publications are

not the only, but certainly one of the most important elements in this knowledge exchange process. Work of high quality provokes reaction from colleague-scientists" (Van Raan, 2000, 305).

As Harter and Hooten argue, "From analysis of the literature output, one can learn who is writing, what they are writing about, for whom they are writing, and who is sponsoring the knowledge production" (Harter & Hooten, 1992, 583). Hence bibliometric analysis is one of the most significant means of scientometrics (Braam, 1991). Merton notes that "from a sociological perspective, citations, as the most routinized form of peer recognition, are a variously consequential element in the reward system of the social institution of science and scholarship" (Merton, 2000, 438). Harter and Hooten observe that "citation counts have been interpreted as a measure of usefulness of research output. The legitimacy of citation analysis for evaluation has been strengthened by research documenting a high correlation of citation counts with other measures of quality" (Harter & Hooten, 1992, 584).

Although the Index, proposed by Garfield, was primarily designed for bibliographic retrieval, "it did not take him long to recognize its further potentialities as an extensive and variously applicable research tool..." (Merton, 2000, 435). Garfield realized very soon that his indexes were "a new dimension in documentation through association of ideas" that made them a quite unique and powerful instrument for mapping sciences (Garfield, 1963). He made frequent use of citation analysis to see the connections between sciences, research themes, and researchers. Data in the Citation Index can be used for analysis on different levels: disciplines, universities and other research institutions, departments and researchers.

The method of citation analysis can be considered highly appropriate for this study for several reasons. First of all, when scholars from one discipline cite works by researchers from other disciplines, it reflects some connections between those two disciplines through links between two scientific documents belonging to particular knowledge domains. "In general, a citation implies a relationship between a part or the whole of the cited document and a part or the whole of the citing document. Citation analysis is that area of bibliometrics which deals with the study of these relationships" (Smith, 1981, 83).

As Cronin states, "The most common means of bestowing credit and recognition in science is via citation" (Cronin, 1984, 2). Those connections might be more of a sociological

character or epistemological one, but the fact remains that they exist not only in an observer's imagination but in reality. "A basic assumption ... is that a subject literature reflects the contents of a field and that its citation patterns can serve as a source of data for identifying interdisciplinary relationships" (Smith, 1992, 255). Simple citation counts, as Smith points out, referring to works of Peritz (1981), cannot be satisfactory because it might provide researchers studying interdisciplinary linkages with somewhat misleading data. She recommends as an alternative "analyzing citations from other disciplines to the literature of library and information science" (Smith, 1992, 255).

There have been attempts to study patterns of migration of researchers from one field to another. For example, Hargens, analyzing intellectual migration patterns in 1986, noted that citation analysis would be a method to use for tracing connections between sciences:

> "When one group of scholars relies heavily on the concepts and techniques of another group, it is likely that the former will heavily cite the publications of the latter. Thus, attempts to study information flows among scholarly fields usually employ some form of data on citation flows" (Hargens, 1986, 146).

He could not use the method in his study because at that time the Institute for Scientific Information kept separate files for data on the natural sciences and mathematics, on the behavioral sciences, and on the arts and humanities. For this reason, as Hargens argues, "those who analyze citation-flow data tend to focus on whether they reveal patterns consistent with common preconceptions of the boundaries of scientific fields rather than on the nature of citation flows across such boundaries" (Hargens, 1986, 146). Combining three files in one database, the Web of Knowledge solves this problem. Actually, the very existence of this truly multidisciplinary data set shows that the need for more active searching for interdisciplinary connections has been fully actualized in scholarly communities.

Using data from the Web of Knowledge allows one to see where a particular discipline is situated in the "big picture" of human knowledge. This opportunity is crucial for this study because it analyzes research connections of LIS educators with a variety of non-LIS doctorates. As Rinia puts it,

> "The analysis of interdisciplinary impact by means of bibliometric method shows that cross disciplinary citations, together with other indicators, may

> provide useful insight into relations between fields en [sic] subfields of science. Apart from more well known connections, they reveal less commonly expected relations between disciplines and subfields and give insight into knowledge exchange taking place" (Rinia et al., 2002, 360).

Above all, citation analysis as a quantitative method can provide valid and reliable data on research performance of LIS scholars who migrated to the field from other disciplines in contrast to statements based on mere informal observations. The latter leads to the variety of opinions on multidisciplinarity of LIS schools. As Van Raan notes, "In these times of emerging new fields and increasing inter-disciplinarity, it is not easy for peers to form a valid opinion on the performance of those being evaluated" (Van Raan, 2000, 302).

Moreover, it might not be easy either "to form a valid opinion" on multidisciplinary and interdisciplinary activities for those who are involved in them. Retrospection, which is a necessary component of every survey or interview, is a valid method but implies a significant amount of "creative interpretation" on the part of a subject. In contrast, the method of citation analysis, being unobtrusive (Smith, 1981), offers an opportunity to get an objective survey of a disciplinary landscape.

Some researchers would not like the picture of science or would not agree with it or both, but their personal preferences and interpretations cannot change the picture because it exists whether it pleases some scholars or not. Aaronson states, "Citation analysis is objective because it is based on written information that anyone can check. It is the aggregate of the subjective decisions of all publishing scientists" (Wouters, 1999, 6). But as with all scientific methods, citation analysis has its limitations. They will be reviewed in the following section.

### 3.3.3 Limitations

Citation analysis is a powerful and popular instrument for tracing interdisciplinary linkages and analyzing the structure of scientific communities and research connections between their members. Like all methods, it has its limitations. Those limitations will be discussed briefly in this chapter. Some of those limitations do not appear to be significant for this particular study. Some might lead to possible misinterpretations.

It is logical to start with the definition of citation. The notion of citation, seemingly unambiguous, in reality is very complex. This complexity caused questions about the validity of citation analysis as a method for identifying relationships between sciences. Braam notes, "One aspect of validity of citation data...concerns the motivations, attitudes and values underlying citation behavior" (Braam, 1991, 11). "Why do authors cite the particular articles they are citing?", he asks (Braam, 1991, 11). A decade later, Case and Higgins phrase a related question, but on an even more basic level, "Why do authors cite one another?" (Case & Higgins, 2000, 635). The answer is not simple. The reasons for citing particular works and authors can vary dramatically. As Leydesdorff & Amsterdamska observe,

> "...the analysis of textual links between citing and cited papers tells us nothing about the citing authors' perception of the papers they cited, about their reasons for citing a particular paper, or about the social determinants of citation behavior" (Leydesdorff & Amsterdamska, 1990, 308).

Smith lists 15 "scholarly" reasons, suggested by Garfield (Smith, 1981). Researchers cite each other's works for many reasons. The list of possible reasons ideally starts with "true scholarly impact" and ends with "less-than-noble purposes" (Smith, 1981). Cronin argues in his essay "The Citation Process", that "an author's reasons for citing in a particular way at a particular time are controlled by an internalized set of norms" (Cronin, 1984, 2). In addition, "Citing behavior seems to vary according to personal traits" (Wouters, 1999, 3). Bollen and Van De Sompel name several drawbacks of citation analysis such as publication and citation delay, citation bias, process bias, and granularity (Bollen and Van De Sompel, 2006).

In addition, there are negative citations. Scholars, in their scientific publications, cite not only works they agree with but the work they severely criticize or correct. "Sloppy work will not often be cited, except in heated controversies - or so the reasoning goes" (Wouters, 1999, 3). This is expected, and, what is more important, the presence of "negative" citations would not alter the results in this study. Either positive or negative citations function as pointers from one discipline to another. More importantly, the probability of random citations might be much lower in case of referring to works from other disciplines. Researchers who know little about another discipline would not waste time finding an article from such a discipline without a serious reason, i.e., actual use of that particular study. Researchers who

know much about other disciplines may cite works from those disciplines for somewhat "non-academic" reasons but the very fact of knowledge of the "foreign" domain can be considered as a proof of an existing connection between the researcher's discipline and other fields of study.

Except for citing works they really use in their research, authors of scientific publications tend to cite seminal works even when they do not build upon them (especially young researchers who are afraid of being accused of scientific ignorance). They cite colleagues in hopes that they would cite them in return and they cite "important figures" in the field. The list of "political" reasons to cite can be continued. The "less-than-noble" reasons for citing a particular work might be of interest to a social psychologist rather than to a science historian. But this limitation, as the previous one, cannot be much of a problem in this study because its goal is to show links between disciplines reflected in citation patterns to the works of LIS educators with and without LIS advanced degrees. Citing a seminal work or a prominent researcher from another field means knowing its main authorities, so even if it is done for political reasons it would still show the existing connection with other disciplines.

Self-citations sometimes complicate bibliometric data. Authors may use and abuse the right to cite their own works. The latter might be misleading as well as heavy citing of authors who are not only as scholars but also administratively important in the field. But both phenomena, though they might take place in scholarly publishing, are exceptions rather than norms. Authors who work on one topic over an extended period of time have to refer to their own works, especially if they do pioneering research.Therefore, self-citing, though it must be acknowledged as a possible limitation, will not alter the results in this particular study. It would be impossible to use citation analysis without an assumption that most authors do cite works they build upon, including their own.

There are other limitations that might complicate data analysis in this study. First, the patterns of citing might be different in different sciences (Smith, 1981). Even though the citing process depends on authors' personal traits, "nevertheless, the overall citing properties of the publications within a certain field share the same characteristics" (Wouters, 1999, 3). In sciences, the number of co-authors and number of citations to publications are much higher than in social sciences. "The common notion of the interaction of the increasing

number of co-authors and the growing role of author self-citations assumed as a consequence of the large number of authors involved", is not supported by data and the "actual number of co-authors in the set of multi-authored papers has... no essential influence on the share of self-citations in all citations a paper receives" (Glanzel & Thijs, 2004, 403).

The differences between citing cultures, between "motivational backgrounds" put scholars with and without an LIS doctorate in a different position in terms of the visibility of their research results. This also complicates comparison between those two groups. "The fact that publication and citation behavior vary among disciplines was noted shortly after the appearance of the first *Science Citation Index* in 1961" (Leydesdorff & Amsterdamska, 1990, 305).

One complicating factor is that the LIS faculty who migrated to LIS from other disciplines might keep connections with their native disciplines and are familiar, and, moreover, accustomed to the level of tacit knowledge with the citing behaviors accepted in a particular field of study while their LIS colleagues have no way of knowing of those patterns. They may not internalize LIS norms either. This is one of the most important limitations and cannot be overcome within this study.

If researchers cite works from other disciplines, the period between the time when the cited work was published and the time when it was cited is usually significantly longer than within one field. That can be a problem because, again, it might limit compatibility of data on LIS and data on non-LIS doctorate holders, especially within the time frame used for this study. The most recent works (2005, 2006) might lack pointers to them from other disciplines only because of a time deficit. This drawback is being compensated to some degree by wide availability of many core journals in all disciplines. According to Barjak, there is positive correlation between Internet use (including electronic journals) and research productivity (Barjak, 2006).

Apparently, scholars often use the Internet to exchange ideas, to present the results of their research and to receive feedback. "As the use of the Internet becomes more and more embedded in scholarly communication in many forms, scholars will face more complex choices in managing communication through electronic and paper media" (Kling & McKim, 1999, 905). Tracing electronic scholarly communications in general, and publishing, in particular, requires a different technique of data collection. Cronin and Shaw maintain that

the Internet brings "new ways of tracking scholars' visibility, both within and beyond their traditional spheres of influence" (Cronin & Shaw, 2002, 1267).

It is worth noticing that e-journals from different disciplines are more readily available than their print counterparts, "offering opportunities for more rapid communication, broader access to scholarly literature, new documentary forms (hypertext), and richer modes of scholarly communication..." (Kling & Callahan, 2003, 128). With modern academic library gateways providing access to a wide array of e-sources, it is equally easy to "open" a scholarly publication from any field. It does not require a physical visit to a library. "Scholarly communities have undertaken numerous and varied efforts to use the Internet to improve the communication of research articles through the use of e-journals in a variety of formats" (Kling & Callahan, 2003, 128). This process may change the structure and dynamic of citing culture in the near future.

In addition, sometimes authors do not cite a relevant work because, for a variety of reasons: "the author was not aware of the document, or could not obtain it, or could not read the language in which it was published" (Smith, 1981, 84). This reason might be common for not citing works from foreign disciplines especially now when the number of publications in every field is enormous. The goal of this study is to identify citations to publications within LIS from other disciplines as proof of growing interest in LIS research agendas and established interdisciplinary connections. It focuses on actual citation patterns.

Methodological differences and epistemological approaches to the same set of research problems might prevent scholars from using publications from other disciplines and citing them. This can as well affect the difference between the groups of LIS and non-LIS doctorate holders in LIS schools. In the first place, scholars in different disciplines have different theoretical frameworks. Pettigrew & McKechnie point out that authors often do not cite theories which, in their opinion, are common knowledge within the whole scholarly community. They write that

> "...authors frequently do not include bibliographic references for the theories that they mention, and seem to assume that all readers are familiar with such IS concepts as 'citation theory', 'berry picking', 'the information search process (ISP)', and 'the theory of human information seeking and information

> retrieval', and with ideas from outside the field such as 'graph theory', 'chaos theory', and 'equiavailability theory'" (Pettigrew & McKechnie, 2001, 69).

But, as with the previous limitation, this one is not really important within the study which strives to see the picture as it is rather than the ideal one.

The Thomson ISI Web of Knowledge[14] is the main source of data in this study. Though the Web of Knowledge is the most frequently used source for citation analysis, its coverage has its limitations. Not all scholarly publications are indexed in the ISI Web of Knowledge. For example, only a subset of proceedings are indexed in the database and they are becoming a more and more important part of the scholarly portfolio not only of researchers in hard sciences but in social sciences as well (Glanzel et al., 2006). The index covers 8,700 high impact peer reviewed journals. Dillon and Norris give a positive evaluation of the Index as a source of publications in LIS.

> "The ISI *Web of Knowledge* contains a list of more than 50 publications that is categorized as dealing with Library and Information Science research. This is certainly not an exhaustive list, but inclusion in the ISI listing is at least indicative of a journal's impact, history, and reputation" (Dillon & Norris, 2005, 284).

Moed identifies ISI's journal coverage[15] for LIS at 71% (Moed, 2005). All in all, the Web of Knowledge remains the main source of data for those studying connections between sciences. Currently it allows users to search simultaneously all three indexes that existed before as separate databases: Science Citation Index, Social Sciences Citation Index, and Arts & Humanities Citation Index. This feature, the possibility to search broadly makes the Web of Knowledge invaluable for this study.

Another limitation relates to the fact that subject categories, assigned to the articles in the Web of Knowledge, characterize journals, not individual articles. This may limit the results of data analysis because it sets the level of data granularity at the level of a journal rather than an article. Thus, possible fluctuations of topics from article to article in regard to their disciplinary connections cannot be registered as well as the richness of those

[14] More information on the Thomson ISI Web of Knowledge can be found in the section 4.2.1 "Sources of citations".

[15] Moed defines journal coverage as "% of references to documents published in ISI source journals, relative to total references to journals" (Moed, 2005, 131).

connections. But this cannot alter the results of this study because, first, only peer reviewed journals are presented in the Web of Knowledge, and such journals usually have a well developed mechanism of accepting only articles that are relevant to the journal's topical identity. Second, the journals that publish articles on topics from a variety of disciplines have the word "interdisciplinary" added to their subject categories.

There is no such thing as an ideal research method. Not all scholars take bibliometrics seriously. Van Raan maintains,

> "There are still strong antipathies toward bibliometric analysis, often based on the argument that publications (and citations) just provide 'easy data' and that the assessment of 'real quality' needs more 'qualitative consideration'". (Van Raan, 2000, 302).

This is an important argument. Lack of qualitative analysis can make quantitative data meaningless but usually bibliometric analysis starts with "quantitative considerations" and ends up with "qualitative considerations".

Van Raan admits that the "process of citation is a complex one, and it certainly does not provide an 'ideal' monitor of a scientific performance..." (Van Raan, 2000, 305). He emphasizes that this method works especially well not for an individual author but for groups of scholars. He argues that applying citation analysis to "a group as a whole over a longer period of time, does yield in many situations a strong indicator of scientific performance..." (Van Raan, 2000, 306). This supports the use of citation analysis as an appropriate method for this study, as it focuses on two groups of scholars.

Awareness of these limitations is important and the limitations have been taken into consideration when interpreting the results of data analysis. Today, the Web of Knowledge is the most authoritative source of data on scholarly publications; so, even with all the limitations, the method of citation analysis based on data collected from the ISI Index in combination with the large number of cases being included can be a reliable means of identifying general trends in interdisciplinary citing patterns between LIS and other disciplines.

## CHAPTER 4: DATA COLLECTION

The following section describes the scope of the study, the kind of data collected, and the procedures of data collection.

### 4.1 Scope of the study

Every study is limited by its scope. This section contains a rationale for choosing the whole population of ALA accredited programs' faculty members over a sample and for using a particular time frame.

#### 4.1.1 Population

All full time faculty members (as of December 2006) in 56 ALA accredited programs holding advanced degrees [16] have been studied (736 faculty members). Collecting data on all these programs was chosen over working with a sample of the population for the following reasons.

LIS educators with non-LIS doctorates constitute quite a diverse group in terms of disciplines of their advanced degrees, age, stage of their careers, and focus of their research. LIS schools' faculty composition reflects a number of demographic factors which possibly influence the structure of publications generated by LIS schools. Some senior faculty members whose publications were well known in the field in the 80s and 90s and provoked many discussions do not publish as much as they used to while some junior faculty members have not reached the peak of their scholarly careers and did not have time to publish as much as their colleagues. The structure and degree of age stratification in different schools are different which makes comparison between them more difficult to interpret.

In addition to this, the difference between those who earned their doctorates decades ago when in doctoral research librarianship could be mixed with History, Education, Management, or English literature, and those who graduated from Ph.D. programs of LIS schools recently with a broader spectrum of disciplinary opportunities in their research due to the merger of "L" and "IS" must be taken into consideration as well.

[16] The faculty members with DA, JD, ED, and MD were also considered to be holding advanced (terminal) degrees in their fields of studies, in addition to those holding the PhD.

The difference between LIS schools' teaching and research foci can be another factor which increases their faculty members' diversity. ALA accredited programs vary in terms of the programs they offer and the number of their faculty members. Some of the schools have undergraduate programs in addition to Master's programs, some do and some do not offer a doctoral degree; and those schools who do offer it, emphasize different sides of modern LIS. Some schools stress the interdisciplinary nature of their Ph.D. programs. Different schools emphasize different aspects of LIS studies in their Master's programs as well. For example, there are schools which focus on media studies or book history and publishing or links between LIS and education in general and with K12 programs, in particular. Recently, a group of I-schools emerged. It is not a completely homogeneous group but there are some features that separate it from other LIS schools, or, rather, put it in the avant-garde of LIS education. There are small schools with as few as 4 full time faculty members and schools with more than 20. It is safe to assume that faculty members in those groups exist in very different research and teaching environments.

This diversity makes sampling extremely difficult. All above mentioned differences between LIS schools can have a significant impact on the publishing and citation patterns of their faculty members. In fact, any sampling technique would potentially cut off some interesting findings because of the high degree of uniqueness of every LIS "migrant" educator. Therefore, all ALA accredited programs' full time (as of December 2006) faculty members holding an advanced degree in LIS or in other disciplines were studied.

### 4.1.2 Time line

The time line of this study is limited to the last decade. Citation patterns were studied for all the publications for the defined above subjects that were published since 1995 and appeared in the Web of Knowledge before the date of data collection was completed, i.e., before September 2006. Most of the data was collected during the summer 2006. Several searches were performed in fall 2006 after the information on all faculty members' disciplinary and institutional affiliations had been confirmed. In such cases, the works published after summer 2006 were omitted.

The period from 1995 to date has been chosen because, as is stated in the literature review, new information technologies, that are responsible to a significant degree for

growing interest in LIS by researchers in all disciplines and, consequently, for migrating researchers from other disciplines to LIS schools, became visible in the early 1990s and widespread by mid 90s.

The same time line was used for all faculty members regardless of the date they started their careers as LIS educators. All the publications of a particular author as sole or first author published starting 1995 and indexed in the Web of Knowledge have been collected, even if the author worked in organizations other than LIS schools, e.g. in a research laboratory, a company, or a non-LIS university department or published a particular work as a member of a professional association, e.g., ALA. This approach allowed consideration of the complete oeuvre of publications by a faculty member in question, a complete profile of his/her disciplinary interests and their dynamic over time.

The majority of the new faculty members who started as assistant professors at various LIS schools recently are unlikely to have articles published in scholarly journals before they entered their PhD programs. For them the period 1995-2006 shrinks significantly, to the length of their PhD programs. This may appear as a drawback in the methodology of the study so this approach should be explained.

One time line for all the subjects in the study has been used though some of the faculty members had left their most productive period far behind them while some did not have enough time to get into their production mode. This approach can be justified by the goals of this study. Its goal is to show the place of LIS schools' faculty members in overall scholarly production of those schools as a group without identifying its stratifications. The structures of faculty differ from school to school. Some schools are well balanced in terms of teaching and research expertise of their instructors and the points of scholarly evolution of the latter. Some schools have more narrow foci, stressing, for example, teaching and paying less attention to research. The lack of publications by junior faculty members or those who are well past their prime as researchers is not a problem because one of the study's goals is to outline the disciplinary focuses of LIS schools' scholarly production in all its complexity as it is presented in the most authoritative data source for mapping sciences. Its focus is on the big picture representing all LIS schools (with the limitations explained earlier) rather than on particular scholars. Its goal is to show what publications (not whose publications) produced by LIS faculty members are available for scholars from other disciplines. The only

demarcation line used in this study, in order to test the above stated hypotheses, is drawn between faculty members with LIS and non-LIS advanced degrees.

### 4.1.3 All publications vs. articles

In the Web of Knowledge, the following types of publications are indexed fully in each journal covered: articles, reviews, book reviews, software reviews, meeting abstracts, editorial materials, notes, letters, and corrections. These formats of scholarly publications certainly have different weight. Articles are by far the most important type of scholarly publications. They are researchers' main way to communicate their findings to the scholarly community. On the other hand, editorial materials, meeting abstracts, and book reviews sometimes start discussions and provoke a sizable number of citations.

The Thomson Scientific is known to be very selective in regard to the quality of scholarly publications indexed. It has been used for assessing scholarly productivity for a long time. Collecting data on all publications, rather than on articles only, allows one to see the big disciplinary picture of LIS.

Showing the big picture of disciplinary connections of LIS faculty is the main goal of this study. Therefore, to avoid losing potentially significant data all types of publications have been collected.

## 4.2 Sources of data collection

This study uses quantitative methods which are sensitive in terms of the quality and limitations of data sources. If the latter allows significant data fluctuations or imposes some 'hidden' limitations, the conclusions can be very misleading. This section describes the study's data sources in detail.

### 4.2.1 Source of citations

Thomson's ISI Web of Knowledge was the source for data on LIS schools' faculty members' publications and those citing them. As of September 2006, the index covers over 22,000 journals, 12,000 conference proceedings, 5,500 Web sites, and 5,000 books. Twenty five million cited references are added to the Web of Knowledge every year. Twenty five thousand articles are being added weekly. Both printed and electronic publications are

present in its databases. Two hundred and forty scientific disciplines and 81 countries are represented in the index. It has 20 million users all over the world.[17]

### 4.2.2 Sources of information on disciplines, institutional affiliations, and publications of LIS faculty members

In order to collect data on disciplinary and institutional affiliations of faculty members the following web sites were searched:

1. Home pages of schools and departments with programs accredited by the American Library Association (ALA). The up-to-date list is available from the ALA web site at http://www.ala.org/ala/accreditation/lisdirb/lisdirectory.htm

Information provided by LIS schools and departments on their faculty members at their official web sites varies from school to school in terms of timeliness and granularity. All 56 schools' web pages have been searched. Most of them provide a brief bio for every faculty member containing information on educational degrees, teaching and research interests and activities. Those bios vary in terms of amount of information and its structure. For example, some schools give information about disciplines of advanced degrees of their faculty members, some provide information only on the institution granting a degree and the year when it was received. Many schools' web sites contain links to faculty members' personal web sites which provided additional information.

2. Personal web sites of LIS schools' faculty members.

Personal web sites of LIS schools' faculty members have been searched when a particular school's web site did not contain enough information. In most cases, a link provided at the schools' official web page was used; but, on a number of occasions, it was necessary to use Google to find information about faculty members' disciplinary and institutional affiliations.

3. Responses to email requests sent to the LIS schools' associate deans and/or faculty members.

In several cases, none of the strategies described above have succeeded. The only way to receive accurate and complete data was to contact schools directly.

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[17] The most current information on the Web of Knowledge is available at the Thomson Scientific official web site http://www.isiwebofknowledge.com

### 4.3 Data collection procedures

This section describes the data that has been collected, i.e. its scope, structure, and the data collection procedures.

#### 4.3.1 Collected data

The Web of Knowledge was searched in order to find all the works of full-time ALA accredited programs' faculty members holding advanced degrees in LIS or other disciplines (including Ph.D., ED, JD, DA, and MD).

The following data was collected for every faculty member:

1. Disciplinary affiliation (the discipline of advanced degree). The data on faculty members' educational degrees were collected from their personal or institutional web sites and were verified based on data received directly from the schools in December 2006.
2. Total number of works published since 1995 and indexed in the Web of Knowledge before September 2006 has been identified by performing a general search by author or advanced search.
3. Number of cited works out of those published since 1995 and indexed before fall 2006.
4. Total number of citations of the works published since 1995.
5. Dates (years) of publication.
6. Disciplinary categories assigned in the Web of Knowledge to the published works that have been cited.

In the Web of Knowledge, disciplinary categories are assigned to the majority of the publications. A list of the subject categories is presented in Appendix 1. Missing categories in older records do not constitute a problem because the categories in the Web of Knowledge are assigned to the journals, as mentioned before, not to the articles. This allowed assignment of the appropriate subject categories to the articles in question for the purpose of this study based on the title of the journal in which a particular article was published.

7. Disciplinary categories assigned in the Web of Knowledge to the works citing the author in question.

#### 4.3.1.1 Types of publications

As explained in section 4.1.3, all types of scholarly publications of LIS faculty indexed in the Web of Knowledge were collected. The data was presented in the database so that the publications could be analyzed all together or by a type of publication. The latter approach was assumed to avoid losing potentially important data on interdisciplinary connections.

#### 4.3.1.2 Authorship

For every faculty member, only publications as a single or first author have been collected, with the assumption that the first author is responsible for the main idea of a publication. This approach was employed in order to avoid redundancy. This choice was also made to insure as complete citation data as possible since the cited reference refers to the first or sole author. Otherwise, the same publications could appear in the database and be analyzed more than once. The works published by a scholar as the only or first author have been marked so that they could be analyzed separately if necessary.

For the works authored by more than one person, information on co-authorship has been collected for future research on interdisciplinary collaboration.

### 4.3.2 Procedures of data collection

The following section describes data collection procedures. It focuses on the search strategies used to find publications of LIS schools' faculty members and works citing them in the Web of Knowledge. Both general search and advanced search in the Web of Knowledge and their applicability are described.

#### 4.3.2.1 Search: General principles

A general search by author or advanced search was performed for every faculty member in order to find out how many works by the author have been indexed in the Web of Knowledge. General search by author was the prevailing means of data collection to make

sure that all the author's publications have been identified.[18] At the time of data collection, the Web of Knowledge did not provide any opportunity to distinguish between the authors with the same surnames and initials. Therefore, in most cases a general search by author would bring up publications by authors with the same surname and first initial, or even the same surname and two initials. In addition to this confusion, the same author can be indexed in the Web of Knowledge with only one or with two initials (in rare cases, three initials). In such cases, the differentiation between relevant and irrelevant results was based on the authors' institutional affiliations and information obtained from their Curriculum vitae. The difficulties in searching for publications by particular authors are well known for those practicing citation analysis and described in detail by Moed. He observes that in ISI "one person may appear under several name variations in the author field..." (Moed, 2005, 49).

Sometimes, general search was not feasible because of a great number of hits. In such cases an advanced search was performed based on information about all the author's affiliations gathered from his/her curriculum vita. Several models have been used. These models along with the procedures of general search are described in detail in the following sections.

#### 4.3.2.2 General search procedures

The following set of snapshots illustrate the process of searching in the Web of Knowledge.

Figure 4.1 shows the general search screen in the Web of Knowledge. The last name and the truncated first name are typed in the "author" search box. For ethical reasons, all real names are masked. The word "Surname" is used instead of real last names and the word "Name" is used to represent first names. The star sign shows that the name was truncated.

[18] Recently, the Thomson Scientific added its distinct author identification system. It was not available at the time of data collection.

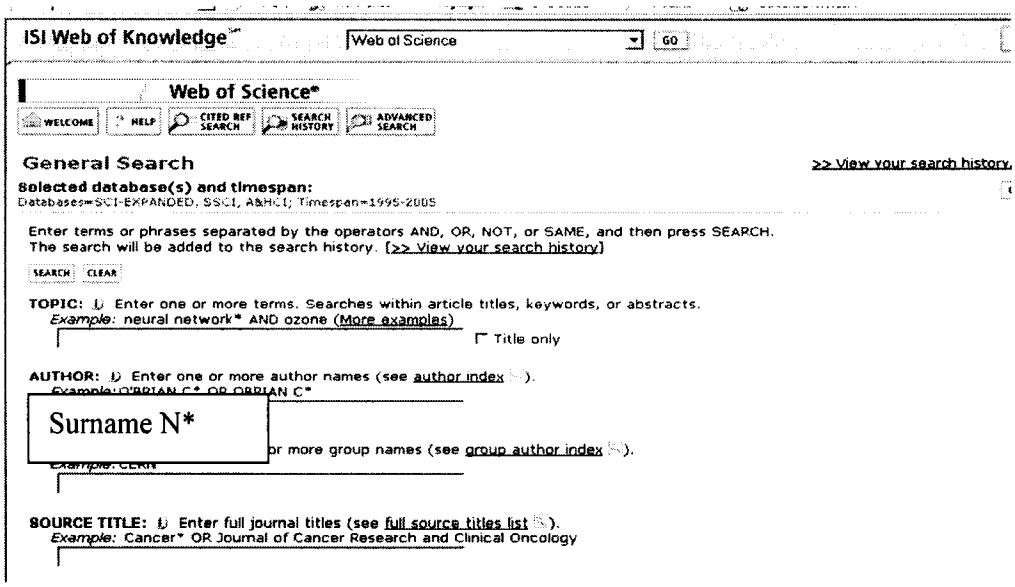


**Fig. 4.1 The Web of Knowledge interface: general search page**

Figure 4.2 shows the screen with the hits for the general search performed by the author name (last and truncated first name). 13 works of the Author were found in the Web of Knowledge. 16 entries for "Surname N*" were found but only 13 of them have been published by the author in question which was established based on the Author's institutional affiliation (Figure 4.3).

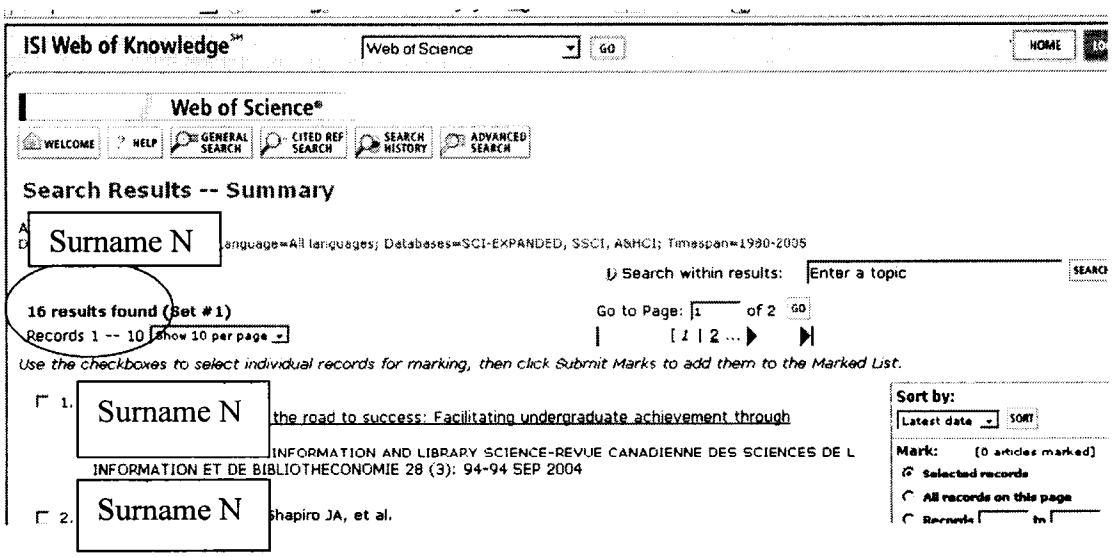


**Fig. 4.2 The Web of Knowledge: identifying number of publications**

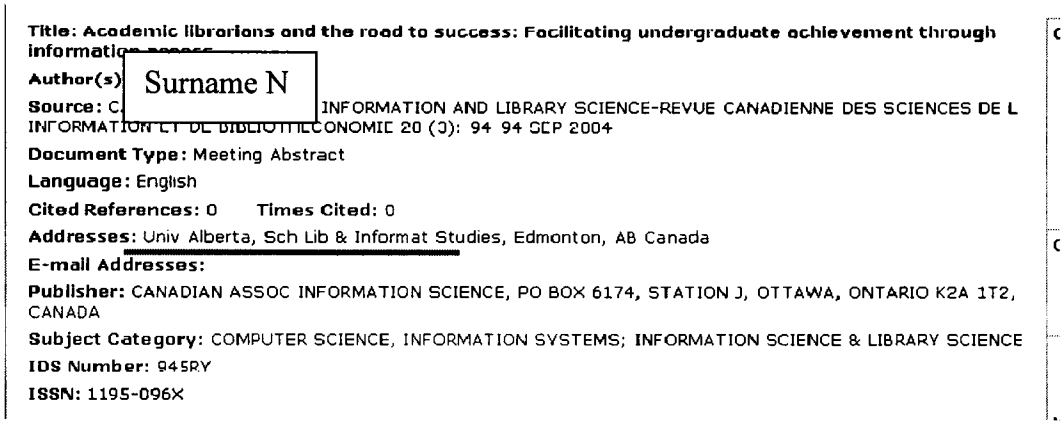


**Fig. 4.3 The Web of Knowledge: finding author's institutional affiliation**

In the Web of Knowledge, it is not necessary to perform a separate search for citations to a particular article. The numbers of citations are shown in the record itself. For example, figure 4.4 demonstrates that 3 out of 13 works that were found and proved to be published by the author in question have been cited. These three publications were cited 4 times total. Information on number of citations is a part of every record retrieved in the general search.

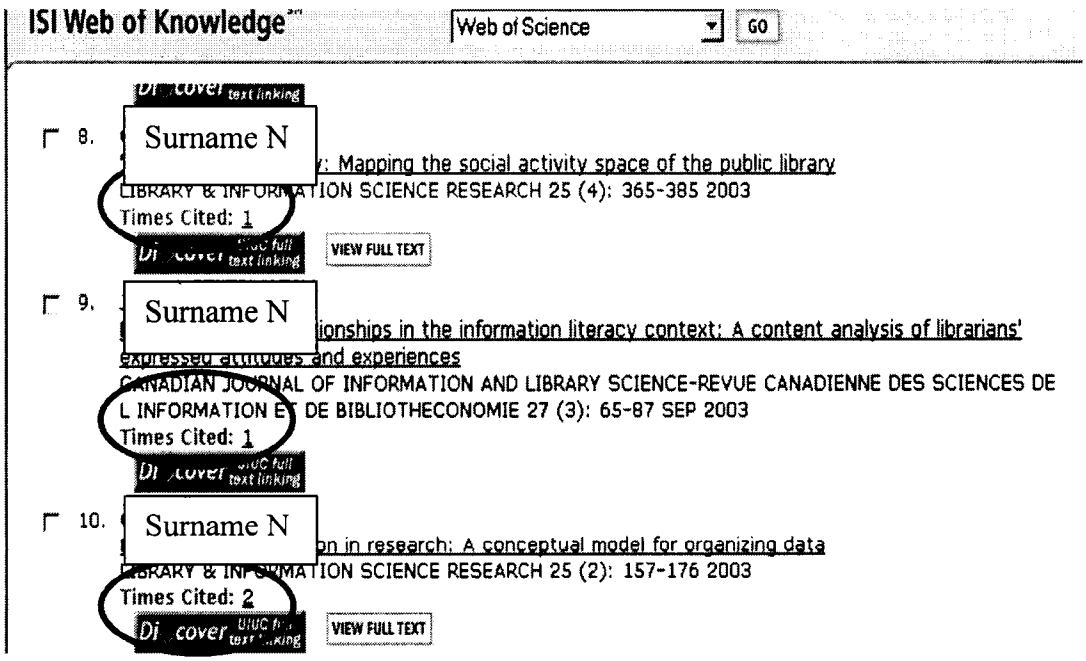


**Fig. 4.4 The Web of Knowledge: identifying cited works by the author**

Figure 4.5 shows the disciplinary categories assigned to the publication in the Web of Knowledge. They appear at the end of the record in the field "Subject Category".

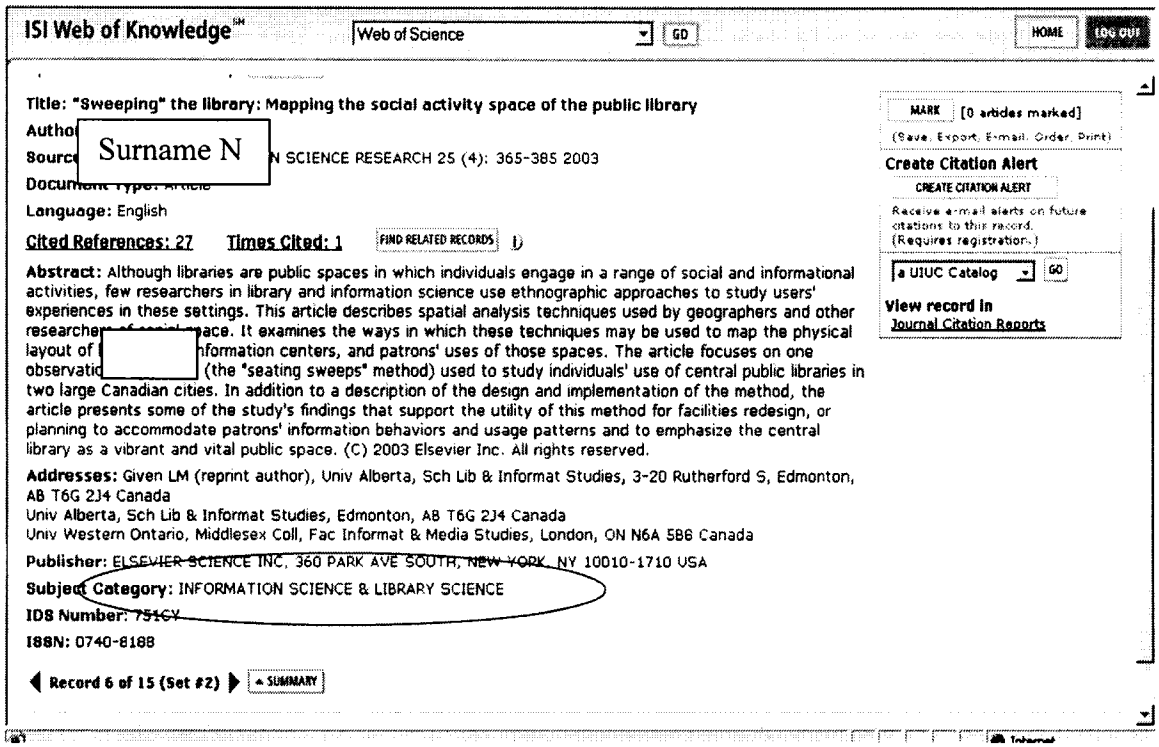


**Fig. 4.5 The Web of Knowledge: identifying disciplinary categories assigned to a publication**

### 4.3.2.3 Models of advanced search

Advanced search was employed in cases when general search by author brought too many irrelevant titles and/or when it was difficult to distinguish between authors with the same names and initials, or doing research in the same field. The query models presented in Table 4.1 were used.

**Table 4.1 Models of advanced search**

| Condition | Query model |
|---|---|
| Complete information on institutional affiliation was available | *Step 1*: OG=(institution1) OR OG=(institution2) OR...OG=(institution N) (#1)<br>*Step 2*: AU=(surname n*) (#2)<br>*Step 3* : #1 AND #2 |
| Information on institutional affiliation was incomplete; complete and up-to-date list of publications was available. | AU=(surname n*) and TS= (article title) |
| Information on institutional affiliation was complete but there were more than one author with the same name and initials at a particular institution;<br>the list of publications did not appear to be up-to-date. | *Step 1*: AU=(surname n*) and TS= (article title)<br>*Step 2*: Checking the list of more recent publications based on co-authorship patterns in previous ones. |

In cases when the list of publications indexed in the Web of Knowledge was too large to sort manually (more than several thousand), or institutional affiliations of the author in question over the period of time since 1995 to summer 2006 were difficult to trace, advanced search proved to be most efficient, especially when a complete list of the author's publications was available. Combinations of several search models ensured that the collected data was complete and accurate.

## CHAPTER 5: RESULTS

In this chapter, the findings of the study are presented. In sections 5.1 and 5.2, data representation and processing are described. Section 5.3 presents the study's findings in both numerical and graphical forms.

### 5.1 Data representation

The data was collected in three primary and several auxiliary Excel tables. The first primary spreadsheet contains information on every author under study. It has the following fields for every author:

1. First name
2. Last name
3. Current institutional affiliation
4. Discipline of advanced degree
5. Whether or not the person holds a Master's degree in LIS

The second primary spreadsheet contains data on the collected publications. This data was entered in the following fields:

1. Publication title (article, book review, editorial material etc.)
2. Publication format (article, book review, editorial material etc.)
3. Year of publication
4. Number of authors
5. Co-authors (when available)
6. Disciplinary categories assigned to the publication in the Web of Knowledge [19]
7. Number of citations to every publication of the author in question
8. Disciplinary categories of the citing works

The third primary spreadsheet was created to collect data on the schools. It contained the following information on every school:

1. Full name
2. Abbreviation

[19] The situations when there were no disciplinary categories assigned to a particular publication or journal are described in section 4.2.1.

3. Total number of full time faculty members
4. Number of faculty members with LIS doctorates
5. Percentage of faculty members with LIS doctorates
6. Number of faculty members with non-LIS doctorates
7. Percentage of faculty members with non-LIS doctorates

In addition to these general spreadsheets, several secondary spreadsheets were maintained to handle particular pieces of data, e.g., a separate spreadsheet was created to identify and represent the ratio between faculty members with doctorates in different disciplines.

### 5.2 Data processing

Data from the Excel spreadsheets was converted into tab delimited text files and loaded into relational database tables (MySQL database software was used to create the relational database). SQL queries were built and run against the database to obtain results. Selectively, the results of the queries were checked against the data in the text files using a custom built Perl script.

### 5.3 Results

The results are organized in three sections. Since complete and accurate data on LIS schools' faculty members was not available when the study was conceptualized, it was necessary to gather and verify information on each school's size and faculty composition. Information collected from the schools' web sites was verified and augmented with data from replies to direct requests to the schools in question[20]. This verified data allows identification of levels of multidisciplinarity of LIS schools in terms of disciplinary affiliations of their faculty members and provides the most up-to-date information on the disciplines of advanced degrees of those faculty members. The preliminary results constituting the basis for the main research are presented in section 5.3.1.

All the results are presented so that (1) the disciplinary connections of the field as a whole could be seen (raw data, representing the whole population of LIS faculty from

[20] The schools' administrators or faculty, who were in a position to supply and/or verify data on their schools' faculty members' disciplines of doctorates, were contacted.

accredited schools) and (2) the comparison between faculty members with LIS and non-LIS doctorates in regard to the frequency of publications in LIS and non-LIS journals and receiving citation from LIS and other disciplines could be made (data per capita).

The findings addressing the research questions are presented in section 5.3.2. Section 5.3.3 represents data on the correlation between the number of faculty members with non-LIS doctorates in LIS schools and the level of multidisciplinarity of those schools' publications and citations to them.

### 5.3.1 Multidisciplinarity of LIS schools' faculty members

The data on the qualitative and quantitative characteristics of LIS schools' faculty members (736 members total as of December 2006) is presented in table 5.1 - 5.3. Table 5.1 shows faculty compositions of 56 ALA accredited programs. Tables 5.2-5.3 present non-LIS disciplines of LIS faculty members. In table 5.2, the disciplines of the doctorates keep their original wording. Table 5.3 presents the same disciplines but grouped with different degrees of granularity.

#### 5.3.1.1 Ratio between faculty members with LIS and non-LIS doctorates

There were 736 full time faculty members with advanced degrees [21] in 56 ALA accredited programs as of December 2006. Faculty members with doctorates in LIS constitute 63 percent of this group. Thirty seven (37%) percent of all LIS schools' faculty members hold advanced degrees in disciplines other than LIS. Thirty six (36%) of faculty with non-LIS doctorates and thirteen percent (13%) of all LIS faculty members have a Master's degree in LIS along with a non-LIS doctorate. This data is presented in table 5.1.

[21] ED, MD, DA, and JD were counted in this research along with Ph.D. as terminal degrees.

**Table 5.1 Faculty compositions of ALA accredited programs as of December 2006**

| School's name in alphabetical order of the names of the universities | Total number of full time faculty members | Faculty members with LIS doctorates | | Faculty members with non-LIS doctorate and Master's Degree in LIS | | Faculty members with non-LIS doctorates | |
|---|---|---|---|---|---|---|---|
| | | # | % | # | % of non-LIS faculty | # | % |
| Alabama | 9 | 5 | 56 | 4 | 100 | 4 | 44 |
| Albany | 11 | 6 | 55 | 1 | 20 | 5 | 45 |
| Alberta | 9 | 6 | 67 | 3 | 100 | 3 | 33 |
| Arizona | 7 | 4 | 57 | 1 | 33 | 3 | 43 |
| British Columbia | 6 | 4 | 67 | 1 | 50 | 2 | 33 |
| Buffalo | 11 | 7 | 64 | 2 | 50 | 4 | 36 |
| California (LA) | 15 | 8 | 53 | 2 | 29 | 7 | 47 |
| Catholic | 8 | 4 | 50 | 3 | 75 | 4 | 50 |
| Clarion | 8 | 3 | 37 | 5 | 100 | 5 | 63 |
| Dalhousie | 5 | 4 | 80 | 0 | 0 | 1 | 20 |
| Denver | 3 | 2 | 67 | 1 | 100 | 1 | 33 |
| Dominican | 8 | 6 | 75 | 2 | 100 | 2 | 25 |
| Drexel | 21 | 7 | 33 | 1 | 7 | 14 | 67 |
| Emporia | 8 | 7 | 87 | 1 | 100 | 1 | 13 |
| Florida State | 27 | 15 | 56 | 3 | 25 | 12 | 44 |
| Hawaii | 6 | 4 | 67 | 2 | 100 | 2 | 33 |
| Illinois | 22 | 13 | 59 | 2 | 22 | 9 | 41 |
| Indiana | 22 | 10 | 45 | 4 | 33 | 12 | 55 |
| Iowa | 4 | 1 | 25 | 1 | 33 | 3 | 75 |
| Kent | 16 | 13 | 81 | 3 | 100 | 3 | 19 |
| Kentucky | 6 | 3 | 50 | 3 | 100 | 3 | 50 |
| Long Island | 16 | 9 | 56 | 4 | 57 | 7 | 44 |
| Louisiana | 11 | 10 | 91 | 1 | 100 | 1 | 9 |
| Maryland | 14 | 8 | 57 | 0 | 0 | 6 | 43 |
| McGill | 9 | 6 | 67 | 1 | 33 | 3 | 33 |
| Michigan | 33 | 9 | 27 | 0 | 0 | 24 | 73 |
| Missouri | 18 | 8 | 44 | 1 | 10 | 10 | 56 |
| Montreal | 14 | 8 | 57 | 2 | 33 | 6 | 43 |
| N Texas | 14 | 10 | 71 | 3 | 75 | 4 | 29 |
| N Carolina, Chapel Hill | 23 | 21 | 91 | 1 | 50 | 2 | 9 |
| N Carolina, Greensboro | 7 | 6 | 86 | 0 | 0 | 1 | 14 |
| N Carolina, Central | 8 | 8 | 100 | N/a | N/a | 0 | 0 |
| Oklahoma | 12 | 8 | 67 | 4 | 100 | 4 | 33 |
| Pittsburgh | 11 | 9 | 81 | 0 | 0 | 2 | 19 |
| Pratt | 6 | 2 | 33 | 2 | 50 | 4 | 67 |

| **Table 5.1, cont.** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Puerto Rico | 8 | 6 | 75 | 0 | 0 | 2 | 25 |
| Queens | 9 | 8 | 89 | 0 | 0 | 1 | 11 |
| Rhode Island | 7 | 4 | 57 | 3 | 100 | 3 | 43 |
| Rutgers | 20 | 12 | 60 | 3 | 38 | 8 | 40 |
| S Carolina | 12 | 11 | 92 | 1 | 100 | 1 | 8 |
| S Connecticut | 11 | 8 | 73 | 3 | 100 | 3 | 27 |
| S Florida | 14 | 12 | 85 | 1 | 50 | 2 | 15 |
| S Jose | 13 | 10 | 77 | 3 | 100 | 3 | 23 |
| S Mississippi | 8 | 7 | 88 | 1 | 100 | 1 | 12 |
| Simmons | 17 | 15 | 88 | 1 | 50 | 2 | 12 |
| St. John | 5 | 3 | 60 | 1 | 50 | 2 | 40 |
| Syracuse | 32 | 11 | 34 | 3 | 14 | 21 | 66 |
| Tennessee | 13 | 9 | 69 | 2 | 50 | 4 | 31 |
| Texas Austin | 18 | 13 | 72 | 0 | 0 | 5 | 28 |
| Texas Women | 13 | 11 | 85 | 1 | 50 | 2 | 15 |
| Toronto | 17 | 12 | 71 | 0 | 0 | 5 | 29 |
| Washington | 27 | 19 | 70 | 0 | 0 | 8 | 30 |
| Wayne State | 11 | 7 | 64 | 3 | 75 | 4 | 36 |
| Western Ontario | 23 | 11 | 48 | 5 | 42 | 12 | 52 |
| Wisconsin Madison | 11 | 8 | 72 | 2 | 67 | 3 | 28 |
| Wisconsin Milwaukee | 19 | 14 | 74 | 1 | 20 | 5 | 26 |
| **Total Number/Percent** | **736** | **465** | **63%** | **98** | **36% of faculty with non-LIS doctorates & 13% of all LIS faculty** | **271** | **37%** |

It is clear that the schools vary in terms of total number of faculty members and ratios between faculty members with LIS and non-LIS doctorates.

Eleven schools have a half or more of their faculty from other disciplines, i.e. with non-LIS doctorates (Catholic (50%), Clarion (63%), Drexel (67%), Indiana (55%), Iowa (75%), Kentucky (50%), Michigan (73%), Missouri (56%), Pratt (67%), Syracuse (66%) and Western Ontario (52%)). Seven schools have ten or more faculty members with non-LIS doctorates (Drexel (14), Florida State (12), Indiana (12), Michigan (24), Missouri (10), Syracuse (21), and Western Ontario (12)). Six schools belong to both groups: they have ten or more faculty with non-LIS doctorates and the percentage of the latter is fifty or higher (Drexel, Indiana, Michigan, Missouri, Syracuse, and Western Ontario). All these schools

have low percentage of those holding MLS degree among faculty with non-LIS doctorates as well. None of the faculty with non-LIS doctorates at Michigan holds a Master's degree in LIS.

There is another interesting group of schools which have a high percentage of faculty from other disciplines but the actual number is low (Catholic, Clarion, Iowa, Kentucky, and Pratt). Some schools can be called pseudo-multidisciplinary because all their faculty with non-LIS doctorates hold a Master's degree in LIS (Alabama, Alberta, Clarion, Denver, Dominican, Emporia, Hawaii, Kent, Kentucky, Louisiana, Oklahoma, Rhode Island, South Carolina, Southern Connecticut, San Jose, and Southern Mississippi).

It might be safe to conclude that one may expect the most interesting things in regard to disciplinary connections from the schools with both high percentage of faculty with non-LIS doctorates and high actual number of those (the overlapping part of the following Venn diagram).

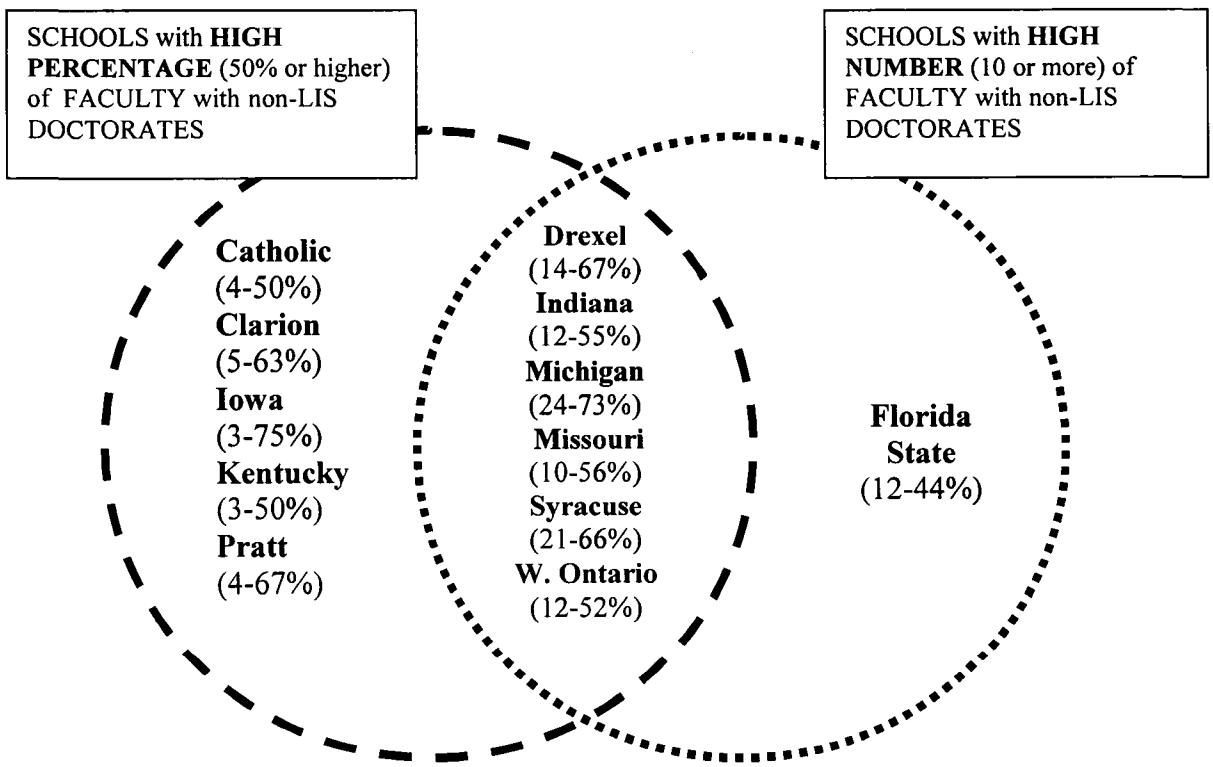


**Fig. 5.1 LIS schools with the high percentage and high number of faculty with non-LIS doctorates (shown in parentheses)**

The disciplinary characteristics of the schools' publication and citation patterns are presented in section 5.3.3.

The table format (table 5.1) does not allow identifying patterns at first sight. The following figures illustrate the data presented in table 5.1 grouping it in several ways. Figure 5.2 represents frequency distribution of faculty with non-LIS doctorates in LIS schools. Ratios between faculty members with LIS and non-LIS doctorates are more evident. Schools are grouped by the percentage of faculty members with doctorates in other disciplines. The majority of the schools (43 schools out of 56, or 77 % of all schools) have 11-50 % of faculty members with non-LIS doctorates. Six schools (11% of all schools) have more than 60 % of migrants from different disciplines; and only for four schools (7% of all schools) this number is less than or equal to 10%. The numbers of the schools having 11-20%, 21-30%, 31-40%, and 41-50% of faculty members with non-LIS doctorates are almost equal (10, 10, 11, and 12 schools respectively).

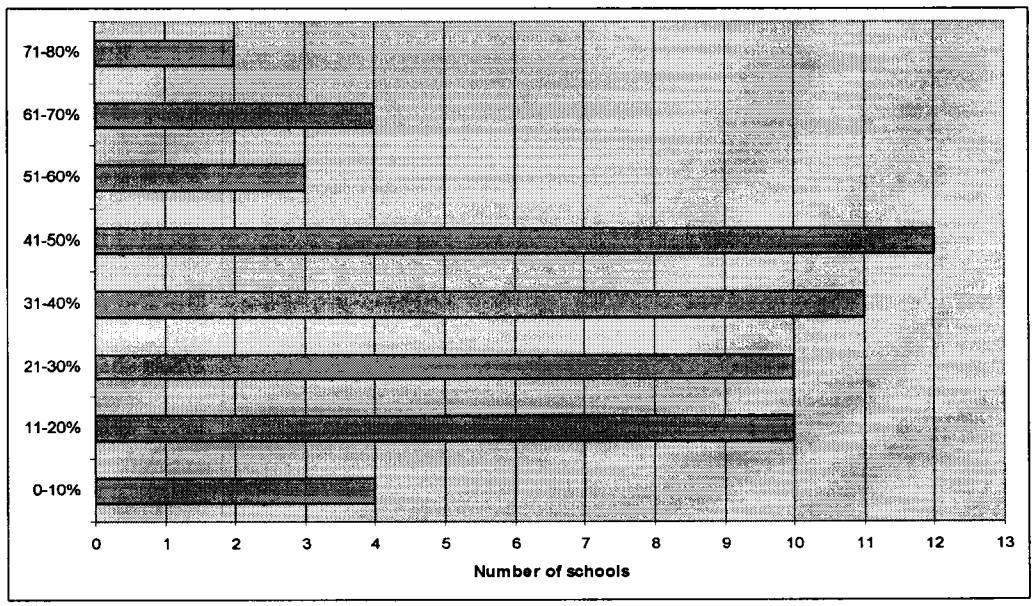


**Fig. 5.2 Percentage of LIS faculty members with non-LIS doctorates in 56 ALA accredited programs**

Figure 5.3 provides a view of the ratios between faculty with and without LIS doctorates in 56 LIS schools (sequenced by the number of faculty members with LIS doctorates).

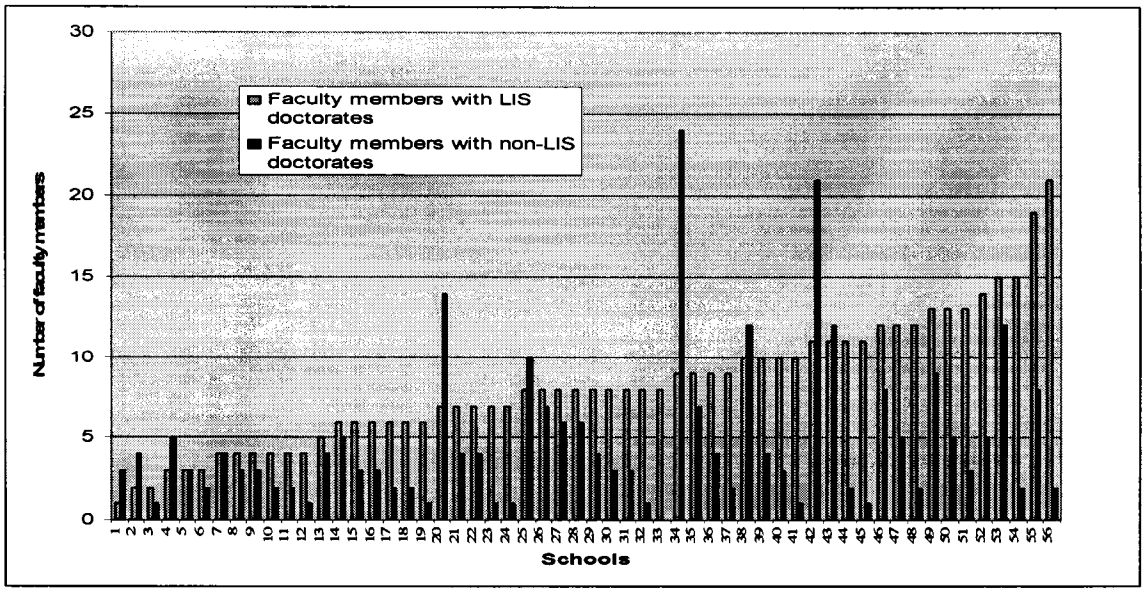


**Fig. 5.3 Number of faculty members with LIS and non-LIS doctorates in 56 ALA accredited programs**

In this figure, one can see those 7 schools which have ten or more faculty members with non-LIS doctorates: the School of Information at the University of Michigan (24), the School of Information Studies at Syracuse University (21), the iSchool at Drexel (14), College of Information at the Florida State University (12), School of Library and Information Science at Indiana University (12), the School of Information Science & Learning Technologies at the University of Missouri (10), and the Faculty of Information & Media Studies at the University of Western Ontario (12).

The figure shows that the number of faculty members in general and of those with LIS and with non-LIS doctorates in particular vary greatly from school to school. The School of Information at the University of Michigan is the largest one among the schools with ALA accredited programs (33 faculty members with doctorates). The Library and Information Science Program in the College of Education at the University of Denver is the smallest one (3 full time faculty members with doctorates). The ratio between the largest and the smallest schools is 11:1.

The levels of multidisciplinarity of the schools' faculty members (the proportion of faculty with non-LIS doctorates) vary significantly as well. The School of Library and Information Science at the North Carolina Central University does not have faculty members

with non-LIS doctorates at all while 73 % of faculty members of the School of Information at the University of Michigan hold advanced degrees in disciplines other than LIS.

Figure 5.4 demonstrates this difference more visibly. It shows the ratios between faculty members with LIS and non-LIS doctorates in each of 56 ALA accredited programs. The latter constitute 37% of the population of LIS schools' faculty members (the upper left part of the bars) and are quite visible in this diagram.

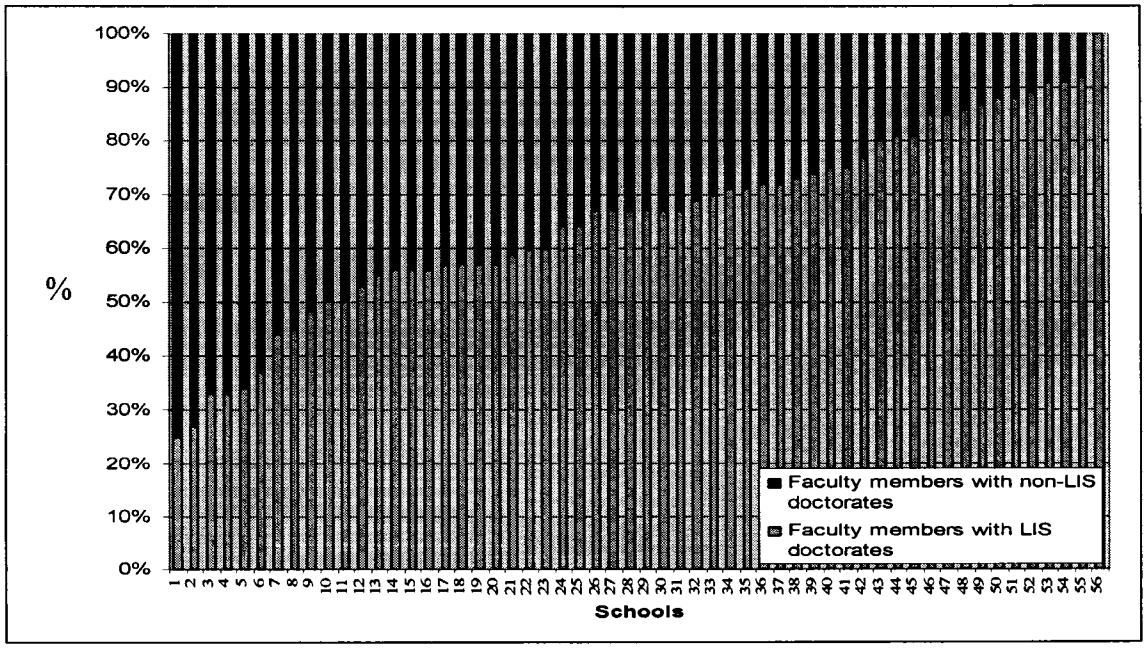


**Fig. 5.4 Proportions of faculty members with LIS and non-LIS doctorates in 56 ALA accredited programs**

The table and the figures represent the LIS schools' faculty compositions accurately but they do not show the actual level of multidisciplinarity. There is a reason for that. In many cases, faculty members with non-LIS advanced degrees have some exposure to LIS. Some of them, for example, worked for a long time in a library in different capacities, so, even without a formal degree in LIS, they know a great deal about library settings. In addition to this, a significant fraction of faculty members with non-LIS doctorates hold Master's degrees in LIS[22]. Those faculty members cannot be considered complete newcomers to the discipline of LIS. The diagram changes dramatically when those faculty with non-LIS doctorates who hold Master's degrees in LIS as well are taken into

[22] It can be a Master's degree in LIS, LS or IS.

consideration. It leaves us with a considerably different "LIS – non-LIS" ratio as seen in figure 5.5. The lower part of the bars represents faculty members with LIS doctorates. The middle part represents faculty with non-LIS doctorate and a Master's degree in LIS in addition. The upper part of the bars shows the portion of faculty members who hold non-LIS doctorates but do not have Masters' degrees in LIS.

In some schools, all "migrants" from other disciplines have Master's degrees in LIS. In such cases, non-LIS doctorates may not mean an addition of a completely non-native circle of research problems and methodology but rather integration of the latter into the research agenda and methodology of LIS[23].

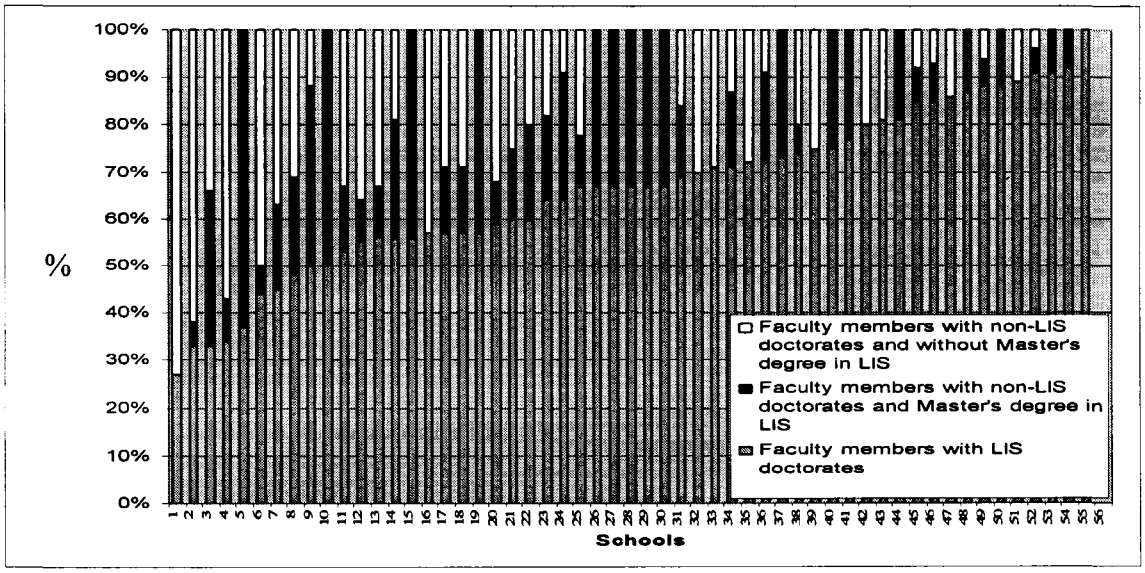


**Fig. 5.5 Proportions of faculty members with LIS doctorates (1), faculty members with non-LIS doctorates and Master's degrees in LIS (2), and faculty members with non-LIS doctorates who do not hold Master's degrees in LIS**

The following diagram illustrates this even more vividly. In figure 5.6, faculty members with any graduate degree (either Master's or a PhD) in LIS are grouped together and compared with those faculty members who hold an advanced degree in other disciplines and do not have a Master's degree in LIS. The order of schools is rearranged based on the

[23] The degree of such integration might be different since a Master's degree is not a research degree and does not imply a significant familiarity with research attributes of the field.

number of faculty members with either a doctorate or a Master's degree in LIS. The percentage of 'foreign' faculty members (those who hold neither a doctorate nor a Master's degree in LIS) changed from 37 % to 23%, less than a quarter.

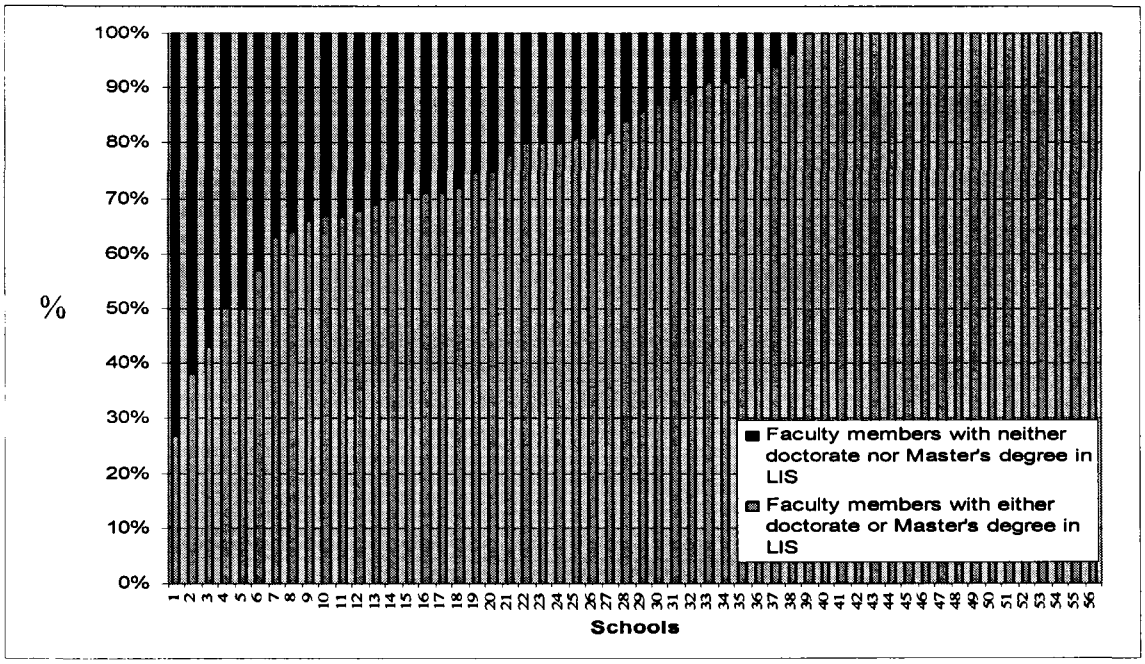


**Fig. 5.6 Proportions of faculty members who hold either a doctorate or a Master's degree in LIS and faculty members who hold neither a doctorate nor a Master's degree in LIS**

This section represents the quantitative part of the preliminary findings. The following section focuses on its qualitative side. It describes the disciplines and their combinations that are present in the LIS schools' faculty members' advanced degrees.

### 5.3.1.2 Disciplines of advanced degrees held by faculty members with LIS and non-LIS doctorates

The variety of disciplines of LIS faculty members' advanced degrees is quite significant (117 fields of study aside from LIS). Faculty members with non-LIS doctorates represent quite an array of disciplinary backgrounds. Table 5.2 shows in which disciplines LIS schools' faculty members hold advanced degrees and the number of "migrants" from particular disciplines to LIS schools. The disciplines of the advanced degrees (and their combinations) are presented the way they are formulated in data received from the schools.

## Table 5.2 Disciplines of doctorates of LIS schools' faculty members

| **Disciplines of doctorates held by LIS schools' faculty members** | Number of faculty members holding a doctorate in particular discipline | Number of faculty members with **LIS** doctorates | Number of faculty members with **non-LIS** doctorates |
|---|---|---|---|
| Administration | 1 | | 1 |
| Administration and leadership | 1 | | 1 |
| Administration, training and policy studies | 1 | | 1 |
| Adult education | 1 | | 1 |
| American civilization | 3 | | 3 |
| American history | 1 | | 1 |
| Anthropology | 1 | | 1 |
| Applied mathematical sciences | 1 | | 1 |
| Applied physics | 1 | | 1 |
| Archives studies | 1 | 1 | |
| Astronomy | 1 | | 1 |
| Biochemistry | 1 | | 1 |
| Business/Technology and operations management | 1 | | 1 |
| Business administration | 1 | | 1 |
| Business administration/ Information systems | 1 | | 1 |
| Business administration/Telecommunications and management information systems | 1 | | 1 |
| Classics | 1 | | 1 |
| Cognitive psychology | 3 | | 3 |
| Communication | 13 | | 13 |
| Communication and culture | 2 | | 2 |
| Communication and information sciences | 3 | 3 | |
| Communication and science studies | 1 | | 1 |
| Communication arts | 1 | | 1 |
| Communication, information and library studies | 10 | 10 | |
| Communications studies | 1 | | 1 |
| Community health | 1 | | 1 |
| Comparative literature | 2 | | 2 |
| Computer and cognitive science | 1 | | 1 |
| Computer science | 31 | | 31 |
| Computer science and engineering | 2 | | 2 |
| Computing | 1 | | 1 |
| Cultural foundations of education | 1 | | 1 |
| Curriculum and instruction | 6 | | 6 |
| Curriculum and teaching | 1 | | 1 |
| Dance | 1 | | 1 |
| Design studies | 1 | | 1 |
| Doctor of Arts | 3 | | 3 |
| Economics | 5 | | 5 |

| Table 5.2, cont. | | | |
|---|---|---|---|
| Education | 11 | | 11 |
| Education (Human development and psychology) | 1 | | 1 |
| Education/ Curriculum and instruction | 2 | | 2 |
| Education/ Instructional design | 1 | | 1 |
| Educational administration | 1 | | 1 |
| Educational communications and technology | 1 | | 1 |
| Educational leadership | 2 | | 2 |
| Educational leadership and cultural foundations | 1 | | 1 |
| Educational leadership and innovations | 1 | | 1 |
| Educational media | 1 | | 1 |
| Educational technology | 10 | | 10 |
| Electrical engineering and computer science | 1 | | 1 |
| Engineering | 2 | | 2 |
| English | 10 | | 10 |
| English (American poetry) | 1 | | 1 |
| English education | 1 | | 1 |
| English literature | 2 | | 2 |
| Ethics and information transfer (multidisciplinary) | 1 | | 1 |
| Experimental/ cognitive psychology | 1 | | 1 |
| Experimental psychology | 1 | | 1 |
| Film studies | 1 | | 1 |
| Folk life studies | 1 | | 1 |
| Folklore | 1 | | 1 |
| French | 1 | | 1 |
| Geography | 1 | | 1 |
| Geology | 1 | | 1 |
| Health services organization and research | 1 | | 1 |
| Higher education | 5 | | 5 |
| Higher education administration | 3 | | 3 |
| Higher education/ library and information sciences | 1 | 1 | |
| History | 14 | | 14 |
| History and sociology of science | 1 | | 1 |
| History of consciousness | 1 | | 1 |
| History of medicine | 1 | | 1 |
| History of science | 1 | | 1 |
| History of technology and human geography | 1 | | 1 |
| Human-computer interaction | 1 | | 1 |
| Human experimental psychology | 1 | | 1 |
| Individual interdisciplinary studies | 1 | | 1 |
| Industrial and business studies/information | 1 | | 1 |
| Industrial and systems engineering | 1 | | 1 |
| Industrial engineering | 1 | | 1 |
| Informatics | 1 | 1 | |
| Information | 3 | 3 | |
| Information and communication | 1 | 1 | |

| Table 5.2, cont. | | | |
|---|---|---|---|
| Information and computer science | 4 | 4 | |
| Information and library science | 10 | 10 | |
| Information and library studies | 4 | 4 | |
| Information science | 55 | 55 | |
| Information science and learning technologies | 1 | 1 | |
| Information science and moral theology | 1 | 1 | |
| Information science and technology | 3 | 3 | |
| Information studies | 38 | 38 | |
| Information studies/educational technology | 1 | 1 | |
| Information systems | 2 | 2 | |
| Information technologies | 4 | 4 | |
| Information transfer | 27 | 27 | |
| Instructional design | 1 | | 1 |
| Instructional systems | 1 | | 1 |
| Instructional systems design | 1 | | 1 |
| Instructional systems technology | 3 | | 3 |
| Instructional technology | 2 | | 2 |
| Interdisciplinary | 1 | | 1 |
| JD | 2 | | 2 |
| Journalism | 1 | | 1 |
| Language, literature and culture | 1 | | 1 |
| Librarianship | 1 | 1 | |
| Library and information science | 228 | 228 | |
| Library and information studies | 6 | 6 | |
| Library science | 53 | 53 | |
| Library science and higher education | 1 | 1 | |
| Library science, information and documentation | 1 | 1 | |
| Linguistics | 6 | | 6 |
| Management | 2 | | 2 |
| Management information systems | 4 | 4 | |
| Management of information systems and technology | 1 | 1 | |
| Management, organizations studies | 1 | | 1 |
| Manufacturing, management and information systems | 1 | | 1 |
| Mathematics education | 1 | | 1 |
| MD | 1 | | 1 |
| Medieval history | 1 | | 1 |
| Mechanical and industrial engineering | 1 | | 1 |
| Medical Informatics | 1 | | 1 |
| Music | 1 | | 1 |
| Musicology | 1 | | 1 |
| Nuclear physics | 1 | | 1 |
| Nutritional science | 1 | | 1 |
| Organization science and information technology | 1 | | 1 |
| Organizational theory and management information systems | 1 | | 1 |

| Table 5.2, cont. | | | |
|---|---|---|---|
| Philosophy | 5 | | 5 |
| Physics | 2 | | 2 |
| Political science | 7 | | 7 |
| Political science/Government | 1 | | 1 |
| Political economy and public policy | 2 | | 2 |
| Public policy and management/ Information technology and organizations | 1 | | 1 |
| Psychoacoustics | 1 | | 1 |
| Psychology | 10 | | 10 |
| Public administration | 5 | | 5 |
| Public administration and policy | 1 | | 1 |
| Science and mathematics education | 1 | | 1 |
| Science and technology studies | 2 | | 2 |
| Secondary education | 1 | | 1 |
| Social science | 1 | | 1 |
| Sociology | 4 | | 4 |
| Soviet and East European studies | 1 | | 1 |
| Special education | 1 | | 1 |
| Speech communication | 1 | | 1 |
| Teaching and curriculum | 1 | | 1 |
| Technology, management, and policy | 1 | | 1 |
| Telecommunications Policy and management | 1 | | 1 |
| **Total** | **736** | **465** | **271** |

The diversity of disciplinary backgrounds of LIS schools' faculty members is remarkable. Some of the disciplines and their combinations appear only once on the list, some hold more prominent positions on it.

To make this diversity more manageable in terms of representation, all the disciplines were put in the following groups: Arts and Humanities, Basic and natural sciences, Communication, Computer science, Education, Multidisciplinary/Interdisciplinary, Professions, and Social sciences. The arts and humanities group includes such disciplines as arts, folklore, history, languages and literature, and philosophy. The basic and natural sciences group contains disciplines like biology, chemistry, geology, geography, mathematics, and physics. The group of social sciences includes such disciplines as anthropology, economics, sociology, political economy, political science, psychology, and public administration. Education and Communication are presented as separate groups due to the prominent position they hold on the list of the faculty members' disciplines of doctorates.

"Multidisciplinary/Interdisciplinary" group contains the doctorates which are phrased as multi- or interdisciplinary by the department granting them (based on the data confirmed by the schools in December 2006). (The operational classification of the disciplines of the doctorates from table 5.2 is presented in Appendix 7).

**Table 5.3 Knowledge domains of doctorates of LIS schools' faculty members**

| Disciplines of doctorates held by LIS schools' faculty members | Number of faculty members holding a doctorate in particular discipline |
|---|---|
| Arts and Humanities | 65 |
| Basic and natural sciences | 14 |
| Communication | 20 |
| Computer science | 36 |
| Education | 60 |
| Multidisciplinary/ Interdisciplinary | 3 |
| Professions | 29 |
| Social sciences | 44 |
| **Total** | **271** |

The same numbers are presented in figure 5.7 to make the trends more visible.

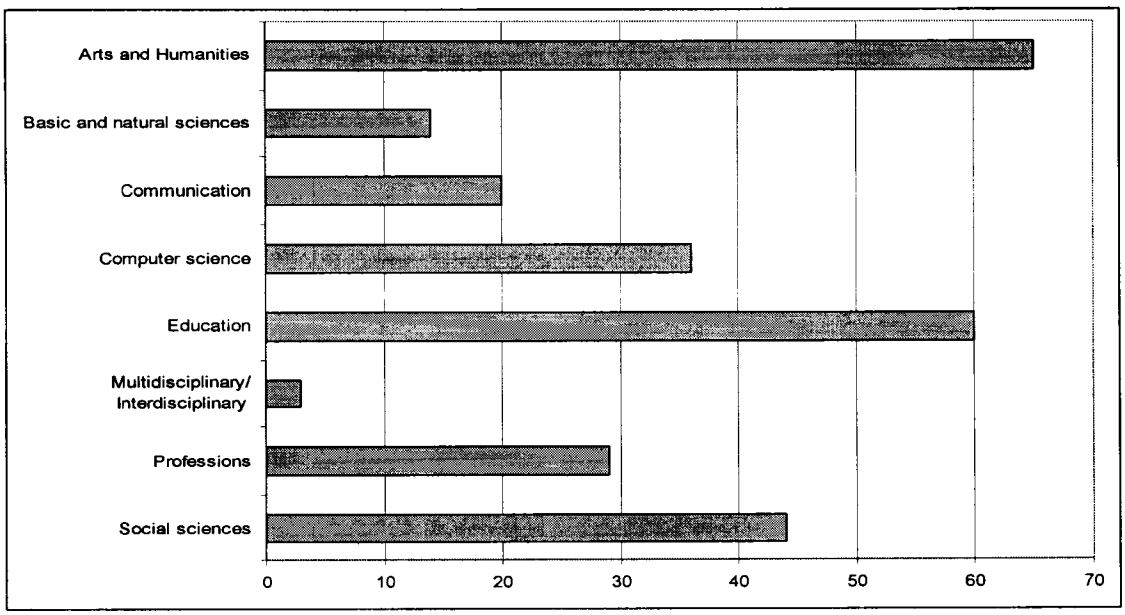


**Fig. 5.7 Knowledge domains of doctorates of LIS schools' faculty members**

LIS schools' faculty members represent all knowledge domains. Hard and soft, "little" and "big" sciences are neighbors on this list. Basic sciences are present along with Social Sciences, Humanities, and professional fields such as Education, Communication, Law, Medicine and Health studies, and Business and Administration. LIS itself belongs to the group of social sciences and LIS schools are professional schools. Probably, this contributes to the ratio between disciplines from different knowledge domains on the list. Professions and social sciences prevail. Humanities and computer science follow them. Basic sciences and art are the smallest groups on the list. And three doctorates are interdisciplinary by definition so cannot be put into any of the above mentioned groups.

The ratio between the number of faculty members with a doctorate in a particular knowledge domain and the total number of publications they produce is shown in figure 5.8. It is clear that the number of publications in a particular group of disciplines reflects the size of the population of the faculty members associated with this group; but the ratios between numbers of publications in a particular domain and the numbers of faculty members representing it in the LIS faculty population varies. Some disciplinary groups such as Arts and Humanities, Computer science, and Social sciences, are more active in publishing than others. They generate the majority of publications by faculty members with non-LIS doctorates.

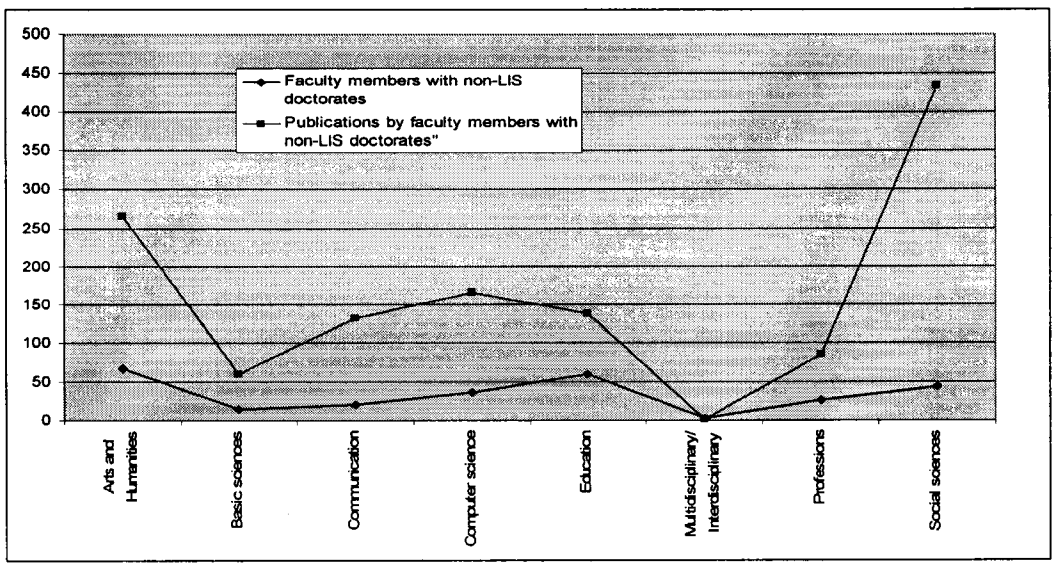


**Fig. 5.8 Publications by faculty members with non-LIS doctorates by disciplines of doctorates**

### 5.3.1.3 Compound nature of the disciplines of the LIS faculty members' doctorates.

In the table 5.2, the disciplines of doctorates held by LIS schools' faculty members are presented in their exact wording. Two things draw one's attention. First, there are doctorates that are multi- or interdisciplinary by definition, e.g. 'Individual interdisciplinary studies', 'Interdisciplinary', and 'Ethics and information transfer (multidisciplinary)'. Second, there are doctorates that can be called "compound" because they combine two different areas of study. The following doctorates belong to this group: 'Public policy and management/ Information technology and organizations', 'Communication and culture', 'Computer and cognitive science', 'Communication and information sciences', 'Cultural foundations of education', 'Information science and moral theology'. It seems that the programs granting research degrees cannot limit themselves to one discipline.

### 5.3.1.4 'Multidisciplinarity' of LIS doctorates

For the sake of consistency, in this text, doctorates in Library Science, Library and Information Science, Information Science, and the like are considered and called throughout the text doctorates in LIS. Such aggregation is necessary because one of the study's goals is to compare two groups of faculty members, those with doctorates in LIS and the ones with doctorates in all other disciplines. Nevertheless, it is important to emphasize that LIS as a field of study is not completely homogeneous. And it is reflected in a variety of phrasing of the titles of advanced degrees granted by LIS schools.

This study focuses only on ALA accredited programs. Even so the current diversity of LIS programs is easily noticeable. Different schools emphasize different aspects of LIS as a field of study in their programs' descriptions on their web sites. Some LIS programs are part of larger departments such as departments or colleges of Management, Communication, or Information studies[24]. The ratio between "L" and "I" in the doctorates granted by different schools can definitely vary but cannot be identified accurately[25]. Nevertheless, the heterogeneity of disciplinary foci of doctorates in LIS is worth noting.

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[24] In some cases Information science and Library and information science coexist as two different tracks in the same department.

[25] Sometimes it is quite clear from the phrasing which part of the "LIS" field is emphasized (e.g. doctorates in Library science vs. doctorates in Information studies). But that kind of observation cannot constitute a solid basis for a research analysis as it is anecdotal.

### 5.3.2 Interdisciplinary publishing and citation patterns of LIS schools' faculty members

This part of the chapter focuses on the main findings of the study -- publishing and citation patterns of LIS schools' faculty members. It presents the findings which answer the study's research questions.

#### 5.3.2.1 Disciplinary categories associated with LIS schools' faculty members' publications and works citing them in the Web of Knowledge

This section describes the data illustrating connections between LIS and other knowledge domains. Three thousand nine hundred and ninety seven publications by LIS faculty members, published since 1995, and indexed in the Web of Knowledge have been collected. In the Web of Knowledge, disciplinary categories are assigned to every record[26]. All the categories assigned to the works of LIS schools' faculty members indexed in the Web of Knowledge or to those citing them were divided into three groups. The categories "Information Science and Library Science" ("IS and L") and "Computer Science, Information Systems" ("CS, IS") were considered as individual groups because they are the main categories assigned to the LIS journals in the Web of Knowledge (both categories together or individually). All other disciplinary categories were grouped together under "Other disciplines". This approach to arranging disciplinary categories was employed to test the study's hypotheses.

The first hypothesis states that LIS faculty members with non-LIS doctorates have stronger connections with other disciplines than faculty with LIS doctorates.
The second hypothesis states that faculty members with advanced degrees in disciplines other than LIS are well established in their new field and maintain strong connections with LIS i.e. actively publish in LIS journals and get cited by scholars publishing in LIS journals.

The following table 5.4 shows disciplinary foci of LIS schools' faculty members' publications since 1995 and the works citing them (indexed in the Web of Knowledge).

[26] The exceptions are discussed in the section 4.3.1.

**Table 5.4 Disciplinary categories assigned to publications of LIS schools' faculty members with LIS and non-LIS doctorates and works citing them, published since 1995 and indexed in the Web of Knowledge**

| Faculty members... | Number of different disciplinary categories assigned in the Web of Knowledge to: | | | | | |
|---|---|---|---|---|---|---|
| | Publications with assigned categories: | | | Citing works with assigned categories: | | |
| | "IS and LS" | "CS, IS" | other disciplines | "IS and LS" | "CS, IS" | other disciplines |
| with LIS doctorates N = 465 | **2475** | **968** | **474** | **4354** | **2643** | **1935** |
| with non-LIS doctorates N = 271 | **769** | **409** | **851** | **1580** | **1043** | **2882** |

The following diagram makes the trends represented in these numbers more visually expressive. It is clear that faculty members with LIS advanced degrees receive the majority of citations from researchers and practitioners from LIS while faculty members with non-LIS doctorates "bring" to the field more citations from other disciplines. They also publish in other disciplines almost twice as often as faculty members with LIS doctorates (supporting hypothesis 1). But faculty members with LIS doctorates do publish in other disciplines and are cited by researchers and practitioners from other disciplines.

Hypothesis 2 stating that LIS schools' faculty members with non-LIS doctorate are well established in their new field and have developed strong connections with its research agenda is supported by the number of publications by these faculty in LIS and the frequency of citations from LIS to their publications.

Figure 5.9 illustrates the overall picture of the LIS publications in 1995- summer 2006. It presents raw data; the ratio between the number of faculty members with and without LIS doctorates is not taken into consideration. The latter group constitutes only 37% of the population of LIS schools' faculty members. Therefore, it is logical to assume that the

differences between the total numbers of publications and citations in the two groups are influenced by the difference in their size.

Table 5.4 and figure 5.9 present frequency of disciplinary categories assigned to publications of LIS faculty and works citing them. Table 5.5 and figure 5.10 represent the adjusted results so that the same raw data on publications of LIS schools' faculty and works citing them are counted per capita. It is easy to see that the patterns represented in these two sets are the same.

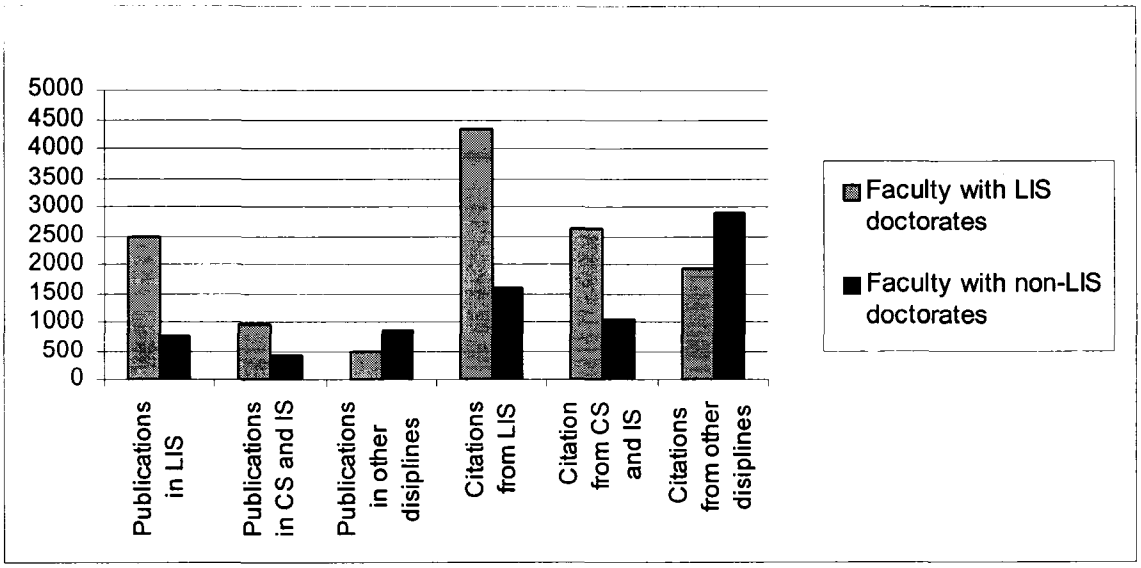


**Fig. 5.9 Frequency of disciplinary categories assigned in the Web of Knowledge to publications of LIS schools' faculty members and to works citing them**

**Table 5.5 Disciplinary categories assigned to publications of LIS schools' faculty members with LIS and non-LIS doctorates and works citing them, published since 1995 and indexed in the Web of Knowledge, *per capita***

| **Faculty members...** | **Number *per capita* of disciplinary categories assigned to:** | | | | | |
|---|---|---|---|---|---|---|
| | Publications with assigned categories: | | | Citing works with assigned categories: | | |
| | "IS and LS" | "CS, IS" | other disciplines | "IS and LS" | "CS, IS" | other disciplines |
| with LIS doctorates | **5.3** | **2.1** | **1.0** | **9.4** | **5.7** | **4.2** |
| with non-LIS doctorates | **2.8** | **1.5** | **3.1** | **5.8** | **3.8** | **10.6** |

On average, faculty with LIS doctorates publish in and are cited more often by LIS publications, while faculty with non-LIS doctorates publish in and are cited more often by publications in other disciplines; nevertheless, faculty with non-LIS doctorates do contribute to and are cited by LIS publications.

The following figure (5.10) represents the adjusted results so that the same raw data on publications of LIS schools' faculty members and works citing them are counted per capita.

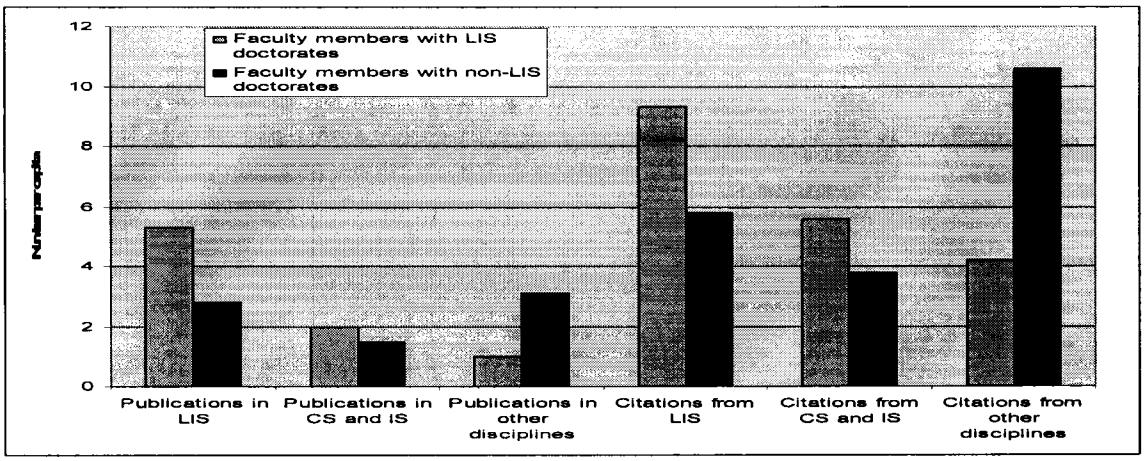


**Fig. 5.10 Frequency of disciplinary categories assigned in the Web of Knowledge to publications of LIS schools' faculty members and to works citing them, *per capita***

The figure 5.10 demonstrates the same general trends as figure 5.9, i.e., faculty with LIS doctorates publish in and are cited more often by publications in LIS periodicals, while faculty with non-LIS doctorates publish in and are cited more often by publications in other disciplines; though, faculty with non-LIS doctorates do contribute to and are cited by LIS publications.

There is another way to show the difference in publishing and citing patterns of faculty members with LIS and non-LIS degrees independently of the sizes of the groups. The following table (5.6) shows not the numbers of disciplinary categories assigned to works published by LIS faculty members and those citing them but the shares (percentages) of those categories across all publications and all citing works for faculty members with LIS doctorates and faculty members with advanced degrees in other disciplines.

**Table 5.6 Percentage of disciplinary categories and total number of disciplinary categories assigned to works published by LIS schools' faculty members since 1995 and works citing them, indexed in the Web of Knowledge**

| Disciplinary categories | Percentage of disciplinary categories in works... | | | |
|---|---|---|---|---|
| | Published by faculty members with | | Citations to works published by faculty members with | |
| | LIS doctorate | Non-LIS doctorate | LIS doctorate | Non-LIS doctorate |
| INFORMATION SCIENCE & LIBRARY SCIENCE | 63% | 38% | 49% | 29% |
| COMPUTER SCIENCE, INFORMATION SYSTEMS | 25% | 20% | 29% | 19% |
| OTHER DISCIPLINES | 12% | 42% | 22% | 52% |
| NUMBER OF DIFFERENT DISCIPLINARY CATEGORIES ASSIGNED TO → | **50** | **80** | **159** | **147** |

The ratio between LIS disciplines and other disciplines supports the hypothesis stating that LIS schools' faculty members with non-LIS doctorates maintain closer connections with other disciplines than those with advanced degrees in LIS, i.e. faculty members with LIS doctorates publish in LIS journals much more than their colleagues with non-LIS doctorates (63% and 38% respectively). The situation reverses when it comes to publishing in other disciplines. Faculty members with non-LIS advanced degrees publish in other disciplines more than three times as much as those with LIS doctorates. The same trend pertains to the citation patterns of the two groups. The ratios are slightly different but the tendency remains the same.

Both groups publish comparable numbers of works in Computer science and information systems and receive similar numbers of citations from the field. This can be explained by the fact, as was mentioned in the literature review, that computer technologies are to a significant degree responsible for the most prominent changes in modern LIS and for making the field appealing to scholars from a wide variety of the disciplines.

### 5.3.2.2 Major knowledge domains representing LIS schools' faculty members' publishing and citations patterns

This section focuses on the knowledge domains in which LIS faculty members publish and from which they receive citations. The data is presented in tables 5.7 and 5.8, and figures 5.11-5.16. All disciplinary categories were divided into groups. There is more then one way to group disciplines. Different authors group disciplines in different ways. The operational categorization of the disciplines is presented in Appendix 6[27].

**Table 5.7 Frequency of disciplinary categories assigned to publications by LIS schools' faculty members and to works citing them arranged by knowledge domains**

| Knowledge domains | Frequency of disciplinary categories assigned to: | | | |
|---|---|---|---|---|
| | Publications by... | Citations to... | Publications by... | Citations to... |
| | *Faculty with LIS doctorates* | | *Faculty with non-LIS doctorates* | |
| Arts and humanities[28] | 99 | 95 | 151 | 115 |
| Basic and natural sciences | 1 | 102 | 26 | 259 |
| Communication | 43 | 138 | 78 | 144 |
| Computer science | 1106 | 3319 | 699 | 1866 |
| Education | 80 | 105 | 82 | 266 |
| Multi/interdisciplinary | 4 | 23 | 12 | 38 |
| Professions | 60 | 499 | 64 | 493 |
| Social sciences | 49 | 297 | 148 | 744 |
| Information science & library science | 2475 | 4354 | 769 | 1580 |
| **Total** | 3917 | 8932 | 2029 | 5505 |

[27] The subject categories in the Web of Knowledge are presented in Appendix 1.

[28] Arts and humanities are combined in one group because there is more then one way to define relationships between these two knowledge domains. For example, Wilson states, "The arts are sometimes taken to mean all the humanities..." (Wilson, 1998, 229).

Per capita representation allows better comparison between the groups of faculty members with LIS and non-LIS doctorates. It is clear from table 5.8 that faculty members with non-LIS doctorates are more active in publishing in other disciplines.

**Table 5.8 Frequency of disciplinary categories assigned to publications by LIS schools' faculty members and to works citing them arranged by knowledge domains, *per capita***

| Knowledge domains | Frequency of disciplinary categories per capita assigned to: | | | |
|---|---|---|---|---|
| | **Publications by...** | **Citations to...** | **Publications by...** | **Citations to...** |
| | ***Faculty with LIS doctorates*** | | ***Faculty with non-LIS doctorates*** | |
| Arts and humanities[29] | 0.21 | 0.20 | 0.56 | 0.42 |
| Basic and natural sciences | 0.002 | 0.22 | 0.096 | 0.96 |
| Communication | 0.09 | 0.3 | 0.29 | 0.53 |
| Computer science | 2.38 | 7.1 | 2.58 | 6.89 |
| Education | 0.17 | 0.23 | 0.3 | 0.98 |
| Multi-/interdisciplinary | 0.009 | 0.05 | 0.04 | 0.14 |
| Professions | 0.13 | 1.07 | 0.24 | 1.82 |
| Social sciences | 0.10 | 0.64 | 0.55 | 2.75 |
| Information science & library science | 5.32 | 9.36 | 2.83 | 5.83 |
| **Total** | **8.41** | **19.17** | **7.49** | **20.32** |

The complete lists of disciplinary categories assigned to publications by LIS faculty members with LIS and non-LIS doctorates and to the works citing them are presented in Appendixes 2-5.

[29] Arts and humanities are combined in one group because there are more then one way to define relationships between these two knowledge domains. For example, Wilson states, "The arts are sometimes taken to mean all the humanities..." (Wilson, 1998, 229).

The data presented in table 5.7 draws attention to two things. First, all the major knowledge domains, including arts and humanities, basic sciences, social sciences and professional fields of study, are well represented. Second, in regard to the numbers of disciplinary categories assigned to publications or articles citing them, faculty members with non-LIS doctorates dominate in all domains except for computer science and LIS (Information Science & Library Science). The raw data allows seeing relative weights of contributions of faculty members with LIS and non-LIS doctorates to knowledge production in LIS and other disciplines. But it does not allow one to make conclusions since the sizes of the groups of faculty members with and without LIS doctorates are quite different (the latter constitute 37% of the whole population of all LIS schools' faculty members). The representation of the data per capita (in table 5.8) solves this problem. Table 5.8 shows that faculty with non-LIS doctorates publish more in all disciplines except LIS. They also receive more citations from other disciplines than their colleagues with LIS doctorates. The following sections will describe publication and citation patterns of LIS faculty members in more detail. Section 5.3.2.2.1 focuses on publishing and section 5.3.2.2.2 describes citation patterns.

#### 5.3.2.2.1 Publishing patterns

Figure 5.11 shows that faculty with LIS doctorates are responsible for more publications in computer science and LIS related publications while faculty with non-LIS doctorates produce more publications in other disciplines. Since these groups differ in size significantly (465:271), figure 5.12 represents the results per capita.

Figure 5.12 shows the same general pattern as figure 5.11. The graph demonstrates that productivity of faculty with non-LIS doctorates is higher in all domains except for LIS. There are two peaks: Computer science and LIS. But the difference between the numbers of disciplinary categories affiliated with computer science and LIS is so substantial that in the figure 5.12 numbers of all other disciplinary categories representing two groups of faculty members seem to be almost the same. When these major disciplinary categories are eliminated from the figure, the ratios between the other categories become more visible.

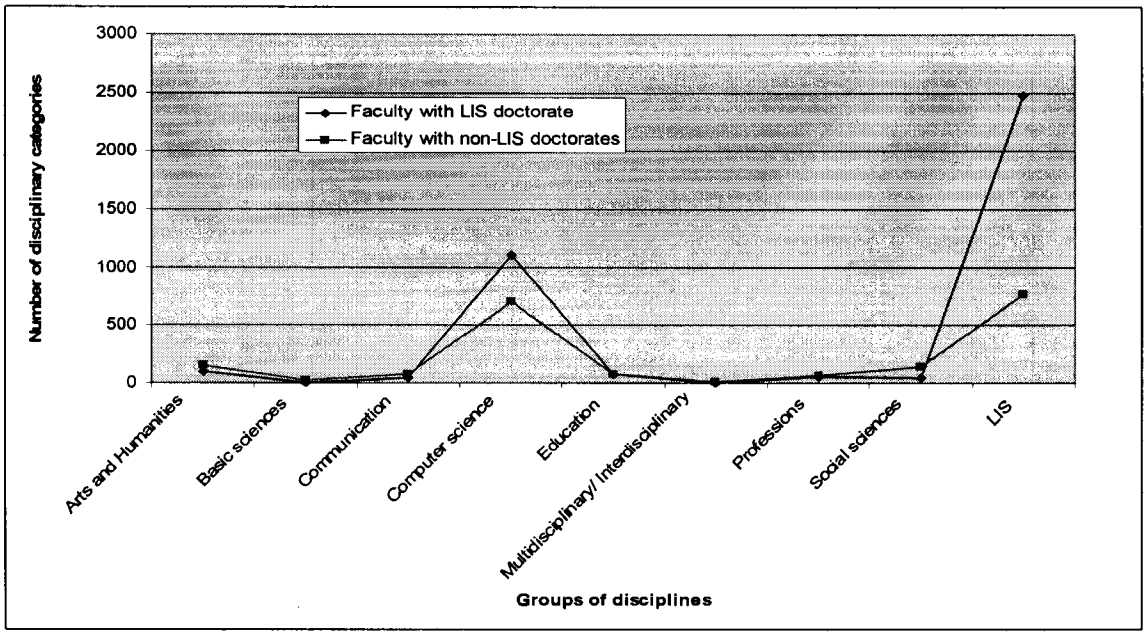


**Fig. 5.11 Frequency of disciplinary categories assigned in the Web of Knowledge to publications (1995-2006) by LIS schools' faculty members**

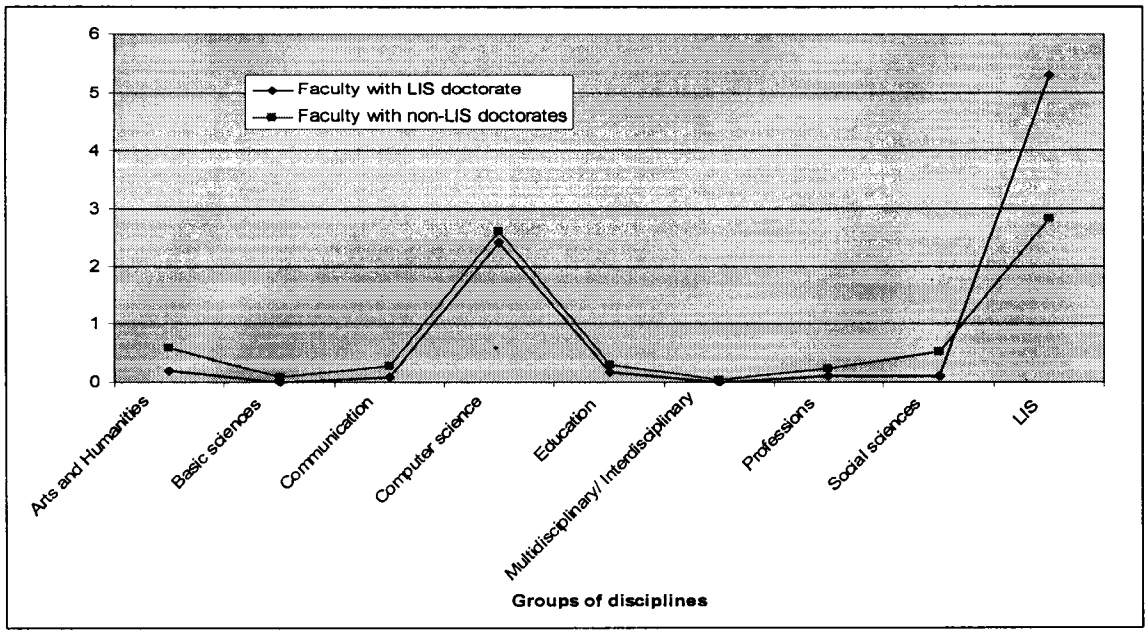


**Fig. 5.12 Frequency of disciplinary categories assigned in the Web of Knowledge to publications (1995-2006) by LIS schools' faculty members, *per capita***

Figure 5.13 presents a comparison between the frequency of disciplinary categories from different knowledge domains (except for computer science and LIS) assigned to publications by faculty members with LIS and non-LIS doctorates.

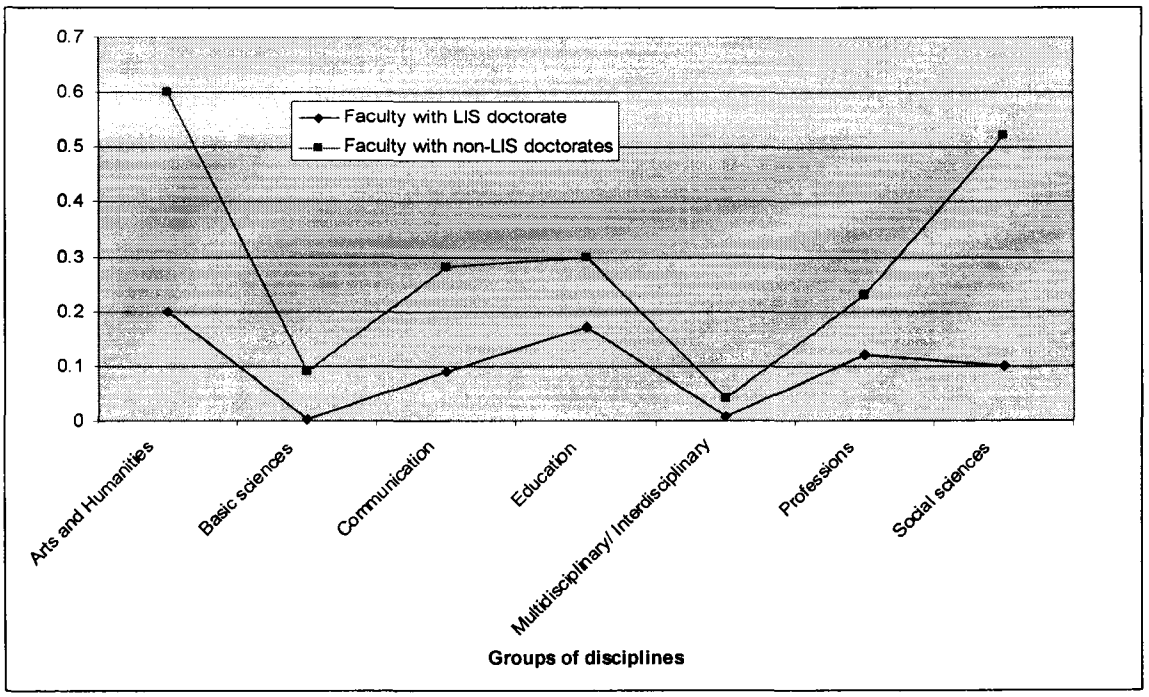


**Fig. 5.13 Frequency of disciplinary categories assigned in the Web of Knowledge to publications (1995-2006) by LIS schools' faculty members, *per capita* (without disciplinary categories related to computer science and LIS)**

### 5.3.2.2.2 Citation patterns

This section presents the part of the data on citation patterns. It was processed in the same way as the data on publication. Figure 5.14 presents the comparison between the numbers of disciplinary categories assigned in the Web of Knowledge to the works citing publications by LIS faculty members. It shows that faculty with LIS doctorates are responsible for more citations from computer science than their colleagues with non-LIS doctorates and for the majority of citations from LIS.

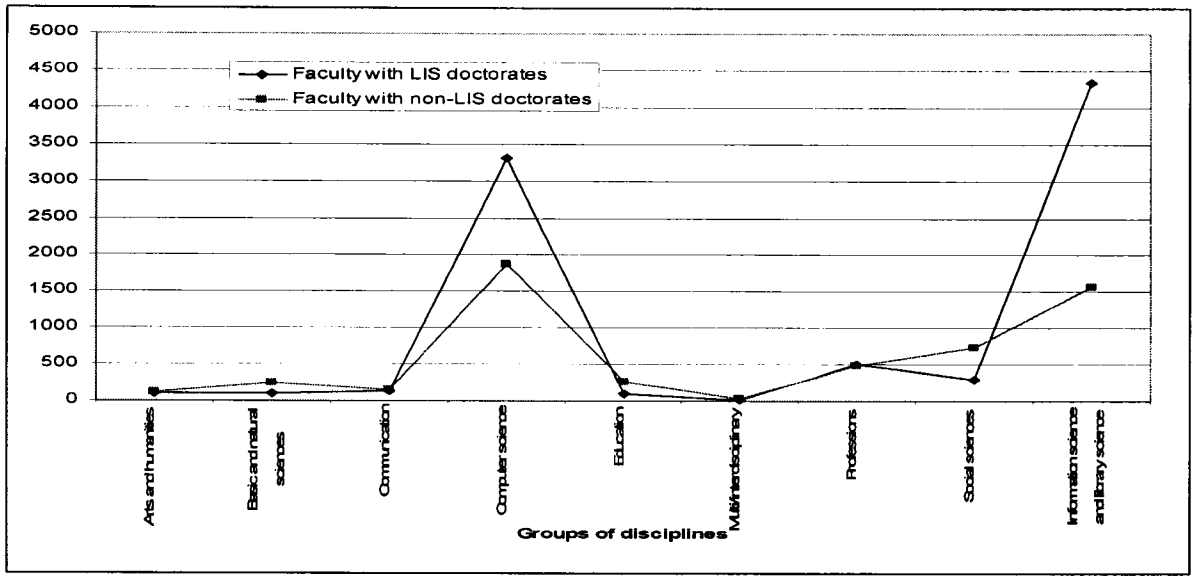


**Fig. 5.14 Frequency of disciplinary categories assigned in the Web of Knowledge to publications citing works of LIS schools' faculty members (1995-2006)**

As is the case with publishing patterns, this raw data indicates the comparison between the "export" from other disciplines "provided" by faculty members with and without LIS doctorate. But it does not allow conclusions to be made on the faculty members' productivity in a particular domain.

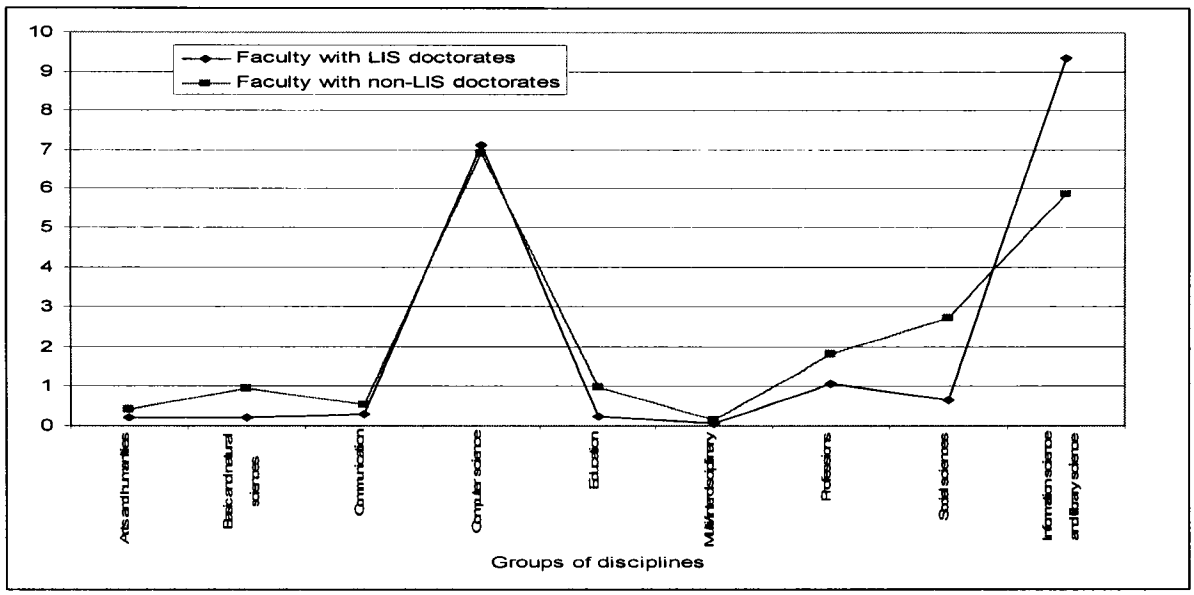


**Fig. 5.15 Frequency of disciplinary categories assigned in the Web of Knowledge to publications citing works of LIS schools' faculty members (1995-2006), *per capita***

Figure 5.15 presents the same data per capita. The graph demonstrates that publications by faculty with non-LIS doctorates attract more attention from other domains than the ones by faculty with LIS doctorate, while the latter harvest the majority of citations from LIS. The numbers of citations from computer science are almost equal in the two groups of faculty members. Figure 5.16 presents the per capita data excluding computer science and LIS.

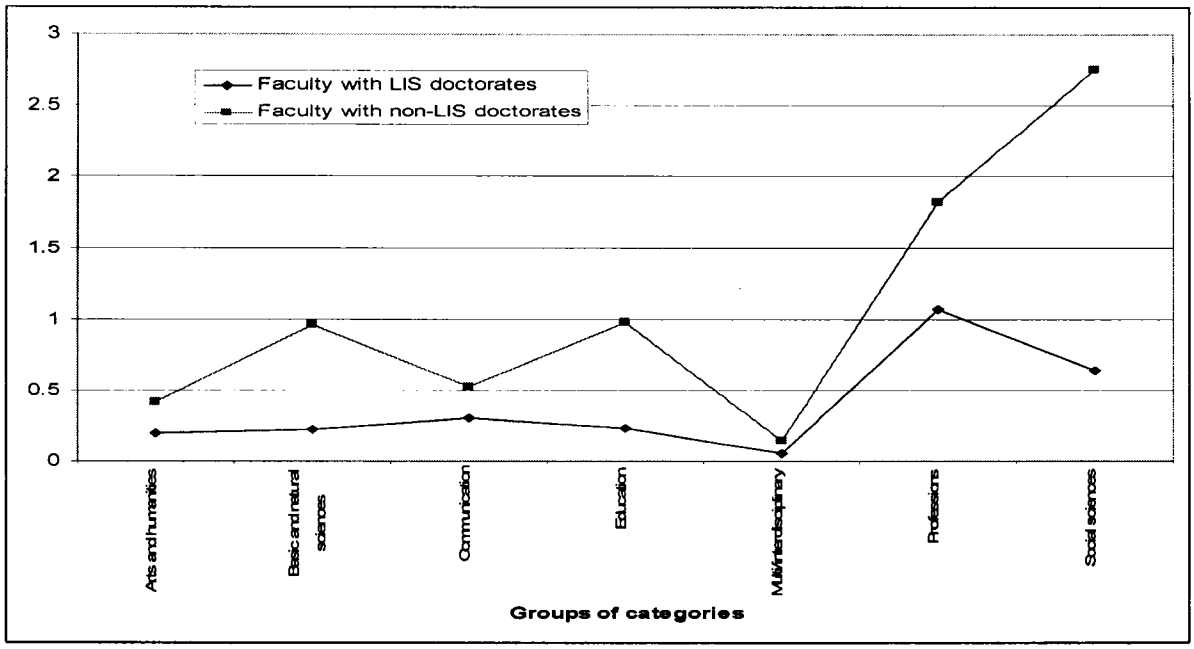


**Fig. 5.16 Frequency of disciplinary categories assigned in the Web of Knowledge to publications citing works of LIS schools' faculty members (1995-2006), *per capita* (without disciplinary categories related to computer science and LIS)**

The actual numbers of occurrences of disciplinary categories from different knowledge domains assigned to publications citing works of LIS faculty members with and without LIS doctorates per capita are presented in table 5.8.

#### 5.3.2.3 Publishing and citation patterns of faculty members with non-LIS doctorates with and without Master's degree in LIS

As mentioned before, 36% of faculty with non-LIS doctorates hold a Master's degree in LIS. The following data shows that it might be one of the factors shaping their publishing and citation patterns. The difference between faculty with non-LIS doctorates and Master's

degrees in LIS and those who have neither a doctorate nor a Master's degree in LIS is remarkable. They are presented in tables 5.9 and 5.10. Table 5.9 presents raw data and table 5.10 shows numbers per capita. It is clear that the orientation on other disciplines among faculty holding neither a doctorate nor a Master's degree in LIS is much more noticeable than among faculty with non-LIS doctorates but with an MLS.

**Table 5.9 Publishing and citation patterns of faculty with non-LIS doctorates: with and without a Master's degree in LIS**

| **Faculty members with non-LIS doctorates and Master's degree in LIS N=98** | | | | **Faculty members with non-LIS doctorates and without Master's degree in LIS N=173** | | | |
|---|---|---|---|---|---|---|---|
| *Published articles in non-LIS periodicals* | *Published articles in LIS periodicals* | *Citing articles published in non-LIS periodicals* | *Citing articles published in LIS periodicals* | *Published articles in non-LIS periodicals* | *Published articles in LIS periodicals* | *Citing articles published in non-LIS periodicals* | *Citing articles published in LIS periodicals* |
| *76* | *364* | *233* | *1256* | *459* | *252* | *2287* | *984* |

**Table 5.10 Publishing and citation patterns of faculty with non-LIS doctorates: with and without a Master's degree in LIS *per capita***

| **Faculty members with non-LIS doctorates and Master's degree in LIS,** | | | | **Faculty members with non-LIS doctorates and without Master's degree in LIS** | | | |
|---|---|---|---|---|---|---|---|
| *Published works in non-LIS periodicals* | *Published works in LIS periodicals* | *Citing works published in non-LIS periodicals* | *Citing works published in LIS periodicals* | *Published works in non-LIS periodicals* | *Published works in LIS periodicals* | *Citing works published in non-LIS periodicals* | *Citing works published in LIS periodicals* |
| *0.79* | *3.71* | *2.38* | *12.81* | *2.65* | *1.46* | *13.21* | *5.69* |

Figures 5.17 and 5.18 represent the same data as tables 5.9 and 5.10 but in a more visually explicit way. LIS schools' faculty members who do not have a Master's degree in LIS are "responsible" for the majority of publications in non-LIS journals associated with the

group of faculty with non-LIS doctorates. They also "bring" the majority of the citations from non-LIS periodicals LIS schools' faculty members receive.

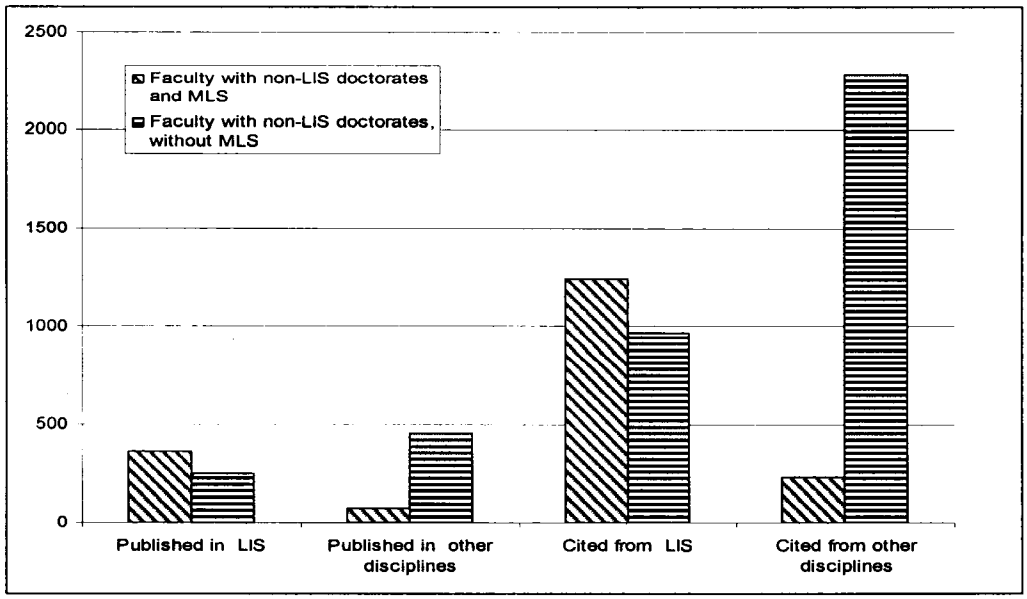


**Fig. 5.17 Publishing and citation patterns of faculty with non-LIS doctorates: with and without a Master's degree in LIS**

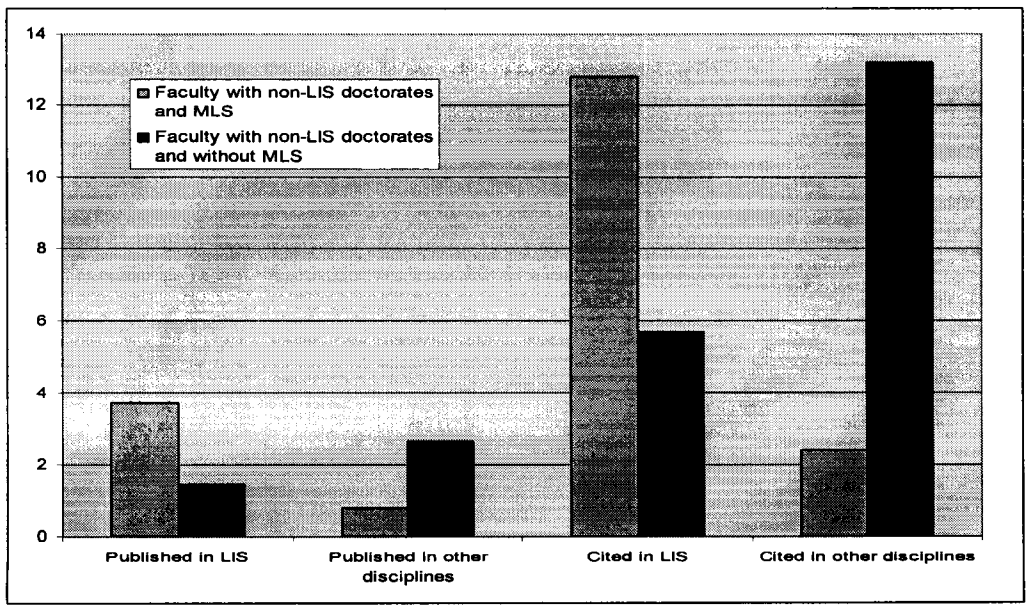


**Fig. 5.18 Publishing and citation patterns of faculty with non-LIS doctorates: with and without a Master's degree in LIS, *per capita***

There is a visible difference between the two groups. Faculty members with non-LIS doctorates and Master's degrees in LIS publish more in LIS than in other disciplines and receive more citations from LIS, while the faculty with non-LIS doctorates and without a Master's degree in LIS are more active in publishing in other disciplines and receive more citations from other disciplines than from LIS.

#### 5.3.2.4 Articles vs. all publications

The research article is the main kind of scholarly publication. It is the most traditional way for any researcher to present his/her results to the scholarly community and to acknowledge those whose ideas they were building upon or to name those whose approaches they were proving wrong. In this study all types of publications, including book reviews, software reviews, meeting abstracts, editorial materials etc. were collected. This decision was made based on a pilot study showing that not only articles generate discussion and, consequently, citations. Other types of publications receive citations as well. To make sure that such an approach does not alter the results and conclusions, the data on all publications and data on articles only have been compared. Table 5.11 shows the difference in number of categories in question in regard to all types of publications and articles only. It also indicates what percent of all publications the articles constitute in every category (published and cited works of LIS schools' faculty members).

The following graphs show that publishing and citing patterns for both groups (all publications and articles only) are comparable for both faculty members with LIS and non-LIS doctorates. The most noticeable decreases are observed in the numbers of publications rather than in the numbers of works citing them, i.e. articles constitute 51-68% of LIS faculty publications (1995-2006) and 85-90% of works citing them (indexed in the Web of Knowledge). It might be easily explained by the fact that research articles cite more publications than other types of publications such as editorial materials, book and software reviews, meeting abstracts, and the like. The important thing is that the patterns remain the same in every group of variables. This is illustrated in table 5.11 and figure 5.19.

**Table 5.11 Disciplinary categories assigned to articles published by LIS schools' faculty members and works citing them versus all types of publications of LIS schools' faculty members and works citing them (Published in 1995-fall 2006 and indexed in the Web of Knowledge)**

| Faculty members | Types of publications | Publications with assigned category "IS and L" | Publications with assigned category "CS, IS" | Publications with assigned categories in all other disciplines | Citing works with assigned category "IS and L" | Citing works with assigned category "CS, IS" | Citing works with assigned categories in all other disciplines |
|---|---|---|---|---|---|---|---|
| With LIS doctorates | All publications | 2475 | 968 | 474 | 4354 | 2643 | 1935 |
| | Articles only | 1285 **(52%)** | 586 **(60%)** | 323 **(68%)** | 3870 **(89%)** | 2313 **(88%)** | 1753 **(90%)** |
| With non-LIS doctorates | All publications | 769 | 409 | 851 | 1580 | 1043 | 2882 |
| | Articles only | 391 **(51%)** | 225 **(55%)** | 535 **(63%)** | 1351 **(85%)** | 889 **(85%)** | 2520 **(87%)** |

Figure 5.19 shows the disciplinary categories assigned in the Web of Knowledge to articles published by LIS schools' faculty and works citing them.

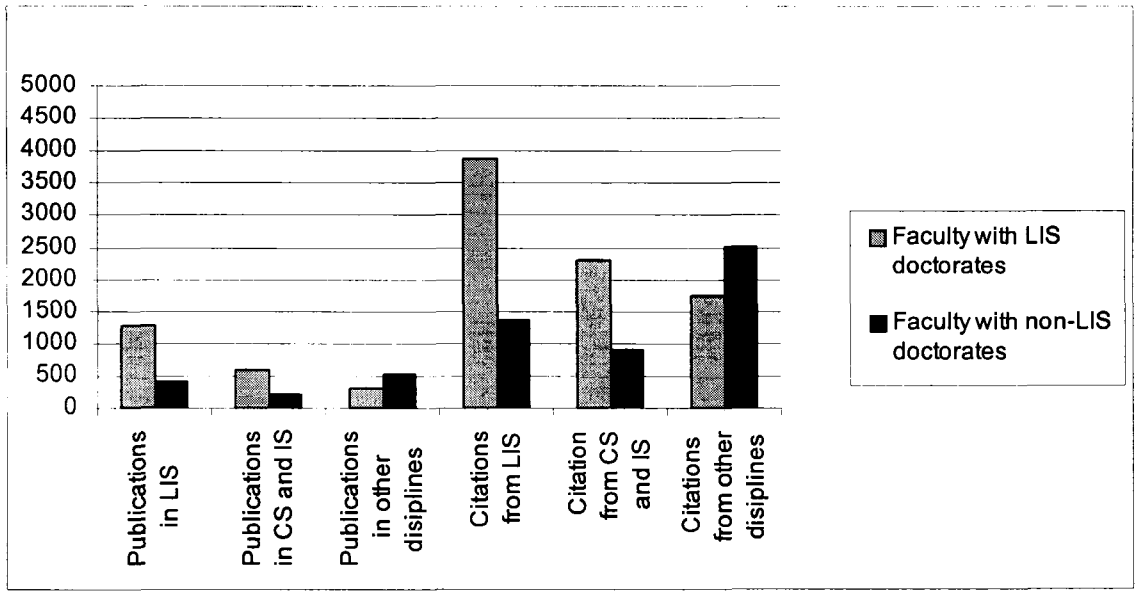


**Fig 5.19 Disciplinary categories of articles published by LIS schools' faculty members and works citing them**

LIS schools' faculty members with LIS doctorate publish more in LIS journals (with the assigned categories of "Information science & library science" and "Computer science, information systems") and receive more citations from works published in those journals than faculty members with non-LIS advanced degrees while the latter publish more actively in other disciplines (disciplinary categories other than those assigned to LIS journals) and receive more citations from works published in them.

### 5.3.3 Multidisciplinarity of LIS schools' faculty members and multidisciplinarity of their publications

This section presents data on the relationships between the levels of multidisciplinarity of LIS schools' faculty (i.e., number and/or percentage of faculty members with non-LIS doctorates) and the level of multidisciplinarity of these schools' research production (i.e., publications and citations they receive).

The following table presents data on multidisciplinarity of both faculty members and their publications.

**Table 5.12 Multidisciplinarity of LIS schools' faculty members and their publications**

| SCHOOLS | Total number of faculty with non-LIS doctorate | Number of faculty with non LIS-doctorate and without MLS | Percentage of faculty with non-LIS doctorate | Frequency of occurrence of non-LIS disciplinary categories assigned to publications | Frequency of occurrence of non-LIS disciplinary categories assigned to works citing those publications |
|---|---|---|---|---|---|
| Alabama | 4 | 0 | 44 | 4 | 2 |
| Albany | 5 | 4 | 45 | 9 | 5 |
| Alberta | 3 | 0 | 33 | 10 | 7 |
| Arizona | 3 | 2 | 43 | 26 | 59 |
| BC | 2 | 1 | 33 | 8 | 4 |
| Buffalo | 4 | 2 | 36 | 14 | 34 |
| California | 7 | 5 | 47 | 46 | 214 |
| Catholic | 4 | 1 | 50 | 4 | 9 |
| Clarion | 5 | 0 | 63 | 1 | 0 |
| Dalhousie | 1 | 1 | 20 | 2 | 2 |
| Denver | 1 | 0 | 33 | 0 | 0 |
| Dominican | 2 | 0 | 25 | 3 | 5 |
| Drexel | 14 | 13 | 67 | 75 | 220 |
| Emporia | 1 | 0 | 13 | 2 | 1 |
| Florida State | 12 | 9 | 44 | 40 | 61 |
| Hawaii | 2 | 0 | 33 | 13 | 41 |
| Illinois | 9 | 7 | 41 | 109 | 292 |
| Indiana | 12 | 8 | 55 | 42 | 307 |
| Iowa | 3 | 2 | 75 | 11 | 115 |
| Kent | 3 | 0 | 19 | 17 | 100 |
| Kentucky | 3 | 0 | 50 | 0 | 21 |
| Long Island | 7 | 3 | 44 | 20 | 21 |
| Louisiana | 1 | 0 | 9 | 6 | 19 |
| Maryland | 6 | 6 | 43 | 37 | 182 |
| McGill | 3 | 2 | 33 | 4 | 41 |
| Michigan | 24 | 24 | 73 | 194 | 1003 |
| Missouri | 10 | 9 | 56 | 44 | 219 |
| Montreal | 6 | 4 | 43 | 3 | 5 |
| N Texas | 4 | 1 | 29 | 10 | 4 |
| NC CH | 2 | 1 | 9 | 56 | 191 |
| NC Green | 1 | 1 | 14 | 11 | 5 |
| NC Central | 0 | 0 | 0 | 1 | 4 |
| Oklahoma | 4 | 0 | 33 | 15 | 28 |
| Pittsburgh | 2 | 2 | 19 | 15 | 21 |
| Pratt | 4 | 2 | 67 | 1 | 0 |

| Table 5.12, cont. | | | | | |
|---|---|---|---|---|---|
| Puerto Rico | 2 | 2 | 25 | 0 | 0 |
| Queens | 1 | 1 | 11 | 5 | 12 |
| Rhode Island | 3 | 0 | 43 | 1 | 0 |
| Rutgers | 8 | 5 | 40 | 36 | 101 |
| S Carolina | 1 | 0 | 8 | 3 | 1 |
| S Connecticut | 3 | 0 | 27 | 3 | 5 |
| S Florida | 2 | 1 | 15 | 7 | 10 |
| S Jose | 3 | 0 | 23 | 8 | 21 |
| S Mississippi | 1 | 0 | 12 | 0 | 0 |
| Simmons | 2 | 1 | 12 | 6 | 51 |
| St John | 2 | 1 | 40 | 0 | 2 |
| Syracuse | 21 | 18 | 66 | 130 | 564 |
| Tennessee | 4 | 2 | 31 | 11 | 89 |
| Texas A | 5 | 5 | 28 | 31 | 218 |
| Texas W | 2 | 1 | 15 | 17 | 2 |
| Toronto | 5 | 5 | 29 | 10 | 42 |
| Washington | 8 | 8 | 30 | 47 | 189 |
| Wayne | 4 | 1 | 36 | 24 | 22 |
| Western Ontario | 12 | 7 | 52 | 48 | 112 |
| Wisconsin Madison | 3 | 1 | 28 | 36 | 35 |
| Wisconsin Milwaukee | 5 | 4 | 26 | 49 | 99 |
| TOTAL | | | | **1325** | **4817** |

It is clear that LIS schools with a greater number of faculty members with non-LIS doctorates produce more publications in non-LIS journals and receive more citations from other disciplines (judged by the number of disciplinary categories assigned to them).

Six schools (11%) with both high number (10 and more) and high percentage (50% and higher) of faculty with non-LIS doctorates are responsible for 40% (533 out of 1325) of all non-LIS disciplinary categories assigned to publications and 50% (2425 out of 4817) of all non-LIS categories assigned to the works citing LIS scholars (see table 5.12).

In 16 schools, all faculties with non-LIS doctorates hold a Master's degree in LIS as well. Interestingly enough, those sixteen schools (29%) account for 7% (86 out of 1324) of all non-LIS disciplinary categories assigned to publications and 5% (256 out of 4828) of all non-LIS categories assigned to the works citing scholars across the schools.

Pearson coefficient was used in order to (1) determine whether there are positive linear relationships between the number of faculty members with non-LIS doctorates in a

particular LIS school and the level of multidisciplinarity of this school's publications and received citations, and (2) identify the strength of those relationships.

Pearson correlation is the most common measure of relationships between two variables. It ranges from "-1" to "1".When it is equal "1", there is a perfect linear relationship between the two variables. Pearson coefficient equal "-1" signifies perfect negative relationship between them. Positive number (between "0" and "1") means a positive relationship. Negative number (between "0" and "-1") signals a negative one. The coefficient equal to "0" or close to "0" means no linear relationship whatsoever between two variables (Vaughan, 2001).

The results presented in the following table were obtained using Excel's data analysis tools. The numbers show that there are strong positive linear relationships between the level of multidisciplinarity of LIS schools' publications and citations to those publications, and the number of faculty with non-LIS doctorates working at those schools. The correlation between the number of faculty with non-LIS doctorates and without Master's degrees in LIS and multidisciplinarity of LIS schools' research production – publications and citations they receive - is stronger ($p = 0.89$ and $p = 0.9$ respectively) than the one between the total number of faculty with non-LIS doctorates and the level of multidisciplinarity of a particular school's publications and citations that publications receive ($p = 0.87$ and $p = 0.85$ respectively). The ratio between faculty with LIS and non-LIS doctorates is a less significant factor than the actual number of faculty members with non-LIS doctorates in regard to multidisciplinarity of schools' publications and citations to them ($p = 0.45$ and $p = 0.47$ respectively).

**Table 5.13 Relationships between the level of multidisciplinarity of LIS schools' faculty and the level of multidisciplinarity of publications by those schools and works citing them**

| Frequency of occurrence of non-LIS disciplinary categories assigned to : | Total number of faculty with non-LIS doctorate | Number of faculty with non LIS-doctorate and without MLS | Percentage of faculty with non-LIS doctorate |
|---|---|---|---|
| Publications by LIS schools' faculty members | **$p = 0.87$** | **$p = 0.89$** | **$p = 0.45$** |
| Works citing publications by LIS schools' faculty | **$p = 0.85$** | **$p = 0.9$** | **$p = 0.47$** |

The following scatter plots illustrate these numbers.

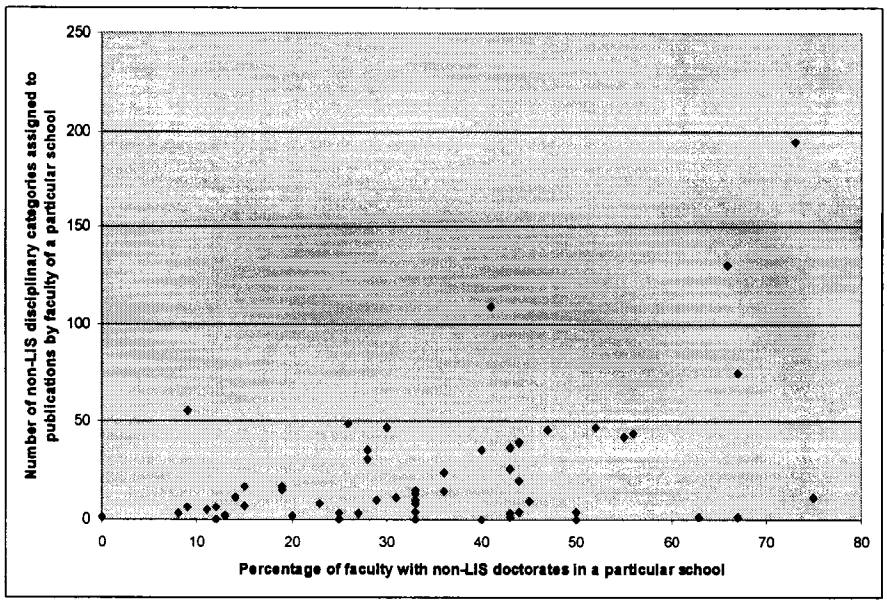


**Fig. 5.20 A scatter plot showing relationship between percentage of faculty with non-LIS doctorates in LIS schools and the number of non-LIS disciplinary categories assigned to publications produced by faculty members of those schools (p = 0.45)**

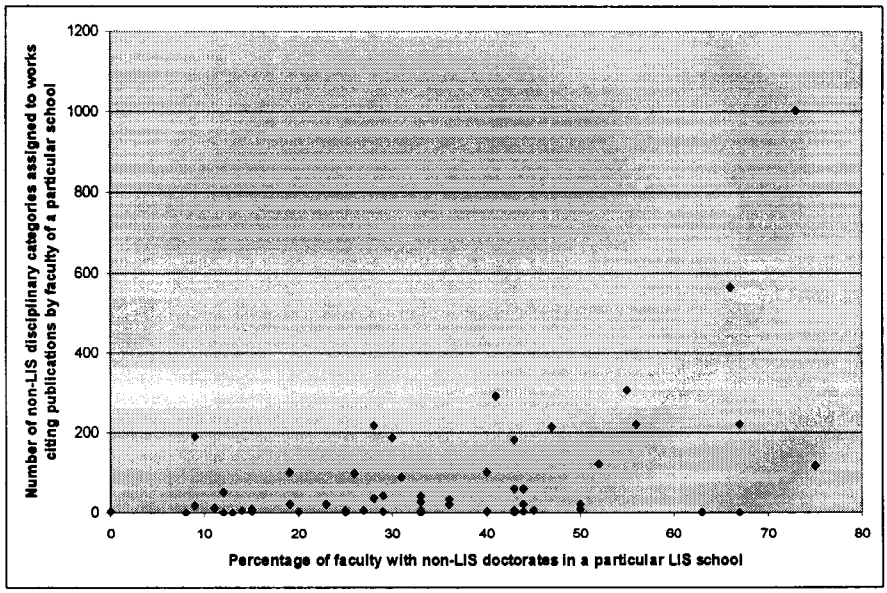


**Fig. 5.21 A scatter plot showing relationship between percentage of faculty with non-LIS doctorates in LIS schools and the number of non-LIS disciplinary categories assigned to works citing publications produced by faculty members of those schools (p = 0.47)**

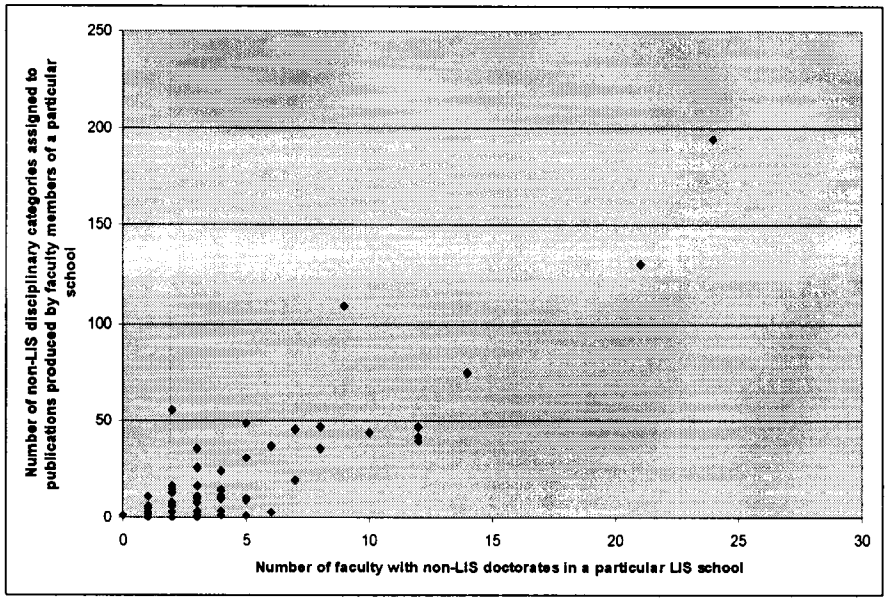


**Fig. 5.22 A scatter plot showing relationship between the number of faculty with non-LIS doctorates in LIS schools and the number of non-LIS disciplinary categories assigned to publications produced by faculty members of those schools (p = 0.87)**

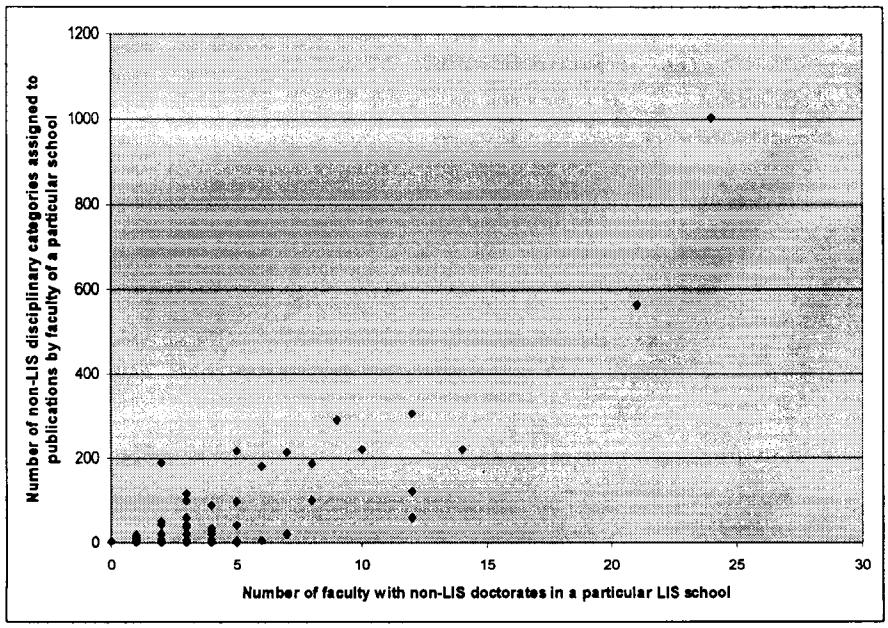


**Fig. 5.23 A scatter plot showing relationship between the number of faculty with non-LIS doctorates in LIS schools and the number of non-LIS disciplinary categories assigned to works citing publications produced by faculty members of those schools (p = 0.85)**

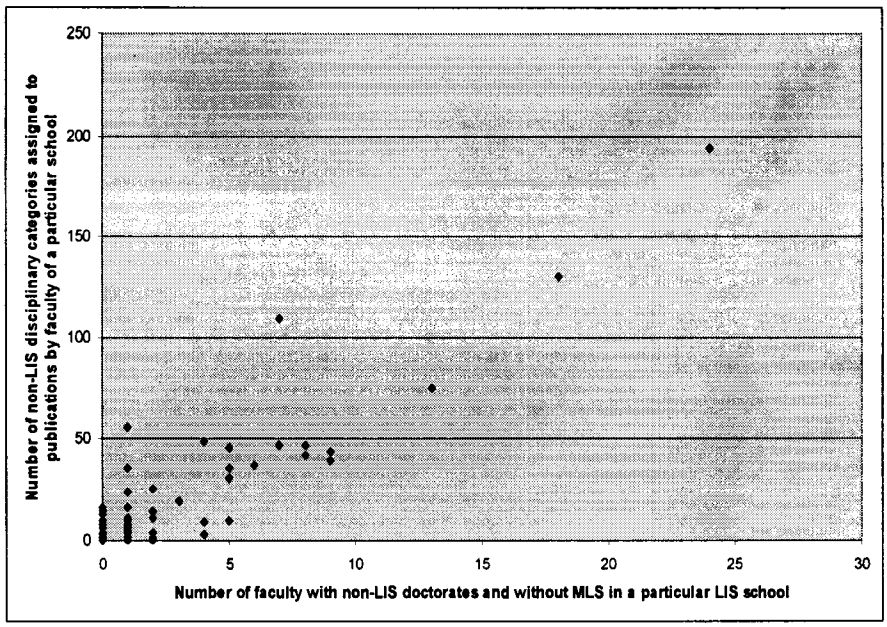


**Fig. 5.24 A scatter plot showing relationship between the number of faculty with non-LIS doctorates and without MLS in LIS schools and the number of non-LIS disciplinary categories assigned to publications produced by faculty members of those schools (p = 0.89)**

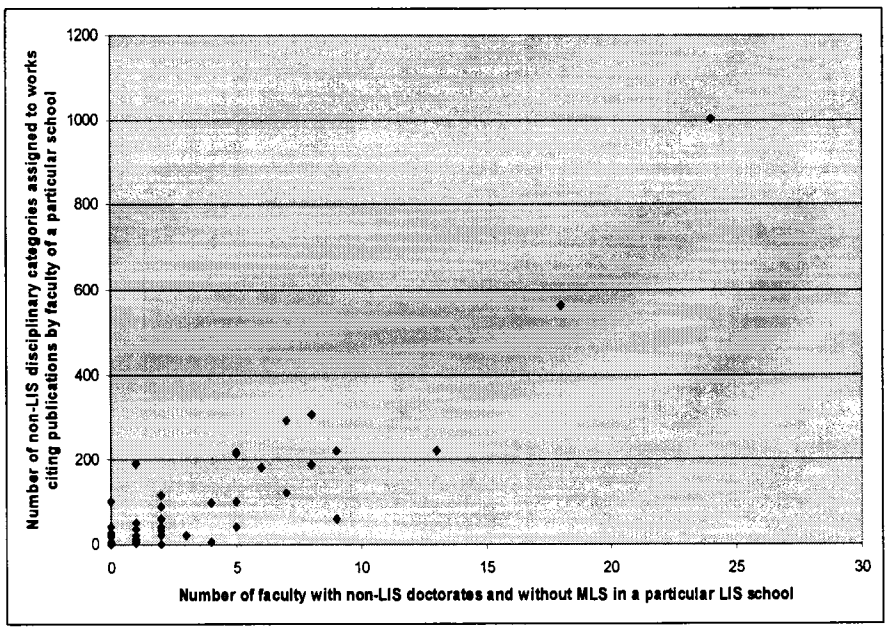


**Fig. 5.25 A scatter plot showing relationship between the number of faculty with non-LIS doctorates and without MLS in LIS schools and the number of non-LIS disciplinary categories assigned to works citing publications produced by faculty members of those schools (p = 0.9)**

## CHAPTER 6: DISCUSSION AND ANALYSIS

In this section, the study's findings are discussed and analyzed. It is important to note at the outset of this section that the comparison between the two groups, the faculty with LIS and non-LIS doctorates, does not involve any statistical analysis because the whole population of full-time faculty members holding advanced degrees in ALA accredited programs was studied rather than samples of this population. Statistical analysis was performed only to identify correlation between the level of multidisciplinarity of LIS schools' research production and the degree of the multidisciplinarity of their faculty.

### 6.1 Introduction: the problem

In 2001, the KALIPER Report, presenting findings of one of the most comprehensive studies of LIS schools, identified multidisciplinarity of LIS schools' faculty members as one of the prominent features of LIS education. ALISE's statistical reports contained data on LIS schools' faculty members with advanced degrees in disciplines other than LIS. This trend has been a topic of several discussions within the community of LIS educators. Some LIS scholars see the growing multidisciplinarity of the field's educators as a sign of its disintegration and further blurring its disciplinary identity. Others perceive it as an opportunity to enhance the discipline's research agenda and methodology through building stronger interdisciplinary connections.

The LIS literature offers a variety of opinions and approaches to LIS' growing interdisciplinarity, including multidisciplinarity of its faculty members; but it lacks data supporting or denying those opinions. The goal of this study was to fill in the gap by providing data on the level of multidisciplinarity of LIS schools' faculty members and their connections with other disciplines through analyzing publishing and citation patterns. The following section presents the study's research questions and hypotheses.

### 6.2 Research questions and hypotheses

This section presents research questions and hypotheses formulated in sections 1.2 and 1.3.

1. Do LIS school faculty members with non-LIS doctorates maintain stronger research connections with other disciplines than their colleagues with LIS

doctorates?

2. Are they as a group well established as researchers in the field of LIS?
3. Does LIS as a field of study maintain connections with other disciplines through borrowing and boundary crossing?
4. What disciplines more than others "express interest" in LIS through citing publications by LIS faculty?
5. What is the relationship between the number of faculty members with non-LIS doctorates in a particular school and the level of multidisciplinarity of its faculty's publications and citations those publications receive?

I hypothesize that:

1. LIS faculty members with non-LIS doctorates have stronger connections with other disciplines than faculty with LIS doctorates. In particular, they publish more in non-LIS scholarly periodicals and receive more citations from non-LIS publications than their colleagues with LIS doctorates.
2. Faculty members with advanced degrees in disciplines other than LIS are well established in their new field and maintain strong connections with LIS i.e. actively publish in LIS journals and get cited by scholars publishing in LIS journals.
3. LIS as a field has strong connections with a variety of disciplines exchanging and sharing with them research topics and methodologies.
4. Presence of faculty with non-LIS doctorates at the LIS schools has an impact on the level of multidisciplinarity of the overall publications by those schools' faculty members.

The strength of the connections with other disciplines was identified based on a faculty member's publishing patterns, i.e., by (1) number of works published in non-LIS journals and (2) number of his/her publications cited by researchers from other fields. The LIS and non-LIS journals were distinguished by the subject categories assigned to all journals indexed in the Web of Knowledge. The same subject categories had to be used to determine inter- and multidisciplinary citations to their works.

### 6.3 The schema of data analysis

This section presents the general ideas and directions of data analysis. In order to facilitate visual perception of the relationships between different variables, a diagram

representing the main groups of the subjects and main variables has been drawn (figure 6.1). The population of full-time faculty associated with 56 ALA accredited programs was divided into two groups: a group of faculty members with LIS doctorates and a group of faculty members with advanced degrees in other disciplines. Publications and works citing them were analyzed for both groups. This analysis was based on disciplinary categories assigned to the publications in the Web of Knowledge and, in this study, were considered the main indicators of disciplinary affiliation of published works.

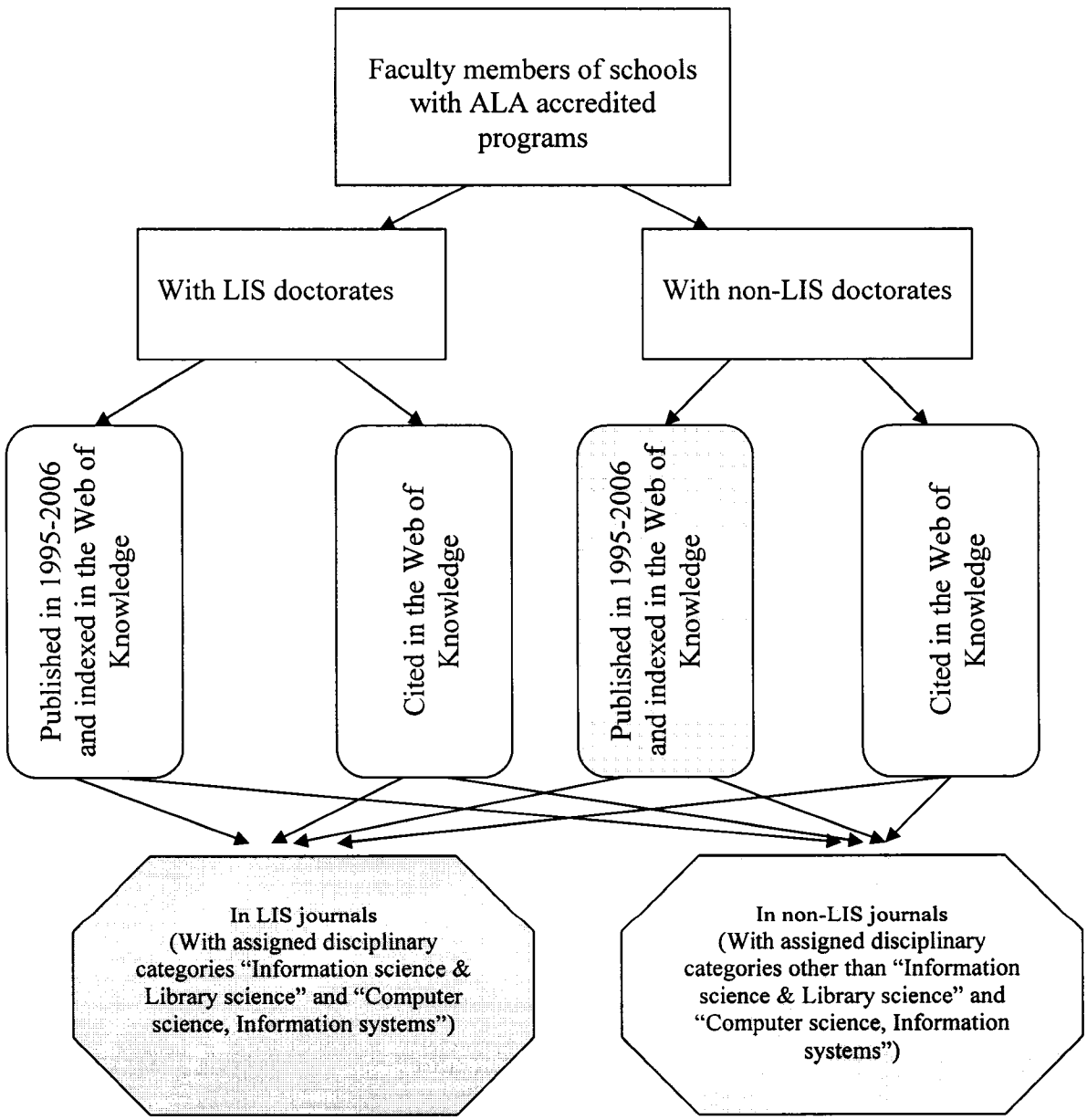


**Fig. 6.1 General schema of the basic relationship between the study's main variables**

The number of publications in periodicals from LIS and other disciplines and the number of different disciplinary categories assigned to publications of LIS schools' faculty members and to works citing them are the main variables allowing comparison of publishing and citation patterns of faculty members with LIS doctorates and non-LIS doctorates in order to evaluate the "disciplinary landscape" of LIS as a field of study.

The diagram illustrates this approach presenting the relationships between different variables under analysis.

Before the publishing and citation patterns of LIS scholars could be studied, it was necessary to identify the exact level of multidisciplinarity of LIS faculty members. Two main indicators were used to define "multidisciplinarity" of LIS schools. The number of faculty members with advanced degrees in disciplines other than LIS was the primary indicator. When those faculty members had a Master's degree in LIS in addition to a non-LIS doctorate, this information was used as an indicator of a lesser degree of "foreignness" to LIS of such faculty members.

The levels of multidisciplinarity based on these two indicators are presented in the following section.

### 6.4 Level of multidisciplinarity of LIS schools and their faculty members

In order to build a solid basis for quantitative analysis of multidisciplinary trends in LIS education, the exact situation in regard to multidisciplinarity of its faculty members was identified based on the two mentioned above indicators of multidisciplinarity of LIS schools in regard to their faculty members.

The study's data shows that 37% of all ALA accredited programs' faculty members have non-LIS doctorates but not all of those 37 % migrants to LIS are completely "foreign" to the field in terms of their educational backgrounds. Some of them worked in libraries; some hold Master's degrees in LIS. It is difficult to evaluate the significance of work experience in a library. What can be considered a significant experience and what can be considered an insufficient experience to be taken into consideration? That kind of data would be fuzzy and will not lead to any clear conclusions, thus an LIS Master's degree was considered a demarcation line between two sub-groups of faculty members with non-LIS doctorates.

The degree of faculty multidisciplinarity varies noticeably from school to school as shown in section 5.3.1.1.

Eleven schools have a half or more of their faculty from other disciplines, i.e. with non-LIS doctorates (Catholic (50%), Clarion (63%), Drexel (67%), Indiana (55%), Iowa (75%), Kentucky (50%), Michigan (73%), Missouri (56%), Pratt (67%), Syracuse (66%), and Western Ontario (52%)). Seven schools have ten or more faculty members with non-LIS doctorates (Drexel (14), Florida State (12), Indiana (12), Michigan (24), Missouri (10), Syracuse (21), and Western Ontario (12)). Six schools belong to both groups: they have ten or more faculty with non-LIS doctorates and the percentage of the latter is fifty or higher (Drexel, Indiana, Michigan, Missouri, Syracuse, and Western Ontario). All these school have low percentage of those holding MLS degree among faculty with non-LIS doctorates as well. None of the faculty with non-LIS doctorates at Michigan holds a Master's degree in LIS.

There is another interesting group of schools which have a high percentage of faculty from other disciplines but the actual number is low (Catholic, Clarion, Iowa, Kentucky, and Pratt).

Some schools can be called pseudo-multidisciplinary because all their faculty with non-LIS doctorates hold a Master's degree in LIS (Alabama, Alberta, Clarion, Denver, Dominican, Emporia, Hawaii, Kent, Kentucky, Louisiana, Oklahoma, Rhode Island, South Carolina, Southern Connecticut, San Jose, and Southern Mississippi).

The fact that six schools with both greater numbers and higher proportions of faculty with non-LIS doctorates account for 40% of all the non-LIS disciplinary categories assigned to publications by faculty as well as half of the works citing them leads to the conclusion that those are the two most important factors (number and proportion of faculty with non-LIS doctorates) influencing the level of interdisciplinarity of the schools' research.

The fact that the schools where all faculty with non-LIS doctorates hold a Master's degree as well, are responsible only for a small fraction of all disciplinary categories assigned to the schools' publications and works citing them (7% and 5% respectively), though those schools constitute almost a third of all LIS schools, might lead to the conclusion that the degree of interdisciplinarity of schools' publications is mostly influenced by the presence of faculty with non-LIS doctorates who have no Master's degree in LIS.

There might be other characteristics of the schools that can have impact on the level of the interdisciplinarity of their publication. Therefore, additional research is needed to focus on LIS schools in greater detail in order to identify all characteristics that may influence the level of interdisciplinarity of their programs and research production.

### 6.4.1 LIS schools' faculty with non-LIS doctorates and Master's degrees in LIS

36% of LIS school faculty with non-LIS doctorates have Master's degrees in LIS completed before or after joining the LIS faculty. The Master's degree in LIS works in the context of this study as a data modifier.

It makes one re-estimate the ratio between the LIS schools' faculty members with LIS and non-LIS doctorates. The faculty members with non-LIS doctorate and some exposure to LIS practice and/or research such as working in a library for a long time or having a Master's degree in LIS are more likely to be better acquainted with LIS traditional problems and research agenda than those who hold advanced degrees in other disciplines and do not have any exposure to LIS.

Fifty-five schools out of fifty-six schools with ALA accredited programs have at least one faculty member with a non-LIS doctorate. But if we take into consideration Master's degrees in LIS as an indicator of "belonging" to LIS, the picture changes quite significantly. At sixteen schools out of fifty-six, all faculty members with non-LIS doctorates have a Master's degree in LIS as well. It means that they are not total "strangers" to the field as those faculty members with non-LIS doctorates who never had any exposure to LIS except for a library patron's experience. Moreover, some faculty members with non-LIS advanced degrees do not hold Master's degrees in LIS but have a substantial experience working in libraries. The latter is difficult to identify and even more difficult to measure. For this reason, in this study, the "demarcation line" has been drawn between the group of faculty with non-LIS doctorates who hold Master's degrees in LIS and those who have neither a doctorate nor a Master's degree in LIS.

The data collected was processed twice. First, the numbers of publications within LIS and out of the field and their disciplinary affiliation identified based on the categories assigned to publications in the Web of Knowledge were categorized separately for two groups: the faculty members with LIS and non-LIS doctorates. Second, the same data was

processed so that the difference between publishing and citation patterns of those faculty members with non-LIS doctorates who hold master's degrees in LIS and those who do not could be determined. The data leads to the conclusion that the orientation on other disciplines among faculty holding neither a doctorate nor a Master's degree in LIS is much more noticeable than among faculty with non-LIS doctorates but with an MLS.

Based on this data, it might be possible to say that there are two kinds of multidisciplinarity in LIS education: multidisciplinarity per se and pseudo-multidisciplinarity. The latter can be of special interest for the students of interdisciplinarity in general, and in LIS, in particular, because a combination of a non-LIS doctorate and a Master's degree for those working at LIS schools as full-time faculty members can mean several different but equally interesting things. First, it may indicate the predisposition of some scholars to working in interdisciplinary environments, which they seek through obtaining training in different disciplines. Second, it may signify that there are reasons for scholars in a variety of disciplines to seek a Master's degree in LIS in addition to their doctorates as for those who hold a Master's degree in LIS to pursue an advanced degree in other fields of study. A study focusing more closely on this group can bring some insights in regard to growing interdisciplinarity in LIS as a field.

### 6.4.2 The wide variety of LIS schools' faculty members' disciplinary backgrounds

The analysis of data collected for this study shows that LIS faculty members represent different knowledge domains. The list of all disciplines or their combinations in which LIS schools' faculty members have advanced degrees contains 117 entries not including LIS. Doctorates in LIS granted by different schools and at different times are not completely identical as well.

There are some disciplines on this list that one would expect to be connected with LIS. They are computer science, education, psychology, history, languages, literature and linguistics, and political science. By contrast, such disciplines as film studies, dance, and musicology appear to be more foreign to LIS. But dance, music, cinema are just different information media with their own unique ways to process and transmit information. New information technologies offer more opportunities to study these kinds of information media, the ones with rich historical tradition. Those fields traditionally belong completely to the

realm of tacit knowledge. Scholars did not consider them for scientific studies but now they appear in the field of LIS, perhaps promising some breakthroughs in terms of understanding relationships between explicit and implicated ways of information transfer. As seen from section 5.3.2.2, there is a significant and unexpected interest in publications by LIS faculty members from basic sciences. Sections 2.2 and 2.3 provide brief and simplified explanations of this interest in LIS from the unlikely disciplines but a detailed discussion of why and what these fields and disciplines are "importing" from LIS is beyond this project.

The next interesting aspect is combining a variety of disciplines or fields of study with information science or technology. Some names of the advanced degrees contain the words "interdisciplinary" or "multidisciplinary", emphasizing that a particular doctorate is intrinsically more open to other disciplines. Some combine different disciplines without "claiming" interdisciplinarity (e.g., Public policy and management/Information technology and organization; Information studies/Educational technology).

## 6.5 Multidisciplinarity of publishing and citation patterns of LIS schools' faculty members

In this section, publishing and citation patterns of LIS schools' faculty members are analyzed. The group of faculty members with LIS doctorates is compared with the group of faculty members with advanced degrees in disciplines other than LIS in order to answer the study's first two research questions and test its first two hypotheses.

It addresses the following research questions:

1. Do LIS school faculty members with non-LIS doctorates maintain stronger research connections with other disciplines than their colleagues with LIS doctorates?
2. Are they as a group well established as researchers in the field of LIS?

It also analyzes data in order to test the following hypotheses:

1. LIS faculty members with non-LIS doctorates have stronger connections with other disciplines than faculty with LIS doctorates. In particular, they publish more in non-LIS scholarly periodicals and receive more citations from non-LIS publications than their colleagues with LIS doctorates.

2. Faculty members with advanced degrees in disciplines other than LIS are well established in their new field and maintain strong connections with LIS i.e. actively publish and get cited by scholars publishing in LIS journals.

The strength of the connections with different disciplines was identified based on a faculty member's publishing patterns, i.e., by number of works published in non-LIS journals and number of his/her publications cited by researchers from other fields.

### 6.5.1 Publishing

The data shows that there is a difference between the two groups in terms of publishing patterns. Faculty members with LIS doctorates publish more often in LIS journals than the faculty with non-LIS doctorates. This applies to all types of publications.

Articles constitute only 51-68% of all publications by the authors under study indexed in the Web of Knowledge but receive the majority of citations (85-90% of all works citing publications of LIS faculty members are articles). That kind of proportion was expected because articles are the main publishing format to present scientific findings. It is logical to assume that scientific data is what generates most of the citations. It is more applicable to citations from other disciplines. Their scholars might not be interested in such publications as editorial materials, and software and book reviews, and other publishing formats which represent opinions and disciplinary "house-keeping" issues more often than research problems when compared to LIS scholars. The relationships between variables are the same whether all publications or only articles are considered.

### 6.5.2 Citations

The data shows the difference between citations patterns of faculty members with LIS and non-LIS advanced degrees. Faculty with LIS doctorates receive substantially more citations from the journals with the category "Information Science & Library Science" which is assigned to all traditional library journals. The total numbers for faculty with LIS and non-LIS doctorates are 4,354 and 1,580 respectively. The numbers, counted per capita, are 9.4 and 5.8 respectively.

The situation changes when we look at the number of citations from other disciplines. The total numbers are 1,935 citations to the works of faculty with LIS doctorates and 2,882

to the publications of faculty with non-LIS doctorates. Taken into consideration that the latter group constitutes only 37% of the population, the gap is even more visible. The numbers per capita for faculty with LIS doctorates and those with non-LIS doctorates are 4.2 and 10.6 respectively.

As for the citations from the journals with the assigned category "Computer Science, Information Systems" which covers most of the computer science related topics and general issues in LIS, the difference between the two groups is not as large as in the two previous cases. The actual numbers are 2,643 for faculty with LIS doctorates and 1,043 for faculty with non-LIS doctorates, the numbers per capita are 5.6 and 3.8 respectively.

These results lead to two basic conclusions. First of all, as it was hypothesized in section 1.3, faculty members with non-LIS doctorates do have stronger connections with other disciplines judged by the number of citations their publications receive from the authors publishing in other disciplines.

At the same time, they receive citations from LIS journals as well. The ratio for the citations from LIS periodicals to faculty with LIS and non-LIS doctorates counted per capita is 5 : 3. The difference between the two groups is noticeable but this allows concluding that LIS schools' faculty members with non-LIS advanced degrees are recognized for their research by LIS scholars. This data also suggests that computer science might be a bridging discipline between LIS and other disciplines.

### 6.6 Dominating disciplinary categories

The categories "Information Science & Library Science" and "Computer Science, Information Systems" dominate over all other disciplinary categories in regard to publishing and citing patterns. They are equally visible and can be called the field's leading disciplinary forces. This empirical data confirms the ideas about strong and rich connections between information science and computer science expressed by scholars from the circle of Machlup and Mansfield in the early 1980s (Machlup & Mansfield, 1983). Wegner even uses "computer science" and "information science" as synonyms (Wegner, 1983). This data demonstrates that the combination "computer and information science", or informatics (Gorn, 1983, 121) was not accidental. This disciplinary collaboration was tested by time, dramatic changes in information technologies, and emergence of the information society.

Interestingly, in 1983, Gorn prophesied that "a number of professions [will] keep spinning off from informatics" (Gorn, 1983, 139). But it seems like informatics penetrated practically all professions and, judged by the data collected in this study, served as a magnet with LIS attracting to the field scholars and practitioners from other disciplines.

Due to the limitations imposed by using disciplinary categories of the Web of Knowledge, this data does not allow making more specific conclusions about the relationships between library and information science, and computer science. But it supports the ideas of the "cementing" role of computer science and information science in the modern field of LIS which covers a wide array of phenomena (as seen from this study's data as well).

### 6.7 Faculty with non-LIS doctorates and multidisciplinarity of LIS schools

The data shows that multidisciplinarity of LIS schools' publications and the works citing them is in a strong positive linear relationship with the number of faculty with non-LIS doctorates. The presence of faculty members who have neither a doctorate nor a Master's degree in LIS proves to be especially significant in this regard. The correlation between the number of faculty members with neither a Ph.D. nor a Master's degree in LIS and the frequency of occurrence of non-LIS disciplinary categories assigned in the Web of Knowledge to the publications by faculty members at a particular school and the works citing them is very strong ($p = 0.89$ and $p = 0.9$ respectively).

This, though, does not mean that hiring faculty with non-LIS doctorates and without an MLS is the recipe for those schools who are interested in increasing their multi- and interdisciplinarity. As Vaughan puts it, "Correlation does not mean causation" (Vaughan, 2001, 100). Strong positive relationships between two variables do not necessarily imply causality. It is especially important to take this into consideration while dealing with such complex phenomena as interdisciplinary connections and educational organizations. As mentioned before, LIS schools differ in size and educational and research foci. There might be a range of factors influencing the quality and quantity of LIS schools' research production. Nevertheless, the fact remains that the greater the number of faculty members with non-LIS doctorates in general and without an MLS, in particular, means a higher degree of multidisciplinarity of a particular school's publications and citations those publications receive.

### 6.8 "Exporting" function of modern LIS as a field of study

This section analyzes the findings addressing the third research question and hypothesis. It answers whether LIS as a discipline is becoming more of an "exporting" field of study. The concepts of disciplinary "import" and "export" were introduced by Cronin and Pearson in 1990. They used "economic analogy... to explore the contributions made by information scientists to other disciplines" (Cronin & Pearson, 1990, 381). They argued that LIS could be considered primarily an importing discipline, borrowing ideas and methodologies from other disciplines rather than "exporting" them to other fields of study.

The emergence and expansion of new information technologies changed the field of LIS by considerably regrouping its methods, and research and educational foci. The discipline that is expected (by definition) to answer the questions pertinent to the notion of information was prone to attract substantial interest from many other fields since the concept of information became the key one. Practitioners, educators, and scholars from different fields needed to know how to manage information efficiently and LIS was to help them. This situation was likely to change the importing-exporting ratio. One might expect stronger interest in LIS from a wide variety of disciplines than ever before. The alliance between IS and computer science perceived at the time of the growth of computer information technologies made the position of LIS as a key field "responsible" for information related knowledge and skills even stronger.

The findings of this study confirm this assumption. Publications of LIS schools' faculty members receive citations from a wide variety of disciplines. The data supports the hypothesis that LIS attracts attention of researchers from different knowledge domains. The study's design does not allow to identify the ratio between "export" and "import" in the interdisciplinary connections of LIS with other disciplines. That can be one possible direction for future research.

The fact that most articles (of all other formats indexed in the Web of Knowledge) cite publications of LIS schools' faculty members provided additional indirect support for the hypothesis – scholars from a variety of disciplines do not just "monitor" LIS' findings but build upon them, acknowledge them through citing them in their research publications.

# CHAPTER 7: CONCLUSIONS

This chapter offers some conclusions that can be built upon in future research projects (section 7.1). It also describes once more the study's limitations (section 7.2). The study's significance and possible applications are presented in section 7.3. Finally, in section 7.4, directions for future research are outlined.

## 7.1 Conclusions

This part offers a brief summary of the findings and their interpretation. The study's findings support all four hypotheses introduced in section 1.3. They show that:

1. LIS schools' faculty members with non-LIS doctorates do maintain stronger connections with other disciplines than their colleagues with LIS doctorates. They publish more often in journals from other disciplines and get cited more often by scholars from other fields of study.
2. At the same time, faculty with non-LIS doctorates are active in LIS research as well. Significant fractions of their works are published in LIS journals and they get cited often in LIS scholarly periodicals.
3. LIS faculty have connections with a wide variety of disciplines. First of all, disciplines of doctorates of LIS educators represent a wide variety of knowledge domains with prevalence of professional fields, social sciences, humanities, and computer science. Second, faculty members with either LIS or non-LIS doctorates receive citations from all major knowledge domains. Faculty with LIS doctorates maintain research connections with other disciplines not as much as faculty with non-LIS doctorates, but they do publish in non-LIS periodicals and receive citations from scholars in other disciplines. This might signify "exporting" qualities of LIS as a discipline.
4. The presence of faculty with non-LIS doctorates has a noticeable impact on the level of multidisciplinarity of the schools' research production. The ratio between faculty with LIS and non-LIS doctorates is a less significant factor than the actual number of faculty members with non-LIS doctorates in regard to multidisciplinarity of schools' publications and citations to them.

The study shows that the proportion of the "outsiders' in LIS education (usually discussed without exact numbers) is highly overestimated. Faculty members with non-LIS doctorates constitute 37 % of all full time faculty members (as of December 2006). Only 64% of them (or 24% of all faculty members) can be considered 'genuine foreigners' to the field of LIS because the other 36 % of that group hold Master's degrees in LIS.

LIS schools' faculty members constitute a highly heterogeneous group in terms of disciplinarity of their research foci. Not only faculty members with non-LIS doctorates but faculty members with LIS doctorates as well publish actively in non-LIS scholarly periodicals and receive citations from researchers and practitioners in a wide variety of fields. LIS as a discipline maintains strong interdisciplinary connections with many other disciplines through its scholars' research.

### 7.2 Limitations

There are some limitations which should be taken into consideration while evaluating the study's results.

First of all, every research method has its limitations. Citation analysis is not an exception. Its possible shortcomings such as elusive and sometimes controversial nature of citations are discussed in detail in the section 3.3.3.

The scope of the study limits applicability of its conclusions as well. This study's scope is limited both in terms of time line and the data source.

First, only works published since 1995 were collected. This leaves off publications of those faculty members whose research career started and reached its prime before the 90s. At the same time, a 10-year period means that the junior faculty members who were hired recently could not publish at the beginning of this period. Only the whole population under study can be characterized on the basis of this study's findings.

Second, only works indexed in the Web of Knowledge have been considered. The Web of Knowledge is the most widely recognized data source for mapping sciences but the number of 'online only' publications are growing and not all of them make it into the Web of Knowledge. Different knowledge domains have their own publishing and citation patterns. One can assume that because of the strong impact of computer science on LIS as a discipline, conference proceedings constitute a large share of many LIS faculty members' publications,

especially those working in the areas of information science close to computer science. In addition, only those publications where a faculty member was a sole or first author have been analyzed.

The next limitation is due to the fact that not all schools providing education for librarians and information specialists have accreditation from ALA for their degree program. Therefore, though the whole population of ALA accredited programs have been studied, there are some information schools that have not been studied, among them the one at the University of California at Berkeley.

### 7.3 Applications and implications

This study describes the current disciplinary situation at LIS schools. It outlines their "disciplinary architecture" and their connections with other disciplines through their faculty members' (both with and without doctorate in LIS) publications. It is the first step toward identifying the level of interdisciplinarity of LIS schools.

The fact that faculty members with non-LIS doctorates show high numbers of publications in LIS and receive a large amount of citations from LIS allows one to conclude that there is no immediate danger of "dissolving" the traditional LIS research agenda in "foreign" topics. On the contrary, the study shows that faculty members with advanced degrees in other disciplines are active in traditional LIS research as in other disciplines. This conclusion might be of interest for those schools which do not have yet a clearly articulated policy on multidisciplinarity.

The study also shows that there is a strong correlation between the number of faculty members with non-LIS doctorates in LIS schools and the level of multidisciplinarity of the schools' publications and citations those publications receive. Correlation does not necessarily means causation, but this study's conclusions can be used by LIS schools which are seeking ways of increasing their multidisciplinarity. Hiring of more faculty with non-LIS doctorates can be one of the ways to do so.

The study focuses on only two forms of the faculty's interdisciplinarity: boundary crossing (publishing in journals of another discipline) and borrowings (citing publications from another discipline). The study's findings, providing quantitative data for the whole population of faculty members from ALA accredited programs, constitute solid grounds for

future research in this direction. With limited augmentations of the data and slight changes in the analysis, they can be used for studying the third, more complex, form of interdisciplinarity – collaboration.

The study's conclusions can help LIS educators, researchers, and administrators to have a clear idea about the actual level of multidisciplinarity of LIS and the disciplinary flows of research themes in the field. This data might be of use for those who are responsible for research funds allocation.

LIS is a rapidly developing discipline and awareness of its disciplinary map can inform decisions on directing and/or redirecting future research efforts of LIS schools to develop an interdisciplinarity-friendly vision of the future evolution of the field.

Borgman and Schement wrote in 1990, "We face a challenging, but necessary, process of self-examination in order to define more clearly and fully our relationships with other disciplines" (Borgman & Schement, 1990, 42). This study can be considered an effort at such self-examination.

### 7.4 Directions for future research

One of the primary goals of this study is establishing some solid ground for the more sophisticated analysis of the interdisciplinarity of LIS as a discipline.

First of all, this study uses citation analysis as its primary method. It allowed data to be collected in the most non-obtrusive way so that individual opinions could not alter the data. This study's conclusions are based on numeric data which increases the degree of their objectivity. It provides data on publishing and citation patterns of LIS schools' faculty members with different degrees of exposure to LIS. But without the "subjective" part, the study of LIS faculty members, with non-LIS doctorates motivations, it is only a half-study.

The next logical step is to study LIS faculty members' perception of the degree of the field's inter- and multidisciplinarity in order to identify factors enabling and fostering interdisciplinary research in the field and the ones that block or hinder it. Combined with future analysis of the factors increasing LIS schools' interdisciplinarity, this data would help to replace intuitive decisions with concrete recommendations on how to make interdisciplinarity in LIS schools work most efficiently.

The study shows strong correlation between the presence of faculty with non-LIS doctorates and the level of multidisciplinarity of the schools' publications and citations those publications receive. It should be important to (1) find out what faculty with LIS doctorates contribute in this direction, and (2) to identify other factors that have impact on the level of multidisciplinarity of LIS schools' research production (size, educational and research foci for starters, and, perhaps, some factors that are not that obvious).

The study shows that a Master's degree in LIS is am important modifying factor in regard to disciplinary affiliations of faculty with non-LIS doctorates' publications and works that cite them. Perhaps, more detailed analysis of all the degrees held by LIS faculty, including Bachelor level, would provide some useful insights on the patterns of interdisciplinary interactions revealed in the process of scholarly publishing.

The study shows that there is a strong interest in LIS from different disciplines. It would be interesting and important to study relationships between LIS and some of the knowledge domains which more frequently than others refer to the works by LIS scholars (e.g. Humanities, Education, and Communication) to identify possible epistemological commonalities and, thus, predict future developments of interdisciplinary overlaps between those fields of study and LIS.

As mentioned earlier, the study focuses only on two forms of interdisciplinary research: borrowing and boundary crossing. Studying the third form of interdisciplinarity is a logical next step. It would allow identifying groups with similar research themes and patterns of collaboration and, possibly, some epistemologically significant connections between the disciplines which currently constitute the actual domain of LIS research.

In the Web of Knowledge, two disciplinary categories ("Computer Science, Information Systems" and "Information Science & Library Science") are assigned to LIS journals. The research design of this study was targeted to the analysis of the differences between publication and citations comparing LIS and other disciplines. It does not allow conclusions to be drawn regarding the ratio between the components of library science, information science, or computer science. The relationships between those components, the degree of their convergence within LIS, are a very interesting topic for future research. The data collected for this study can be augmented and modified in order to address this important and complex issue.

In this study, only citations to LIS schools' faculty members' publications have been collected. This allows us to see only one direction of citation traffic between LIS and other disciplines. It would be interesting to augment the collected data so that both citations and references could be compared. This would enable one to compare "exporting" and "importing" characteristics of the field.

Growing multidisciplinarity of LIS schools' faculty members is an officially established fact in North America. It would be interesting to compare the North American model of LIS interdisciplinarity with the European one. Studying European LIS schools can be complementary to the analysis of LIS schools in the western hemisphere and might lead to new insights on the future of interdisciplinarity in our field.

In conclusion, the study shows that there are noticeable connections between LIS and other disciplines, but its primarily quantitative approach does not provide enough data for identifying the nature of these connections and answering the "intriguing philosophical questions about how different knowledge domains are connected" (Small, 2003, 396). Rather, it contributes to building the grounds for future research projects which might address those questions and explain why disciplines gravitate toward each other, how they interact and what processes take place when a group of disciplines in a multidisciplinary environment like some of the LIS schools blend together turning into a new entity, a truly interdisciplinary field.

## APPENDICES

## APPENDIX 1: SUBJECT CATEGORIES IN THE WEB OF KNOWLEDGE

1. Acoustics
2. Agricultural Economics & Policy
3. Agricultural Engineering
4. Agriculture, Dairy & Animal Science
5. Agriculture, Multidisciplinary
6. Agriculture, Soil Science
7. Agronomy
8. Allergy
9. Anatomy & Morphology
10. Andrology
11. Anesthesiology
12. Anthropology
13. Applied Linguistics
14. Archeology
15. Architecture
16. Area Studies
17. Art
18. Asian Studies
19. Astronomy & Astrophysics
20. Automation & Control Systems
21. Behavioral Sciences
22. Biochemical Research Methods
23. Biochemistry & Molecular Biology
24. Biodiversity Conservation
25. Biology
26. Biophysics
27. Biotechnology & Applied Microbiology
28. Business
29. Business, Finance
30. Cardiac & Cardiovascular Systems
31. Cell Biology
32. Chemistry, Analytical
33. Chemistry, Applied
34. Chemistry, Inorganic & Nuclear
35. Chemistry, Medicinal

36. Chemistry, Multidisciplinary
37. Chemistry, Organic
38. Chemistry, Physical
39. Classics
40. Clinical Neurology
41. Communication
42. Computer Science, Artificial Intelligence
43. Computer Science, Cybernetics
44. Computer Science, Hardware & Architecture
45. Computer Science, Information Systems
46. Computer Science, Interdisciplinary Applications
47. Computer Science, Software Engineering
48. Computer Science, Theory & Methods
49. Construction & Building Technology
50. Criminology & Penology
51. Critical Care Medicine
52. Crystallography
53. Dance
54. Demography
55. Dentistry, Oral Surgery & Medicine
56. Dermatology & Venereal Diseases
57. Developmental Biology
58. Ecology
59. Economics
60. Education & Educational Research
61. Education, Scientific Disciplines
62. Education, Special
63. Electrochemistry
64. Emergency Medicine
65. Endocrinology & Metabolism
66. Energy & Fuels
67. Engineering, Aerospace
68. Engineering, Biomedical
69. Engineering, Chemical
70. Engineering, Civil
71. Engineering, Electrical & Electronic
72. Engineering, Environmental
73. Engineering, Geological
74. Engineering, Industrial

75. Engineering, Manufacturing
76. Engineering, Marine
77. Engineering, Mechanical
78. Engineering, Multidisciplinary
79. Engineering, Ocean
80. Engineering, Petroleum
81. Entomology
82. Environmental Sciences
83. Environmental Studies
84. Ergonomics
85. Ethics
86. Ethnic Studies
87. Evolutionary Biology
88. Family Studies
89. Film, Radio, Television
90. Fisheries
91. Folklore
92. Food Science & Technology
93. Forestry
94. Gastroenterology & Hepatology
95. Genetics & Heredity
96. Geochemistry & Geophysics
97. Geography
98. Geography, Physical
99. Geology
100. Geosciences, Multidisciplinary
101. Geriatrics & Gerontology
102. Gerontology
103. Health Care Sciences & Services
104. Health Policy & Services
105. Hematology
106. History
107. History & Philosophy of Science
108. History of Social Sciences
109. Horticulture
110. Humanities, Multidisciplinary
111. Imaging Science & Photographic Technology
112. Immunology
113. Industrial Relations & Labor

114. Infectious Diseases
115. Information Science & Library Science
116. Instruments & Instrumentation
117. Integrative & Complementary Medicine
118. International Relations
119. Language & Linguistics Theory
120. Law
121. Limnology
122. Literary Reviews
123. Literary Theory & Criticism
124. Literature
125. Literature, African, Australian, Canadian
126. Literature, American
127. Literature, British Isles
128. Literature, German, Dutch, Scandinavian
129. Literature, Romance
130. Literature, Slavic
131. Management
132. Marine & Freshwater Biology
133. Materials Science, Biomaterials
134. Materials Science, Ceramics
135. Materials Science, Characterization & Testing
136. Materials Science, Coatings & Films
137. Materials Science, Composites
138. Materials Science, Multidisciplinary
139. Materials Science, Paper & Wood
140. Materials Science, Textiles
141. Mathematics
142. Mathematics, Applied
143. Mathematics, Interdisciplinary Applications
144. Mechanics
145. Medical Ethics
146. Medical Informatics
147. Medical Laboratory Technology
148. Medicine, General & Internal
149. Medicine, Legal
150. Medicine, Research & Experimental
151. Metallurgy & Metallurgical Engineering
152. Meteorology & Atmospheric Sciences

153. Microbiology
154. Microscopy
155. Mineralogy
156. Mining & Mineral Processing
157. Multidisciplinary Sciences
158. Music
159. Mycology
160. Neuroimaging
161. Neurosciences
162. Nuclear Science & Technology
163. Nursing
164. Nutrition & Dietetics
165. Obstetrics & Gynecology
166. Oceanography
167. Oncology
168. Operations Research & Management Science
169. Ophthalmology
170. Optics
171. Ornithology
172. Orthopedics
173. Otorhinolaryngology
174. Paleontology
175. Parasitology
176. Pathology
177. Pediatrics
178. Peripheral Vascular Disease
179. Pharmacology & Pharmacy
180. Philosophy
181. Physics, Applied
182. Physics, Atomic, Molecular & Chemical
183. Physics, Condensed Matter
184. Physics, Fluids & Plasmas
185. Physics, Mathematical
186. Physics, Multidisciplinary
187. Physics, Nuclear
188. Physics, Particles & Fields
189. Physiology
190. Planning & Development
191. Plant Sciences

192. Poetry
193. Political Science
194. Polymer Science
195. Psychiatry
196. Psychology
197. Psychology, Applied
198. Psychology, Biological
199. Psychology, Clinical
200. Psychology, Developmental
201. Psychology, Educational
202. Psychology, Experimental
203. Psychology, Mathematical
204. Psychology, Multidisciplinary
205. Psychology, Psychoanalysis
206. Psychology, Social
207. Public Administration
208. Public, Environmental & Occupational Health
209. Radiology, Nuclear Medicine & Medical Imaging
210. Rehabilitation
211. Religion
212. Remote Sensing
213. Reproductive Biology
214. Respiratory System
215. Rheumatology
216. Robotics
217. Social Issues
218. Social Sciences, Biomedical
219. Social Sciences, Interdisciplinary
220. Social Sciences, Mathematical Methods
221. Social Work
222. Sociology
223. Spectroscopy
224. Sport Sciences
225. Statistics & Probability
226. Substance Abuse
227. Surgery
228. Telecommunications
229. Theater
230. Thermodynamics

231. Toxicology
232. Transplantation
233. Transportation
234. Transportation Science & Technology
235. Tropical Medicine
236. Urban Studies
237. Urology & Nephrology
238. Veterinary Sciences
239. Virology
240. Water Resources
241. Women's Studies
242. Zoology

## APPENDIX 2: DISCIPLINARY CATEGORIES ASSIGNED IN THE WEB OF KNOWLEDGE TO PUBLICATIONS BY FACULTY MEMBERS WITH LIS DOCTORATES

| | |
|---|---|
| ART | 5 |
| BUSINESS | 5 |
| COMMUNICATION | 23 |
| COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE | 10 |
| COMPUTER SCIENCE, CYBERNETICS | 13 |
| COMPUTER SCIENCE, HARDWARE & ARCHITECTURE | 15 |
| COMPUTER SCIENCE, INFORMATION SYSTEMS | 968 |
| COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS | 37 |
| COMPUTER SCIENCE, SOFTWARE ENGINEERING | 21 |
| COMPUTER SCIENCE, THEORY & METHODS | 42 |
| EDUCATION & EDUCATIONAL RESEARCH | 77 |
| EDUCATION, SCIENTIFIC DISCIPLINES | 2 |
| EDUCATION, SPECIAL | 1 |
| ENGINEERING, ELECTRICAL & ELECTRONIC | 4 |
| ENGINEERING, MULTIDISCIPLINARY | 1 |
| ERGONOMICS | 11 |
| ETHICS | 1 |
| FOLKLORE | 1 |
| HEALTH CARE SCIENCES & SERVICES | 1 |
| HEALTH POLICY & SERVICES | 1 |
| HISTORY | 23 |
| HISTORY & PHILOSOPHY OF SCIENCE | 29 |
| HISTORY OF SOCIAL SCIENCES | 1 |
| HUMANITIES, MULTIDISCIPLINARY | 20 |
| INFORMATION SCIENCE & LIBRARY SCIENCE | 2475 |
| INTERNATIONAL RELATIONS | 1 |
| LAW | 11 |
| LITERARY THEORY & CRITICISM | 1 |
| LITERATURE | 10 |
| MANAGEMENT | 13 |
| MEDICAL INFORMATICS | 14 |
| MEDICINE, GENERAL & INTERNAL | 3 |
| MULTIDISCIPLINARY SCIENCES | 4 |
| MUSIC | 7 |
| OPERATIONS RESEARCH & MANAGEMENT SCIENCE | 3 |
| PHILOSOPHY | 1 |
| PHYSICS, MULTIDISCIPLINARY | 1 |
| PLANNING & DEVELOPMENT | 3 |
| PSYCHOLOGY, CLINICAL | 2 |
| PSYCHOLOGY, EXPERIMENTAL | 2 |
| PSYCHOLOGY, MULTIDISCIPLINARY | 14 |
| PUBLIC ADMINISTRATION | 1 |
| PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH | 3 |
| RELIGION | 1 |
| SOCIAL ISSUES | 1 |

| | |
|---|---|
| SOCIAL SCIENCES, INTERDISCIPLINARY | 6 |
| SOCIAL SCIENCES, MATHEMATICAL METHODS | 3 |
| SOCIOLOGY | 2 |
| TELECOMMUNICATIONS | 20 |
| WOMEN'S STUDIES | 3 |
| | 3917 |

## APPENDIX 3: DISCIPLINARY CATEGORIES ASSIGNED IN THE WEB OF KNOWLEDGE TO PUBLICATIONS BY FACULTY MEMBERS WITH NON-LIS DOCTORATES

| | |
|---|---|
| AGRICULTURE, MULTIDISCIPLINARY | 1 |
| ANTHROPOLOGY | 5 |
| APPLIED LINGUISTICS | 8 |
| AREA STUDIES | 2 |
| BEHAVIORAL SCIENCES | 1 |
| BIOCHEMICAL RESEARCH METHODS | 1 |
| BIOTECHNOLOGY & APPLIED MICROBIOLOGY | 1 |
| BUSINESS | 10 |
| CHEMISTRY, MULTIDISCIPLINARY | 1 |
| COMMUNICATION | 59 |
| COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE | 29 |
| COMPUTER SCIENCE, CYBERNETICS | 30 |
| COMPUTER SCIENCE, HARDWARE & ARCHITECTURE | 43 |
| COMPUTER SCIENCE, INFORMATION SYSTEMS | 409 |
| COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS | 32 |
| COMPUTER SCIENCE, SOFTWARE ENGINEERING | 57 |
| COMPUTER SCIENCE, THEORY & METHODS | 98 |
| CONSTRUCTION & BUILDING TECHNOLOGY | 1 |
| DANCE | 2 |
| ECONOMICS | 19 |
| EDUCATION & EDUCATIONAL RESEARCH | 81 |
| EDUCATION, SCIENTIFIC DISCIPLINES | 1 |
| ENGINEERING, CIVIL | 1 |
| ENGINEERING, ELECTRICAL & ELECTRONIC | 6 |
| ENGINEERING, INDUSTRIAL | 2 |
| ENGINEERING, MULTIDISCIPLINARY | 4 |
| ENVIRONMENTAL SCIENCES | 2 |
| ENVIRONMENTAL STUDIES | 1 |
| ERGONOMICS | 20 |
| ETHICS | 1 |
| FILM, RADIO, TELEVISION | 2 |
| GEOGRAPHY | 1 |
| HEALTH POLICY & SERVICES | 1 |
| HISTORY | 26 |
| HISTORY & PHILOSOPHY OF SCIENCE | 59 |
| HISTORY OF SOCIAL SCIENCES | 6 |
| HUMANITIES, MULTIDISCIPLINARY | 10 |
| INFORMATION SCIENCE & LIBRARY SCIENCE | 769 |
| INTERNATIONAL RELATIONS | 1 |
| LANGUAGE & LINGUISTICS THEORY | 7 |
| LITERARY THEORY & CRITICISM | 1 |
| LITERATURE | 18 |
| MANAGEMENT | 13 |
| MATHEMATICS | 1 |
| MATHEMATICS, APPLIED | 2 |

| | |
|---|---|
| MATHEMATICS, INTERDISCIPLINARY APPLICATIONS | 5 |
| MEDICAL INFORMATICS | 10 |
| MEDICINE, GENERAL & INTERNAL | 1 |
| METEOROLOGY & ATMOSPHERIC SCIENCES | 2 |
| MULTIDISCIPLINARY SCIENCES | 12 |
| MUSIC | 2 |
| NEUROSCIENCES | 1 |
| NURSING | 1 |
| NUTRITION & DIETETICS | 1 |
| OPERATIONS RESEARCH & MANAGEMENT SCIENCE | 5 |
| PHILOSOPHY | 9 |
| PHYSICS, FLUIDS & PLASMAS | 1 |
| PHYSICS, MATHEMATICAL | 1 |
| PLANNING & DEVELOPMENT | 2 |
| POLITICAL SCIENCE | 28 |
| PSYCHOLOGY, APPLIED | 7 |
| PSYCHOLOGY, DEVELOPMENTAL | 1 |
| PSYCHOLOGY, EDUCATIONAL | 10 |
| PSYCHOLOGY, EXPERIMENTAL | 7 |
| PSYCHOLOGY, MATHEMATICAL | 4 |
| PSYCHOLOGY, MULTIDISCIPLINARY | 14 |
| PUBLIC ADMINISTRATION | 4 |
| RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING | 9 |
| REHABILITATION | 1 |
| ROBOTICS | 1 |
| SOCIAL ISSUES | 3 |
| SOCIAL SCIENCES, BIOMEDICAL | 1 |
| SOCIAL SCIENCES, INTERDISCIPLINARY | 2 |
| SOCIOLOGY | 13 |
| SPORT SCIENCES | 1 |
| STATISTICS & PROBABILITY | 2 |
| TELECOMMUNICATIONS | 19 |
| URBAN STUDIES | 2 |
| VETERINARY SCIENCES | 1 |
| WOMEN'S STUDIES | 1 |
| | 2029 |

## APPENDIX 4: DISCIPLINARY CATEGORIES ASSIGNED IN THE WEB OF KNOWLEDGE TO PUBLICATIONS CITING WORKS OF FACULTY MEMBERS WITH LIS DOCTORATES

| | |
|---|---|
| ACOUSTICS | 2 |
| AGRICULTURAL ECONOMICS & POLICY | 1 |
| AGRICULTURE, DAIRY & ANIMAL SCIENCE | 1 |
| AGRICULTURE, MULTIDISCIPLINARY | 2 |
| AGRICULTURE, SOIL SCIENCE | 1 |
| AGRONOMY | 2 |
| ANESTHESIOLOGY | 1 |
| ANTHROPOLOGY | 3 |
| APPLIED LINGUISTICS | 5 |
| ASTRONOMY & ASTROPHYSICS | 3 |
| AUTOMATION & CONTROL SYSTEMS | 1 |
| BEHAVIORAL SCIENCES | 2 |
| BIOCHEMICAL RESEARCH METHODS | 6 |
| BIOCHEMISTRY & MOLECULAR BIOLOGY | 8 |
| BIOLOGY | 4 |
| BIOPHYSICS | 1 |
| BIOTECHNOLOGY & APPLIED MICROBIOLOGY | 9 |
| BUSINESS | 25 |
| CARDIAC & CARDIOVASCULAR SYSTEMS | 4 |
| CELL BIOLOGY | 5 |
| CHEMISTRY, APPLIED | 1 |
| CHEMISTRY, MEDICINAL | 2 |
| CHEMISTRY, MULTIDISCIPLINARY | 8 |
| CLINICAL NEUROLOGY | 5 |
| COMMUNICATION | 108 |
| COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE | 104 |
| COMPUTER SCIENCE, CYBERNETICS | 63 |
| COMPUTER SCIENCE, HARDWARE & ARCHITECTURE | 24 |
| COMPUTER SCIENCE, INFORMATION SYSTEMS | 2643 |
| COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS | 238 |
| COMPUTER SCIENCE, SOFTWARE ENGINEERING | 56 |
| COMPUTER SCIENCE, THEORY & METHODS | 191 |
| CONSTRUCTION & BUILDING TECHNOLOGY | 3 |
| CRIMINOLOGY & PENOLOGY | 1 |
| CRITICAL CARE MEDICINE | 1 |
| DENTISTRY, ORAL SURGERY & MEDICINE | 1 |
| DERMATOLOGY | 2 |
| ECONOMICS | 5 |
| EDUCATION & EDUCATIONAL RESEARCH | 90 |
| EDUCATION, SCIENTIFIC DISCIPLINES | 14 |
| EDUCATION, SPECIAL | 1 |
| ENDOCRINOLOGY & METABOLISM | 1 |
| ENERGY & FUELS | 1 |
| ENGINEERING, BIOMEDICAL | 1 |
| ENGINEERING, CHEMICAL | 4 |

| | |
|---|---|
| ENGINEERING, CIVIL | 3 |
| ENGINEERING, ELECTRICAL & ELECTRONIC | 31 |
| ENGINEERING, ENVIRONMENTAL | 1 |
| ENGINEERING, GEOLOGICAL | 1 |
| ENGINEERING, INDUSTRIAL | 25 |
| ENGINEERING, MANUFACTURING | 9 |
| ENGINEERING, MULTIDISCIPLINARY | 13 |
| ENVIRONMENTAL SCIENCES | 6 |
| ENVIRONMENTAL STUDIES | 10 |
| ERGONOMICS | 60 |
| ETHICS | 4 |
| ETHNIC STUDIES | 1 |
| EVOLUTIONARY BIOLOGY | 1 |
| FAMILY STUDIES | 3 |
| FILM, RADIO, TELEVISION | 5 |
| FOOD SCIENCE & TECHNOLOGY | 1 |
| FORESTRY | 1 |
| GASTROENTEROLOGY & HEPATOLOGY | 4 |
| GENETICS & HEREDITY | 3 |
| GEOCHEMISTRY & GEOPHYSICS | 1 |
| GEOGRAPHY | 6 |
| GEOGRAPHY, PHYSICAL | 2 |
| GEOSCIENCES, MULTIDISCIPLINARY | 2 |
| GERIATRICS & GERONTOLOGY | 1 |
| HEALTH CARE SCIENCES & SERVICES | 38 |
| HEALTH POLICY & SERVICES | 10 |
| HISTORY | 7 |
| HISTORY & PHILOSOPHY OF SCIENCE | 38 |
| HISTORY OF SOCIAL SCIENCES | 1 |
| HUMANITIES, MULTIDISCIPLINARY | 15 |
| IMMUNOLOGY | 1 |
| INDUSTRIAL RELATIONS & LABOR | 2 |
| INFECTIOUS DISEASES | 1 |
| INFORMATION SCIENCE & LIBRARY SCIENCE | 4354 |
| INSTRUMENTS & INSTRUMENTATION | 2 |
| INTEGRATIVE & COMPLEMENTARY MEDICINE | 1 |
| LANGUAGE & LINGUISTICS THEORY | 1 |
| LAW | 18 |
| LITERATURE | 5 |
| LITERATURE, ROMANCE | 1 |
| MANAGEMENT | 74 |
| MARINE & FRESHWATER BIOLOGY | 1 |
| MATERIALS SCIENCE, CHARACTERIZATION & TESTING | 1 |
| MATERIALS SCIENCE, MULTIDISCIPLINARY | 1 |
| MATHEMATICS | 1 |
| MATHEMATICS, APPLIED | 5 |
| MATHEMATICS, INTERDISCIPLINARY APPLICATIONS | 6 |
| MECHANICS | 2 |
| MEDICAL INFORMATICS | 64 |
| MEDICAL LABORATORY TECHNOLOGY | 1 |

| | |
|---|---|
| MEDICINE, GENERAL & INTERNAL | 17 |
| MEDICINE, LEGAL | 1 |
| MEDICINE, RESEARCH & EXPERIMENTAL | 2 |
| METALLURGY & METALLURGICAL ENGINEERING | 1 |
| METEOROLOGY & ATMOSPHERIC SCIENCES | 1 |
| MINERALOGY | 1 |
| MINING & MINERAL PROCESSING | 1 |
| MULTIDISCIPLINARY SCIENCES | 20 |
| MUSIC | 8 |
| NEUROSCIENCES | 6 |
| NURSING | 9 |
| NUTRITION & DIETETICS | 5 |
| OBSTETRICS & GYNECOLOGY | 11 |
| ONCOLOGY | 6 |
| OPERATIONS RESEARCH & MANAGEMENT SCIENCE | 37 |
| OPHTHALMOLOGY | 1 |
| OPTICS | 1 |
| PALEONTOLOGY | 1 |
| PATHOLOGY | 1 |
| PEDIATRICS | 1 |
| PHARMACOLOGY & PHARMACY | 10 |
| PHILOSOPHY | 3 |
| PHYSICS, FLUIDS & PLASMAS | 1 |
| PHYSICS, NUCLEAR | 1 |
| PHYSIOLOGY | 2 |
| PLANNING & DEVELOPMENT | 1 |
| PLANT SCIENCES | 2 |
| POLITICAL SCIENCE | 4 |
| POLYMER SCIENCE | 1 |
| PSYCHIATRY | 5 |
| PSYCHOLOGY | 5 |
| PSYCHOLOGY, APPLIED | 16 |
| PSYCHOLOGY, BIOLOGICAL | 1 |
| PSYCHOLOGY, CLINICAL | 9 |
| PSYCHOLOGY, DEVELOPMENTAL | 1 |
| PSYCHOLOGY, EDUCATIONAL | 7 |
| PSYCHOLOGY, EXPERIMENTAL | 10 |
| PSYCHOLOGY, MATHEMATICAL | 4 |
| PSYCHOLOGY, MULTIDISCIPLINARY | 43 |
| PSYCHOLOGY, SOCIAL | 4 |
| PUBLIC ADMINISTRATION | 2 |
| PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH | 19 |
| RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING | 2 |
| REHABILITATION | 2 |
| RELIGION | 2 |
| REPRODUCTIVE BIOLOGY | 3 |
| RESPIRATORY SYSTEM | 1 |
| SOCIAL ISSUES | 5 |
| SOCIAL SCIENCES, BIOMEDICAL | 2 |
| SOCIAL SCIENCES, INTERDISCIPLINARY | 36 |

| | |
|---|---|
| SOCIAL SCIENCES, MATHEMATICAL METHODS | 1 |
| SOCIAL WORK | 6 |
| SOCIOLOGY | 20 |
| SPORT SCIENCES | 2 |
| STATISTICS & PROBABILITY | 8 |
| SURGERY | 7 |
| TELECOMMUNICATIONS | 30 |
| TOXICOLOGY | 9 |
| URBAN STUDIES | 7 |
| UROLOGY & NEPHROLOGY | 1 |
| VIROLOGY | 1 |
| WATER RESOURCES | 1 |
| WOMEN'S STUDIES | 5 |
| | 8932 |

## APPENDIX 5: DISCIPLINARY CATEGORIES ASSIGNED IN THE WEB OF KNOWLEDGE TO PUBLICATIONS CITING WORKS OF FACULTY MEMBERS WITH NON-LIS DOCTORATES

| | |
|---|---|
| ACOUSTICS | 2 |
| AGRICULTURAL ECONOMICS & POLICY | 1 |
| AGRICULTURE, DAIRY & ANIMAL SCIENCE | 1 |
| AGRICULTURE, MULTIDISCIPLINARY | 1 |
| ANDROLOGY | 1 |
| ANTHROPOLOGY | 4 |
| APPLIED LINGUISTICS | 18 |
| ARCHAEOLOGY | 1 |
| ARCHITECTURE | 1 |
| AREA STUDIES | 5 |
| ASTRONOMY & ASTROPHYSICS | 1 |
| AUTOMATION & CONTROL SYSTEMS | 9 |
| BEHAVIORAL SCIENCES | 6 |
| BIOCHEMICAL RESEARCH METHODS | 2 |
| BIOCHEMISTRY & MOLECULAR BIOLOGY | 9 |
| BIOLOGY | 4 |
| BIOPHYSICS | 3 |
| BIOTECHNOLOGY & APPLIED MICROBIOLOGY | 3 |
| BUSINESS | 56 |
| BUSINESS, FINANCE | 1 |
| CARDIAC & CARDIOVASCULAR SYSTEMS | 1 |
| CELL BIOLOGY | 1 |
| CHEMISTRY, MULTIDISCIPLINARY | 5 |
| CLINICAL NEUROLOGY | 2 |
| COMMUNICATION | 108 |
| COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE | 149 |
| COMPUTER SCIENCE, CYBERNETICS | 126 |
| COMPUTER SCIENCE, HARDWARE & ARCHITECTURE | 52 |
| COMPUTER SCIENCE, INFORMATION SYSTEMS | 1043 |
| COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS | 156 |
| COMPUTER SCIENCE, SOFTWARE ENGINEERING | 104 |
| COMPUTER SCIENCE, THEORY & METHODS | 232 |
| DENTISTRY, ORAL SURGERY & MEDICINE | 6 |
| DERMATOLOGY | 2 |
| ECOLOGY | 2 |
| ECONOMICS | 49 |
| EDUCATION & EDUCATIONAL RESEARCH | 242 |
| EDUCATION, SCIENTIFIC DISCIPLINES | 24 |
| EMERGENCY MEDICINE | 1 |
| ENDOCRINOLOGY & METABOLISM | 1 |
| ENGINEERING, BIOMEDICAL | 5 |
| ENGINEERING, CHEMICAL | 1 |
| ENGINEERING, CIVIL | 2 |
| ENGINEERING, ELECTRICAL & ELECTRONIC | 30 |
| ENGINEERING, INDUSTRIAL | 20 |

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| ENGINEERING, MANUFACTURING | 4 |
| ENGINEERING, MULTIDISCIPLINARY | 22 |
| ENVIRONMENTAL SCIENCES | 11 |
| ENVIRONMENTAL STUDIES | 17 |
| ERGONOMICS | 102 |
| ETHICS | 6 |
| ETHNIC STUDIES | 1 |
| EVOLUTIONARY BIOLOGY | 1 |
| FILM, RADIO, TELEVISION | 4 |
| FISHERIES | 1 |
| FOLKLORE | 1 |
| FOOD SCIENCE & TECHNOLOGY | 2 |
| GASTROENTEROLOGY & HEPATOLOGY | 2 |
| GENETICS & HEREDITY | 4 |
| GEOCHEMISTRY & GEOPHYSICS | 1 |
| GEOGRAPHY | 32 |
| GEOGRAPHY, PHYSICAL | 3 |
| GEOSCIENCES, MULTIDISCIPLINARY | 5 |
| GERIATRICS & GERONTOLOGY | 1 |
| GERONTOLOGY | 1 |
| HEALTH CARE SCIENCES & SERVICES | 28 |
| HEALTH POLICY & SERVICES | 8 |
| HISTORY | 8 |
| HISTORY & PHILOSOPHY OF SCIENCE | 36 |
| HISTORY OF SOCIAL SCIENCES | 1 |
| HUMANITIES, MULTIDISCIPLINARY | 3 |
| IMAGING SCIENCE & PHOTOGRAPHIC TECHNOLOGY | 1 |
| IMMUNOLOGY | 1 |
| INFORMATION SCIENCE & LIBRARY SCIENCE | 1580 |
| INTERNATIONAL RELATIONS | 5 |
| LANGUAGE & LINGUISTICS THEORY | 13 |
| LAW | 21 |
| LINGUISTICS | 1 |
| LITERATURE | 13 |
| MANAGEMENT | 90 |
| MARINE & FRESHWATER BIOLOGY | 1 |
| MATHEMATICS, APPLIED | 8 |
| MATHEMATICS, INTERDISCIPLINARY APPLICATIONS | 13 |
| MECHANICS | 1 |
| MEDICAL INFORMATICS | 42 |
| MEDICINE, GENERAL & INTERNAL | 12 |
| MEDICINE, RESEARCH & EXPERIMENTAL | 2 |
| METEOROLOGY & ATMOSPHERIC SCIENCES | 6 |
| MULTIDISCIPLINARY SCIENCES | 38 |
| MUSIC | 1 |
| NEUROSCIENCES | 8 |
| NUCLEAR SCIENCE & TECHNOLOGY | 1 |
| NURSING | 13 |
| NUTRITION & DIETETICS | 3 |
| OBSTETRICS & GYNECOLOGY | 1 |

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| OCEANOGRAPHY | 1 |
| ONCOLOGY | 6 |
| OPERATIONS RESEARCH & MANAGEMENT SCIENCE | 31 |
| OPHTHALMOLOGY | 2 |
| OPTICS | 1 |
| ORTHOPEDICS | 5 |
| OTORHINOLARYNGOLOGY | 1 |
| PATHOLOGY | 2 |
| PEDIATRICS | 4 |
| PHARMACOLOGY & PHARMACY | 4 |
| PHILOSOPHY | 7 |
| PHYSICS, CONDENSED MATTER | 4 |
| PHYSICS, FLUIDS & PLASMAS | 43 |
| PHYSICS, MATHEMATICAL | 45 |
| PHYSICS, MULTIDISCIPLINARY | 18 |
| PHYSIOLOGY | 1 |
| PLANNING & DEVELOPMENT | 9 |
| POLITICAL SCIENCE | 9 |
| PSYCHIATRY | 4 |
| PSYCHOLOGY | 12 |
| PSYCHOLOGY, APPLIED | 88 |
| PSYCHOLOGY, CLINICAL | 12 |
| PSYCHOLOGY, DEVELOPMENTAL | 6 |
| PSYCHOLOGY, EDUCATIONAL | 64 |
| PSYCHOLOGY, EXPERIMENTAL | 74 |
| PSYCHOLOGY, MATHEMATICAL | 18 |
| PSYCHOLOGY, MULTIDISCIPLINARY | 107 |
| PSYCHOLOGY, SOCIAL | 19 |
| PUBLIC ADMINISTRATION | 4 |
| PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH | 23 |
| RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING | 30 |
| REHABILITATION | 3 |
| RHEUMATOLOGY | 1 |
| ROBOTICS | 4 |
| SOCIAL ISSUES | 6 |
| SOCIAL SCIENCES, BIOMEDICAL | 3 |
| SOCIAL SCIENCES, INTERDISCIPLINARY | 40 |
| SOCIAL SCIENCES, MATHEMATICAL METHODS | 6 |
| SOCIAL WORK | 4 |
| SOCIOLOGY | 28 |
| SPORT SCIENCES | 4 |
| STATISTICS & PROBABILITY | 3 |
| SURGERY | 9 |
| TELECOMMUNICATIONS | 36 |
| THEATER | 1 |
| TOXICOLOGY | 3 |
| TRANSPORTATION | 1 |
| URBAN STUDIES | 14 |
| VETERINARY SCIENCES | 1 |
| WATER RESOURCES | 2 |

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| WOMEN'S STUDIES | 7 |
| ZOOLOGY | 2 |
| | 5505 |

## APPENDIX 6: GROUPS OF DISCIPLINARY CATEGORIES IN THE WEB OF KNOWLEDGE

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|---|---|
| **Arts and humanities** | APPLIED LINGUISTICS<br>ARCHAEOLOGY<br>ARCHITECTURE<br>ART<br>DANCE<br>ETHICS<br>FILM, RADIO, TELEVISION<br>FOLKLORE<br>HISTORY<br>HISTORY & PHILOSOPHY OF SCIENCE<br>HISTORY OF SOCIAL SCIENCES<br>HUMANITIES, MULTIDISCIPLINARY<br>LANGUAGE & LINGUISTICS THEORY<br>LINGUISTICS<br>LITERARY THEORY & CRITICISM<br>LITERATURE<br>LITERATURE, ROMANCE<br>MUSIC<br>PHILOSOPHY<br>RELIGION<br>THEATER |
| **Basic and natural sciences** | ACOUSTICS<br>ASTRONOMY & ASTROPHYSICS<br>BIOCHEMICAL RESEARCH METHODS<br>BIOCHEMISTRY & MOLECULAR BIOLOGY<br>BIOLOGY<br>BIOPHYSICS<br>BIOTECHNOLOGY & APPLIED MICROBIOLOGY<br>CELL BIOLOGY<br>CHEMISTRY, APPLIED<br>CHEMISTRY, MEDICINAL<br>CHEMISTRY, MULTIDISCIPLINARY<br>ECOLOGY<br>ENERGY & FUELS<br>EVOLUTIONARY BIOLOGY<br>GENETICS & HEREDITY<br>GEOCHEMISTRY & GEOPHYSICS<br>GEOGRAPHY<br>GEOGRAPHY, PHYSICAL<br>GEOSCIENCES, MULTIDISCIPLINARY<br>MARINE & FRESHWATER BIOLOGY<br>MATERIALS SCIENCE, CHARACTERIZATION & TESTING<br>MATERIALS SCIENCE, MULTIDISCIPLINARY<br>MATHEMATICS<br>MATHEMATICS, APPLIED<br>MATHEMATICS, INTERDISCIPLINARY APPLICATIONS<br>MECHANICS |

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| | METEOROLOGY & ATMOSPHERIC SCIENCES<br>MINERALOGY<br>NEUROSCIENCES<br>NUCLEAR SCIENCE & TECHNOLOGY<br>OCEANOGRAPHY<br>PALEONTOLOGY<br>PHYSICS, CONDENSED MATTER<br>PHYSICS, FLUIDS & PLASMAS<br>PHYSICS, MATHEMATICAL<br>PHYSICS, MULTIDISCIPLINARY<br>PHYSICS, NUCLEAR<br>PHYSIOLOGY<br>PLANT SCIENCES<br>POLYMER SCIENCE<br>RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING<br>REPRODUCTIVE BIOLOGY<br>STATISTICS & PROBABILITY<br>WATER RESOURCES<br>ZOOLOGY |
| Communication | COMMUNICATION<br>TELECOMMUNICATIONS |
| Education | EDUCATION & EDUCATIONAL RESEARCH<br>EDUCATION, SCIENTIFIC DISCIPLINES<br>EDUCATION, SPECIAL |
| Professions | AGRICULTURAL ECONOMICS & POLICY<br>AGRICULTURE, DAIRY & ANIMAL SCIENCE<br>AGRICULTURE, MULTIDISCIPLINARY<br>AGRICULTURE, SOIL SCIENCE<br>AGRONOMY<br>ANDROLOGY<br>ANESTHESIOLOGY<br>AUTOMATION & CONTROL SYSTEMS<br>BUSINESS<br>BUSINESS, FINANCE<br>CARDIAC & CARDIOVASCULAR SYSTEMS<br>CLINICAL NEUROLOGY<br>CONSTRUCTION & BUILDING TECHNOLOGY<br>CRIMINOLOGY & PENOLOGY<br>CRITICAL CARE MEDICINE<br>DENTISTRY, ORAL SURGERY & MEDICINE<br>DERMATOLOGY<br>EMERGENCY MEDICINE<br>ENDOCRINOLOGY & METABOLISM<br>ENGINEERING, BIOMEDICAL<br>ENGINEERING, CHEMICAL<br>ENGINEERING, CIVIL<br>ENGINEERING, ELECTRICAL & ELECTRONIC<br>ENGINEERING, ENVIRONMENTAL |

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| | ENGINEERING, GEOLOGICAL<br>ENGINEERING, INDUSTRIAL<br>ENGINEERING, MANUFACTURING<br>ENGINEERING, MULTIDISCIPLINARY<br>FISHERIES<br>FOOD SCIENCE & TECHNOLOGY<br>FORESTRY<br>GASTROENTEROLOGY & HEPATOLOGY<br>GERIATRICS & GERONTOLOGY<br>GERONTOLOGY<br>HEALTH CARE SCIENCES & SERVICES<br>HEALTH POLICY & SERVICES<br>IMAGING SCIENCE & PHOTOGRAPHIC TECHNOLOGY<br>IMMUNOLOGY<br>INDUSTRIAL RELATIONS & LABOR<br>INFECTIOUS DISEASES<br>INSTRUMENTS & INSTRUMENTATION<br>INTEGRATIVE & COMPLEMENTARY MEDICINE<br>LAW<br>MANAGEMENT<br>MEDICAL INFORMATICS<br>MEDICAL LABORATORY TECHNOLOGY<br>MEDICINE, GENERAL & INTERNAL<br>MEDICINE, LEGAL<br>MEDICINE, RESEARCH & EXPERIMENTAL<br>METALLURGY & METALLURGICAL ENGINEERING<br>MINING & MINERAL PROCESSING<br>NURSING<br>NUTRITION & DIETETICS<br>OBSTETRICS & GYNECOLOGY<br>ONCOLOGY<br>OPERATIONS RESEARCH & MANAGEMENT SCIENCE<br>OPHTHALMOLOGY<br>OPTICS<br>ORTHOPEDICS<br>OTORHINOLARYNGOLOGY<br>PATHOLOGY<br>PEDIATRICS<br>PHARMACOLOGY & PHARMACY<br>PLANNING & DEVELOPMENT<br>PSYCHIATRY<br>REHABILITATION<br>RESPIRATORY SYSTEM<br>RHEUMATOLOGY<br>SPORT SCIENCES<br>SURGERY<br>TOXICOLOGY<br>TRANSPORTATION<br>UROLOGY & NEPHROLOGY<br>VETERINARY SCIENCES |

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| | VIROLOGY |
| Social sciences | ANTHROPOLOGY |
| | AREA STUDIES |
| | BEHAVIORAL SCIENCES |
| | ECONOMICS |
| | ENVIRONMENTAL SCIENCES |
| | ENVIRONMENTAL STUDIES |
| | ERGONOMICS |
| | ETHNIC STUDIES |
| | FAMILY STUDIES |
| | INTERNATIONAL RELATIONS |
| | POLITICAL SCIENCE |
| | PSYCHOLOGY |
| | PSYCHOLOGY, APPLIED |
| | PSYCHOLOGY, BIOLOGICAL |
| | PSYCHOLOGY, CLINICAL |
| | PSYCHOLOGY, DEVELOPMENTAL |
| | PSYCHOLOGY, EDUCATIONAL |
| | PSYCHOLOGY, EXPERIMENTAL |
| | PSYCHOLOGY, MATHEMATICAL |
| | PSYCHOLOGY, MULTIDISCIPLINARY |
| | PSYCHOLOGY, SOCIAL |
| | PUBLIC ADMINISTRATION |
| | PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH |
| | SOCIAL ISSUES |
| | SOCIAL SCIENCES, BIOMEDICAL |
| | SOCIAL SCIENCES, INTERDISCIPLINARY |
| | SOCIAL SCIENCES, MATHEMATICAL METHODS |
| | SOCIAL WORK |
| | SOCIOLOGY |
| | URBAN STUDIES |
| | WOMEN'S STUDIES |

## APPENDIX 7: GROUPS OF DISCIPLINES OF DOCTORATES OF LIS FACULTY

**Arts and Humanities:**

American civilization
American history
Classics
Comparative literature
Dance
Design studies
Doctor of Arts
English
English (American poetry)
English education
English literature
Film studies
Folk life studies
Folklore
French
History
History and sociology of science
History of consciousness
History of medicine
History of science
History of technology and human geography
Language, literature and culture
Linguistics
Medieval history
Music
Musicology
Philosophy
Soviet and East European studies

**Basic and natural sciences:**

Applied mathematical sciences
Applied physics
Astronomy
Biochemistry
Geography
Geology
Mathematical education
Nuclear physics
Physics
Psychoacoustics

Science and mathematical education
Science and technology studies

**Communication:**

Communication
Communication and culture
Communication and science studies
Communication arts
Communication studies
Speech communication
Telecommunications, policy and management

**Computer science:**

Computer and cognitive science
Computer science
Computer science and engineering
Computing
Human-computer interaction

**Education:**

Adult education
Cultural foundations of education
Curriculum and instruction
Curriculum and teaching
Education
Education (Human development and psychology)
Education/Curriculum and instruction
Education/Instructional design
Educational administration
Educational communications and technology
Educational leadership
Educational leadership and cultural foundations
Educational leadership and innovations
Educational media
Educational technology
Higher education
Higher education administration
Instructional design
Instructional systems
Instructional systems design
Instructional systems technology
Instructional technology
Secondary education

Special education
Teaching and curriculum

**Library and information science:**

Archives studies
Communication and information sciences
Communication, information and library studies
Higher education/Library and information science
Informatics
Information
Information and communication
Information and computer science
Information and library science
Information and library studies
Information science
Information science and learning technologies
Information science and moral theology
Information science and technology
Information studies
Information studies/Educational technology
Information systems
Information technologies
Information transfer
Librarianship
Library and information science
Library and information studies
Library science
Library science and higher education
Library science, information and documentation
Management information systems
Management of information systems and technology

**Multidisciplinary/Interdisciplinary:**

Ethics and information transfer (multidisciplinary)
Individual interdisciplinary studies
Interdisciplinary

**Professions:**

Administration
Administration and leadership
Administration, training and policy studies
Business administration
Business administration/Information systems

Business administration/telecommunications and management information systems
Business/technology and operations management
Community health
Electrical engineering and computer science
Engineering
Health services organization and research
Industrial and business studies/information
Industrial and systems engineering
Industrial engineering
JD
Journalism
Management
Management, organizations studies
Manufacturing, management and information systems
MD
Mechanical and industrial engineering
Medical informatics
Nutritional science
Organization science and information technology
Organizational theory and management information systems
Technology, management and policy

**Social sciences:**

Anthropology
Cognitive psychology
Economics
Experimental psychology
Experimental/Cognitive psychology
Human experimental psychology
Political economy and public policy
Political science
Political science/Government
Psychology
Public administration
Public administration and policy
Public policy and management/Information technology and organizations
Social science
Sociology

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## CURRICULUM VITAE

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## EDUCATION

| | |
|---|---|
| *Ph.D. in LIS* | University of Illinois at Urbana-Champaign, 2007<br>*Dissertation's topic*: LIS faculty members with non-LIS doctorate: Multidisciplinary and interdisciplinary research and publishing patterns as revealed by the means of citation analysis.<br>*Dissertation Advisor*: Linda Smith |
| *MS in LIS* | University of Illinois at Urbana-Champaign, 1999 |
| *MS in Psychology* | Yaroslavl Pedagogical University, Yaroslavl, Russia, 1992 |
| *BS in Biology* | Cum laude, Yaroslavl State University, Yaroslavl, Russia, 1981 |

## RESEARCH INTERESTS

- Information organization and representation (social classifications, classification schemas for interdisciplinary studies, metadata construction)
- LIS as a discipline (dynamics of LS-IS relationships, evolution of LIS as a discipline)
- LIS education (multidisciplinary trends in LIS curriculum)
- Documentation (informational value of images)

## TEACHING INTERESTS

- Reference service (online reference sources, effective communication strategies for reference librarians, cross-cultural communications)
- Knowledge organization (cataloging and classifications; indexing)
- Library administration; Human resources management
- Foundations and history of LIS

## TEACHING EXPERIENCE

*Co-Instructor* — *Graduate School of Library and Information Science, University of Illinois at Urbana-Champaign, Fall 2003*

- Co-taught LIS250BSI, "*Business, Social Sciences, and the Internet*", developing syllabus, giving lectures, leading discussions, and designing and grading students' assignments

*Teaching Assistant* — *Graduate School of Library and Information Science, University of Illinois at Urbana-Champaign, Fall 2002 – Spring 2004*

- *Libraries, Information and Society* (Summer 2003, Spring 2004)
- *Library Administration* (Spring 2003)
- *Global Issues in Librarianship* (Spring 2003)
- *Administration and Management of Libraries and Information Centers* (Fall 2002)

*Instructor* — *Mortenson Center for Library International Programs (MC) at the University of Illinois at Urbana-Champaign, 1997 -1998*

- Taught courses in the Computer Literacy Training Program, including "*Internet Reference Resources*" and "*Online Catalogues and Databases*"
- Conducted individual training sessions for international librarians
- Supervised MC associates' research projects

*Assistant professor* — *Psychology Department, Yaroslavl Pedagogical University, 1993-1994 and 1995-1997 academic years*

- Taught courses:
  - Developmental Psychology
  - Personality
  - Psychology of communication
- Served as an academic advisor to students

*Visiting Lecturer* — *Department of Library Science, Yaroslavl College of Culture, 1995-1996*

- Organized and presented lectures on information technologies
- Provided technical training to librarians and college students

*Instructor* *Yaroslavl College of Commerce, 1983-1985*

- Taught courses in Biology and Chemistry

## RESEARCH EXPERIENCE

*Research Assistant* *Web-based Information Science Education Consortium (WISE)*
*August 2005 – December 2005, January 2007 -*

- Processed and analyzed data on the WISE online courses
- Participated in designing surveys for WISE students and instructors
- Analyzed educational profiles of LEEP (Library Experimental Educational Program) students

*Research Assistant* *National Center for Supercomputing Applications,*
*Advanced Applications Database Project (AAD), 2000-2001*

- Participated in the database's web interface design and its usability testing
- Worked on metadata construction

## PUBLICATIONS AND WORKS IN PROGRESS

Pluzhenskaia M. (2007). Research collaboration of Library and Information Science (LIS) schools' faculty members with LIS and non-LIS advanced degrees: multidisciplinary and interdisciplinary trends. In: Proceedings of the 8th Conference of the ISKO Spanish Chapter, "Interdisciplinarity and Transdisciplinarity in the Organization of Scientific Knowledge", Leon, Spain, April 2007.

Pluzhenskaia, M. (2006). Multidisciplinary and interdisciplinary trends in research and publishing patterns of Library and Information Science (LIS) schools' faculty members with non-LIS doctorate. In: *Proceedings of 1st International Conference on Multidisciplinary Information Sciences and Technologies, InSciT2006, Merida, Spain, October 2006.*

Montague, R. & Pluzhenskaia, M. (2006). Web-based Information Science Education (WISE): Collaboration to Explore and Expand Quality in LIS Online Education. *Journal of Education for Library and Information Science* (forthcoming).

Weech, T. & Pluzhenskaia, M. (2005). LIS Education and Multidisciplinarity: An explanatory Study. *Journal of Education for Library and Information Science, 46* (2): 154-164.

Pluzhenskaia, M. (2004). LIS multidisciplinary curricula: Usual suspects or new actors? (Abstract). *Canadian Journal of Information and Library Science, 28* (3): 106-107.

## SCHOLARLY PRESENTATIONS AND POSTERS

*From closed shelves to open cyberspace: Access to information in Canadian and American public libraries.* Library History Interest Group of the Canadian Library Association. CLA Annual meeting, May 2007, St. John's, Newfoundland, Canada (forthcoming).

*Multidisciplinary trends in publishing of faculty members of ALA accredited LIS schools: Citation analysis of the scholarly works published in 1995 – 2005* (Poster). Association of Library and Information Science Educators (ALISE), January 2007, Seattle, Washington.

*Folksonomies or fauxsonomies: How social is social bookmarking?* (Poster). SIG CR 16th Annual Classification Research Workshop: Social Classification: Panacea or Pandora? ASIS&T Annual Meeting, November 2006, Austin, Texas.

*Russian Icon as Document.* The Document Academy (DOCAM) Annual Meeting, October 2005, University of California, Berkeley, California.

*Multidisciplinarity in LIS education.* Research showcase, Graduate School of Library and Information Science, April 2005, University of Illinois, Urbana-Champaign, Illinois.

*Publishing Patterns of LIS Faculty with and without Doctorate in LIS* (Poster). Association of Library and Information Science Educators (ALISE), January 2005, Boston, Massachusetts.

*Multidisciplinary Trends in LIS Education: Visual Representation.* Great Lakes Conference "Connections", May 2004, Toronto, Ontario, Canada.

(With T. Weech) *LIS Education and Multidisciplinarity: Enhancement or Disintegration* (Top three competitive papers session). Association of Library and Information Science Educators (ALISE), January 2004, San-Diego, California.

## SELECTED PROFESSIONAL PRESENTATIONS

*American Bibliography of Slavic and East European Studies: New trends.* American Association for the Advancement of Slavic Studies (AAASS) Convention, December 2004, Boston, Massachusetts.

*New features and future development of the American Bibliography of Slavic and East European Studies.* Slavic Research Summer Institute at the University of Illinois at Urbana-Champaign, June 2004, Urbana, Illinois.

*Russian libraries' online catalogs.* Slavic Librarians' Workshop, June 2000, Urbana, Illinois.

*Providing access to online resources in regional libraries.* Regional conference of librarians of Yaroslavl Region, April 1997, Yaroslavl, Russia.

## PROFESSIONAL EXPERIENCE

*Managing Editor* — *American Bibliography of Slavic and East European Studies (ABSEES), University of Illinois at Urbana-Champaign Library, February 2004 – July 2005*

- Edited records for the ABSEES Database
- Supervised ABSEES indexers and contributing editors
- Handled subscriptions, renewals, and usage statistics
- Solicited and monitored user feedback
- Maintained ABSEES web page
- Set new development strategies

*Graduate Assistant* — *Slavic Reference Service, Slavic and East European Library, University of Illinois at Urbana-Champaign, 1998-2000*

- Responded to a wide variety of reference queries (online and in person)
- Created and maintained databases "Slavic and East European newspapers"
- Performed original and copy cataloguing (books and microfilms)

*Graduate Assistant* — *Mortenson Center for Library International Programs (MC), University of Illinois at Urbana-Champaign, 1997-1998, Summer and Fall 1999, Summer 2002, Summer 2003*

- Maintained Access database of MC Visitors and associates

*Department Head* — *Department of Automation, Yaroslavl Regional Scientific Library, 1995-1997*

- Supervised maintaining and upgrading the library's computer system
- Supervised developing and implementing the library's new integrated system

*Department Head* *Department of Information on Culture and Arts, Yaroslavl Regional Scientific Library, 1991-1994*

- Organized and coordinated information resource sharing between the library and other scientific and cultural institutions, including universities, museums, theatres, and regional public library systems

**SERVICE**

American Bibliography for Slavic and East European Studies (ABSEES), contributing editor, *2006-*

Doctoral Studies Committee, Graduate School of Library and Information Science, University of Illinois at Urbana-Champaign, student representative, *2004-2005*

American Association for the Advancement of Slavic Studies (AAASS), Bibliography and Documentation Committee, ex officio member, *2004-2005*

**PROFESSIONAL AFFILIATIONS**

American Library Association (ALA)
American Society for Information Science and Technology (ASIS&T)
Association for Library and Information Science Association (ALISE)
Association for Integrative Studies (AIS)
Society for Social Studies of Science (4S)

**AWARDS, HONORS AND FELLOWSHIPS**

Hostetter A&M Fellowship, 2004 – 2005
Graduate Teacher Certificate, University of Illinois at Urbana-Champaign, 2002-2003
Support Act Fellowship (USIA), 1994 – 1995
High Honors Diploma, Yaroslavl State University, 1981